



HP 2000 SERIES CONTRIBUTED LIBRARY



2000 BASIC
PROGRAM DOCUMENTATION

VOLUME IV

(800) EDUCATION

36000-91004

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Changed August 1976

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LIST OF EFFECTIVE PAGES

The List of Effective Pages gives the most recent date on which the technical material on any given page was altered. If a page is simple re-arranged due to a technical change on a previous page, it is not listed as a changed page. Within the manual, changes are marked with a vertical bar in the margin.

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2000 BASIC CONTRIBUTED LIBRARY HANDBOOK

(800) EDUCATION

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Changed 8/76

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CLASSIFICATION CODE CATEGORY

(Not all categories have programs. Please refer to the INDEX to HP BASIC Program Library for available programs in HP BASIC)

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102 INFORMATION STORAGE AND RETRIEVAL
103 TABLE HANDLING
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903 GAMES

INTRODUCTION

GENERAL

HP designs, manufactures and markets more than 3600 products, including electronic test and measuring instruments and systems; computational products that include desk top and personal-sized calculators, minicomputers and computer systems used in science, education, business and industry, medical electronic products for patient monitoring, diagnosis, and research; chromatographic and spectroscopic instrumentation for chemical analysis; and a variety of solid-state components.

Corporate, International, and Intercontinental Operations headquarters and the corporate research are located in Palo Alto, California; European Operations headquarters are in Geneva, Switzerland. HP has sales and service facilities in 65 countries.

THE HP CONTRIBUTED SOFTWARE CENTER

Hewlett-Packard's General Systems Division makes available to all HP 2000 and HP 3000 system users a wide variety of computer programs through the HP Contributed Software Center. The Contributed Software Center is composed of the General System Division's two contributed libraries; the 2000 Series (BASIC) and the 3000 Series. The Center serves as the administrator for the libraries. Software is submitted to the Center which then prepares it for distribution. The preparation includes indexing programs according to their use or function, and publishing library catalogs and handbooks which contain abstracts and/or documentation.

Contributed software is written by users of HP systems and submitted to the Center for inclusion in the appropriate library. These programs range from file manipulation routines to educational packages and apply to several different HP systems. Before writing a particular application scan the catalogs or handbooks containing information on programs written for the system you are using. Some programs can be used without modification while other programs serve as a starting point for developing special purpose software.

New programs are welcome for consideration as entries to the HP 2000 Series, and the HP 3000 Series Contributed Library. It is HP's opportunity to expand communication among HP computer system users. Minimum submittal requirements are (1) machine readable source paper or magnetic tape (documentation should be contained in the code, when possible), (2) a typed and reproducible program documentation form (these forms are printed in contributed program catalogs and are also available on request from the Center). All program packages should be wrapped securely and sent to:

Hewlett-Packard Contributed Software Center
General Systems Division
5303 Stevens Creek Blvd.
Santa Clara, Calif. 95050

Contributed software is checked by HP personnel; however, it is impractical to test programs under all circumstances. **HEWLETT-PACKARD MAKES NO WARRANTY EXPRESSED OR IMPLIED AND ASSUMES NO RESPONSIBILITY IN CONNECTION WITH THE CONTRIBUTED PROGRAM MATERIAL.** However, if you encounter an error, software report forms are supplied with library handbooks and catalogs. Fill them out and forward them to the

Center. We will in turn direct them to the contributor of the software.

2000 SERIES (BASIC)

Program written for the HP 2000 Systems are documented in 5 Volumes, an addendum to Volumes I-IV, plus additional extended documentation for certain individual programs.

3000 SERIES

Programs written for HP 3000 Systems are abstracted in a Contributed Software Index and Catalog. The library is available as a complete package containing the Index and Catalog, extended documentation, and a corresponding magnetic tape.

NEW ORGANIZATION OF LIBRARY

The HP 2000 Series Contributed Library consists of the five volumes and addendum documentation for the former 2000F Level Library, plus manual updates and one 2400' reel of magnetic tape. The manual updates accumulate all changes to the 2000F documentation which relate to the newest system in the 2000 SERIES BASIC family. The magnetic tape contains all of the software from the 2000F Contributed Library arranged in twelve separate accounts—six (ZXXX's), and six (CXXX's). The "Z" accounts range from Z901 which corresponds to the software and documentation from Volume 1, to Z906 which corresponds to the software and documentation from the addendum. The programs which reside in the "Z" accounts have been tested, unrestricted, and will execute on the new computer system. The "C" accounts range from C901 which corresponds to software from Volume 1 to C906 which corresponds to the software from the addendum. These programs have also been tested but will not execute on the new computer system without user modification. The Contributed Software Center is not recoding the "C" account programs. Note: There is no C905 account; all of the games will execute on the new system.

Program documentation is arranged alphabetically, by calling Name, within each major category. Each volume represents a particular category or categories. The addendum Volume updates Volumes I-IV.

VOLUMES

VOLUME I	(100)	DATA HANDLING
	(200)	TESTING, DEBUGGING AND PROGRAMMING AIDS
VOLUME II	(300)	MATH AND NUMERICAL ANALYSIS
	(400)	PROBABILITY AND STATISTICS
	(500)	SCIENTIFIC AND ENGINEERING APPLICATIONS
VOLUME III	(600)	MANAGEMENT SCIENCES AND OPERATIONS RESEARCH
	(700)	BUSINESS AND MANUFACTURING APPLICATIONS
VOLUME IV	(800)	EDUCATION
VOLUME V	(900)	MISCELLANEOUS (GAMES)**

Plotting routines previously classified under 904 are now found in Volume I under DATA HANDLING; this leaves Volume V exclusively for GAMES.

ORDERING INFORMATION

Contact your local HP Sales Office for ordering information on Contributed Software.

There are (4) four ways to order the library.

1. SOFTWARE AND DOCUMENTATION

- HP 36600A (800 BPI) HP 2000 Series Mag Tap of software and 5 Volumes of documentation plus the addendum to Volumes I-IV
- HP 36600A-option 100 (1600 BPI) HP 2000 Series Mag Tape of software and 5 Volumes of documentation plus addendum to Volumes I-IV.

2. SOFTWARE

- HP 36600 -10001 (800 BPI) HP 2000 Series MAG Tape of software
- HP 36600 -11001 (1600 BPI) HP 2000 Series Mag Tape of software

3. DOCUMENTATION (Collection)

- HP 36600 -90001 5 Volumes of documentation plus the addendum documentation

4. DOCUMENTATION

- HP 36000-91001 Volume I HP 2000 BASIC Program Library
- HP 36000-91002 Volume II HP 2000 BASIC Program Library
- HP 36000-91003 Volume III HP 2000 BASIC Program Library
- HP 36000-91004 Volume IV HP 2000 BASIC Program Library
- HP 36000-91005 Volume V HP 2000 BASIC Program Library
- HP 36000-920001 Addendum to Volumes I-IV HP 2000 BASIC Program Library

EXTENDED DOCUMENTATION

- FINDIT Users Manual 36250, Option DOO
- CTC1 Documentation 36210, Option DOO
- CTC2 Documentation 36311, Option DOO
- CTC3 Documentation 36212, Option DOO
- CTC4 Documentation 36213, Option DOO
- CTC5 Documentation 36214, Option DOO
- CTC6 Documentation 36638, Option DOO
- TSBILL Documentation 36888-90039
- BASP Documentation 36888-90022
- MUSIC 36888-90028

ADDITIONAL ORDERING INFORMATION

If you are upgrading from a 2000F to the new 2000 Series System, manual updates are separately available by sending your request to:

Software/Publications Distribution
Hewlett Packard Company
5303 Stevens Creek Blvd.
Santa Clara, Calif. 95050

Please give the name of the manual, it's part number, and state that the update is required, not the complete manual. There is no charge for the manual updates.

For Example, to order Volume I update request:

HP 2000 Series Contributed Library, Vol I.
Part Number 36000-91001
Update Only

ERRORS IN CONTRIBUTED SOFTWARE

Every HP BASIC Program included in the Contributed Library is checked by HP personnel and verified for accuracy with the sample RUN submitted. However, it is impractical to test programs under all circumstances, and HP does not assume responsibility for errors in contributed software. If you do encounter errors, please report them to the HP Contributed Software Center on the Error Report form supplied with this publication.

SYSTEM SPECIFICATIONS

Library programs have been collected over a period of years, and some of the earlier programs were written for a "single terminal" BASIC system, or an early version of the HP 2000 series Time-Share systems.

The chart below lists varying system features. In many cases slight modifications in coding will allow a program to RUN on systems other than the one for which it was originally written.

Program Features	2000A	2000B	2000C	2000D	2000E High Speed 2000F	2000 Series BASIC
Maximum program size	5100 words	5100 words	10,000 words	4100 words	10,000 words	10,000 words
Maximum No. of files	8	8	16	4	16	16
Maximum Number of Record/File	128	128	32,767	48	32,767	32,767
Maximum Number of Words/Record	64	64	256	128	256	256
Programmable Functions						
TIME	X	X	X	X	X	X
ENTER	X	X	X	X	X	X
COMMON	X	X	X	X	X	X
CHAIN	Chain="name"	Chain="name"	Chain="name"	Chain="name"	Chain="name"	Chain="name"
PRINT USING (IMAGE)			X		X	X
BRK					X	programmably detectable
ASSIGN			X		X	X
RESTARTABLE RND			X	X	X	X
SPACE			X		X	X
LINE			X		X	X
Additional functions on 2000 Series BASIC						
ABS, ATN, CHR\$, CONS, COS,						X
CTE, EXP, INT, LN,						X
LOG, NUM, POS, REC, SIN,						X
SIN, SPA, SQR, SYS,						X
TAB, TAN, TIM, TRN,						X
TYP, UPS, ZER						X

RELATED INFORMATION

EDUCATIONAL USER'S GROUP AT HP

The HP Educational User's Group is a worldwide organization of people sharing similar ideas, goals and concerns about education computing. The continuing focus of the User's Group is the exchange of ideas and experiences, channeled through periodic all-user meetings, regional sub-group activities and the Educational Newsletter.

For more information on these activities, contact:
Educational User Services, Hewlett-Packard Company,
5303 Stevens Creek Blvd., Santa Clara, California 95050.

THE HP CLEARING HOUSE

The HP Clearinghouse was established in January, 1975 as an attempt to bring under one cover all those computer applications that would be of potential interest to HP users. The first catalog was printed in June, 1975 and contains information on some 200 applications, approximately 100 of them submitted by users. The catalog is organized into four categories: (1) Instructional Applications (presented by subject area); (2) Administrative Applications (listed by application type, e.g. student information systems); (3) Educational Utility Packages (CAI authoring/execution languages, IDF utilities, etc.); and (4) References (books, periodicals, and bibliographies). There are also six cross-reference indexes. This catalog is updated at approximately six-month intervals. The Clearinghouse disseminates information only – actual software is distributed by the originator or through the HP 2000 Series Contributed Library.

There are a number of manuals and documents relating to the HP 2000 Series Basic System that may be helpful to you.

2000/F to 2000/Access System Upgrade Kit and
Conversion Program Manual (19665-90001)

2000/F to 2000 Access System Educational Appli-
cation Upgrades (19665-90002)

Access BASIC Reference Manual, HP 2000
(22687-90001)

Access Operator's Manual, HP 2000 (22687-90005)

Access System Operator's Pocket Guide
(22687-9007)

College Information System – System Overview
(24384-90001)

College Information System Reference Manual
(24384-90003)

College Information System – Technical Manual
(24384-90005)

Course Writing Facility Reference Manual
(22692-90001)

FCOPY/2000 Reference Manual (22700-90001)

HP MATH for HP 2000 Access Curriculum Guide
(22693-90003)

HP MATH for HP 2000 Access Proctor's Manual
(22693-90002)

HP MATH for HP 2000 Access Teacher's Hand-
book (22693-90001)

Instructional Dialogue Facility for HP 2000
Access Author's Manual (22691-90003)

Instructional Dialogue Facility for HP 2000
Access Author's Pocket Guide (22691-
90004)

Instructional Dialogue Facility for HP 2000 Access
Course Developer's (22691-90002)

Instructional Dialogue Facility for HP 2000 Access
Proctor's Manual (22691-90001)

Instructional Management Facility for HP 2000
Access Proctor's Manual (22690-90001)

Instructional Management Facility for HP 2000
Access System Manager's Reference Manual
(22690-90002)

Learning Timeshare BASIC (22687-90009)

Telecommunications Supervisory Package/2000
Manager's Manual (20240-90001)

Telecommunications Supervisory Package/2000
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HEWLETT-PACKARD CONTRIBUTED SOFTWARE CENTER
DOCUMENTATION FORM FOR CONTRIBUTED BASIC PROGRAMS

TITLE _____

PROGRAM NAME _____

CLASSIFICATION CODE

--	--	--

SELECT UP TO FOUR CROSS REFERENCE WORDS FROM CROSS REFERENCE INDEX _____

DESCRIPTION () Program () Subroutine

(Please include the specific application of your program – i.e., how do *you* use it, or recommend its application.)



USER INSTRUCTIONS

If possible, please include 'INSTRUCTIONS' as an option in your program. (Define the inputs requested by the program or subroutine. List the files used, and the data format of each. List the maximum file size. If applicable, include algorithms used.)

NOTE ON SUBROUTINES: The following conventions have been adopted for stand-alone subroutines. Variable names should begin with Z. When more than 10 variables are used, Z, . . . Z9, list the other variable names under Special Considerations. Subroutine line number should begin at 9000.

SYSTEM SPECIFICATIONS

System: () Single Terminal Basic () 2000A () 2000B () 2000C () 2000E () 2000C'/F () 2000 Series

Terminal: () Teletype () Mark Sense Card Reader () CRT () Other _____

Note: Does this program use the BRK function? () Yes () No

SPECIAL CONSIDERATIONS

List any special hardware requirements, subroutine variable names not beginning with a 'Z', accuracy limitations, literature references, etc.

CONTRIBUTOR'S NAME AND ORGANIZATION ADDRESS

TO BE PUBLISHED? () yes () no

DISCLAIMER

To the best of my knowledge this contributed program is free of any proprietary information and I hereby agree that HP may reproduce, publish, and use it, and authorize others to do so without liability of any kind.

Signature _____ Date _____

Attach a sample run including input data and resulting TTY output data. Send a paper tape, or whenever possible, please send program on dump tape, ID C915

Do you use this program for instructional purposes?

What age level are the students?

Please briefly describe the course, and topics within the course.

**ERROR REPORT FORM
(HP BASIC CONTRIBUTED)**

Comment fully on any software "bugs" in the space provided and enclose any teleprinter output that may be useful in defining the problem. A copy will be forwarded to the contributor. A reply will be returned to the person who submits this report. Send completed report to:

Hewlett-Packard Company
HP 2000 Series Contributed Library
5303 Stevens Creek Blvd.
Santa Clara, California 95050

Submitted By	Date
Organization Name	Program Name
Address	Order No.
City, State, Zip	Program No.
Phone	
Has software been modified by user?	NO YES (If YES, explain below)

Enclosed References:

TTY LOG

LISTING

Corrected Tape

Corrected LISTING

CONTRIBUTED PROGRAM **BASIC**ALGIE
36851**TITLE:**

BASIC ALGEBRA DRILL

DESCRIPTION:

This program provides drill in elementary algebraic equations. Any one of four different types of equations may be chosen and the user may elect to give himself a limited amount of time which he may specify to respond to each problem. A session lasts until the user gets twenty correct answers. A summary is printed at the end of the run.

801

INSTRUCTIONS:

The program asks for the user's name, type of problem desired, whether the user wishes to time himself and if so how many seconds are to be allowed for answers.

ACKNOWLEDGEMENTS:

Bill Jarosz
De Paul University

RUN

RUN
ALGIE

THIS IS A COMPUTER-ASSISTED DRILL IN BASIC ALGEBRA.
TO STOP PRACTICE BEFORE A SESSION IS COMPLETE, HOLD THE
CTRL KEY DOWN, HIT THE LETTER C, AND RETURN.
A SESSION LASTS UNTIL YOU GET 20 CORRECT ANSWERS.
ALL ANSWERS ARE POSITIVE OR NEGATIVE INTEGERS.

WHAT'S YOUR NAME?BILL JAROSZ

TYPE 1 FOR PROBLEMS OF THE FORM: $3X=15$
2 FOR PROBLEMS OF THE FORM: $3X+5=20$
3 FOR PROBLEMS OF THE FORM: $2(X+4)=12$
4 FOR PROBLEMS OF THE FORM: $2(X-3)+4(X-7)=-10$
WHICH DO YOU WANT?4

DO YOU WANT TO TIME YOURSELF (1=YES,0=NO)?1
HOW MANY SECONDS PER ANSWER?30

$2(Y-9)+3(Y-7) = -44$ $Y = -1$
 $1(J-4)+3(J+1) = 35$ $J = 9$
 $1(Z-6)-4(Z+3) = 6$ $Z = -8$
 $1(C+1)-3(C+6) = -9$ $C = -4$
 $3(Z-6)+5(Z-1) = 9$ $Z = 4$
 $6(X+4)+8(X-9) = 22$ $X = 4$
SORRY, TIME'S UP. LET'S TRY ANOTHER PROBLEM.

$9(C+4)+8(C+4) = 102$ $C = 2$
 $3(Z-3)-2(Z-1) = -10$ $Z = -3$
 $1(B-9)+1(B-2) = 1$ $B = 6$
 $1(J-7)+4(J+1) = -18$ $J = -3$
 $8(K-1)+7(K-1) = -105$ $K = -6$

YOU'RE HALF WAY THROUGH NOW.

$3(B-6)+6(B-7) = -33$ $B =$
SORRY, TIME'S UP. LET'S TRY ANOTHER PROBLEM.

$5(C-1)-7(C+5) = -28$ $C = -6$
 $5(Z-8)+5(Z+7) = -75$ $Z = -7$
 $2(J-7)+7(J-6) = 7$ $J =$
SORRY, TIME'S UP. LET'S TRY ANOTHER PROBLEM.

$6(C+8)-9(C-3) = 63$ $C =$
SORRY, TIME'S UP. LET'S TRY ANOTHER PROBLEM.

$5(Z+2)-4(Z-6) = 41$ $Z = 7$
 $8(C+2)-7(C+7) = -42$ $C = 75$
YOUR ANSWER IS WRONG. TRY IT AGAIN. -75
YOUR ANSWER IS STILL WRONG. LET'S TRY ANOTHER PROBLEM.

$8(C-9)+2(C-3) = -58$ $C = 2$
 $1(B-7)+2(B-3) = -28$ $B = -5$
 $4(U+2)-2(U+5) = 16$ $U = 9$
 $7(X+5)-6(X+6) = 7$ $X = 8$
 $5(W-3)+9(W-6) = -181$ $W = -8$
 $2(B+1)-1(B+7) = -4$ $B = -1$
YOUR ANSWER IS WRONG. TRY IT AGAIN. 1
THAT'S RIGHT.

YOU ONLY NEED ONE MORE CORRECT ANSWER.

$7(Z+1)+9(Z+9) = 232$ $Z = 9$

BILL JAROSZ
YOU TRIED 25 PROBLEMS.
19 WERE CORRECT ON THE FIRST TRY.
1 WAS CORRECT ON THE SECOND TRY.
1 WAS NOT ANSWERED CORRECTLY ON EITHER TRY.
YOU GAVE YOURSELF 30 SECONDS TO ANSWER EACH QUESTION.
YOU RAN OUT OF TIME 4 TIMES.
YOUR TOTAL TIME WAS 9 MINUTES AND 45 SECONDS.
DONE

TITLE:	COMPUTER-AUGMENTED CALCULUS TOPICS (PROJECT SOLO)	AREA 36668
DESCRIPTION:	<p>This program uses Euler's method (rectangles) to approximate the area of any specified polynomial of the form</p> $Y = AX^3 + BX^2 + CX + D$ <p>over any specified interval on the X-axis.</p>	
INSTRUCTIONS:	<p>The user is asked to input the values of A, B, C, and D in the polynomial. They may take any value, including 0.</p> <p>Then the program asks the user to select an interval on the X-axis (lower bound, upper bound), and then specify the number of approximating rectangles to be used.</p> <p>When the program has printed its resulting approximation to the area under the curve in the interval, the user may select option 1, 2, 3, or 4, which represent:</p> <ol style="list-style-type: none"> 1. Change the number of approximating rectangles. 2. Change the interval on the X-axis. 3. Input new values of A, B, C, and D. 4. Terminate program run. 	
SPECIAL CONSIDERATIONS:	<p>This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum series.</p> <p>FOR INSTRUCTIONAL PURPOSES Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science</p> <p>Student Background Required: Elem. Calculus (can be concurrent), BASIC</p> <p>The curriculum material listed below is available for classroom implementation of this program.</p> <p style="padding-left: 40px;">HP 5951-5611 Computer-Augmented Calculus Topics HP 5951-5612 Classroom Set (30 books)</p> <p>For ordering information of curriculum material, contact:</p> <p style="padding-left: 40px;">Hewlett-Packard Computer Curriculum Project Scientific Press 1629 Channing Ave. Palo Alto, California 94303</p>	
ACKNOWLEDGEMENTS:	Project Solo University of Pittsburgh	

RUN

RUN
AREA

THIS PROGRAM COMPUTES APPROXIMATIONS TO THE AREA BOUNDED BY THE X-AXIS AND THE GRAPH OF ANY POLYNOMIAL FUNCTION OF DEGREE THREE OR LESS OVER AN INTERVAL OF THE X-AXIS. THE METHOD USED TO APPROXIMATE THE AREA IS TO BUILD RECTANGLES WHOSE SUM WILL BE AN APPROXIMATION TO THE AREA WE ARE TRYING TO FIND. THE POLYNOMIAL FUNCTION IS OF THE FORM

$$Y = A \cdot X^3 + B \cdot X^2 + C \cdot X + D.$$

YOU CAN GIVE ANY VALUES (INCLUDING 0) TO A, B, C, AND D. OK., ASSIGN NUMERICAL VALUES TO A, B, C, AND D.

A=?0
B=?1
C=?0
D=?0

SELECT AN INTERVAL (R,S) ON THE X-AXIS BY ASSIGNING VALUES TO R AND S.

R=?0
S=?2

HOW MANY RECTANGLES DO YOU WANT TO BUILD ON [R,S]?
N=?4

THE INTERVAL IS [0 , 2].
THE NUMBER OF RECTANGLES IS 4 .
THE FUNCTION IS
0 X³ + 1 X² + 0 X + 0 .

THE APPROXIMATION TO THE AREA IS ***** 1.75 *****

PLEASE SELECT OPTION 1, 2, 3, OR 4. YOUR OPTION?1
HOW MANY RECTANGLES DO YOU WANT TO BUILD ON [R,S]?
N=?256

THE INTERVAL IS [0 , 2].
THE NUMBER OF RECTANGLES IS 256 .
THE FUNCTION IS
0 X³ + 1 X² + 0 X + 0 .

THE APPROXIMATION TO THE AREA IS ***** 2.65106 *****

PLEASE SELECT OPTION 1, 2, 3, OR 4. YOUR OPTION?2
SELECT AN INTERVAL (R,S) ON THE X-AXIS BY ASSIGNING VALUES TO R AND S.
R=?-2
S=?2
HOW MANY RECTANGLES DO YOU WANT TO BUILD ON [R,S]?
N=?512

N MUST BE A POSITIVE WHOLE NUMBER LESS THAN 500. TRY AGAIN.
HOW MANY RECTANGLES DO YOU WANT TO BUILD ON [R,S]?
N=?256

THE INTERVAL IS [-2 , 2].
THE NUMBER OF RECTANGLES IS 256 .
THE FUNCTION IS
0 X³ + 1 X² + 0 X + 0 .

THE APPROXIMATION TO THE AREA IS ***** 5.3335 *****

PLEASE SELECT OPTION 1, 2, 3, OR 4. YOUR OPTION?3
OK., ASSIGN NUMERICAL VALUES TO A, B, C, AND D.
A=?5
B=?-3.5
C=?8.111
D=?0.01
SELECT AN INTERVAL (R,S) ON THE X-AXIS
BY ASSIGNING VALUES TO R AND S.
R=?-2
S=?2
HOW MANY RECTANGLES DO YOU WANT TO BUILD ON [R,S]?
N=?256

THE INTERVAL IS [-2 , 2].
THE NUMBER OF RECTANGLES IS 256 .
THE FUNCTION IS
5 X³ + -3.5 X² + 8.111 X + .01
THE APPROXIMATION TO THE AREA IS ***** 72.6652 *****

PLEASE SELECT OPTION 1, 2, 3, OR 4. YOUR OPTION?4
DONE

CONTRIBUTED PROGRAM **BASIC**

BASE
36796

TITLE:

BASE CONVERTER

DESCRIPTION:

Converts a number in any base (1-10) into any base (1-10).

INSTRUCTIONS:

User will input a number and its base and then input into what base he would like the number converted. The computer will then print the number in the new base.

**SPECIAL
CONSIDERATIONS:**

It will not work in any base higher than base 10.

ACKNOWLEDGEMENTS:

Peter Katz
Ravenswood High School

RUN

RUN
BASE

THIS PROGRAM IS A BASE CONVERTER
IT CONVERTS A NUMBER IN A BASE 10 OR LESS
INTO A GIVEN BASE (10 OR LESS)

ENTER THE NUMBER?256
ENTER ITS BASE?10
ENTER DESIRED BASE?8

THE NUMBER 256 IN BASE 8 IS 400

ENTER THE NUMBER?64
ENTER ITS BASE?10
ENTER DESIRED BASE?2

THE NUMBER 64 IN BASE 2 IS 1.00000E+06

ENTER THE NUMBER?400
ENTER ITS BASE?8
ENTER DESIRED BASE?10

THE NUMBER 400 IN BASE 10 IS 256

ENTER THE NUMBER?1.00000E+06
ENTER ITS BASE?2
ENTER DESIRED BASE?10

THE NUMBER 1.00000E+06 IN BASE 10 IS 64

ENTER THE NUMBER?10.249
EXTRA INPUT - WARNING ONLY

ENTER ITS BASE?10
ENTER DESIRED BASE?6

THE NUMBER 10 IN BASE 6 IS 14

ENTER THE NUMBER?10249
ENTER ITS BASE?10
ENTER DESIRED BASE?6

THE NUMBER 10249 IN BASE 6 IS 115241.

ENTER THE NUMBER?115241
ENTER ITS BASE?6
ENTER DESIRED BASE?10

THE NUMBER 115241. IN BASE 10 IS 10249

ENTER THE NUMBER?
DONE

CONTRIBUTED PROGRAM **BASIC**BISQAR
36240**TITLE:**

SQUARING BINOMIALS

DESCRIPTION:

This program presents the student with a series of five binomials to be squared. He types in the coefficients of the correct answer and is told whether or not he is correct on the problems when he is through the list. The time taken for his response to all five is printed out.

INSTRUCTIONS:

Directions to the student are included on an optional basis within the program. The student is asked to practice squaring binomials of the form $A^*X + B$. The answers will be a trinomial of the form $P^*X^2 + Q^*X + R$. The values of P, Q and R should be typed in, separated by commas.

**SPECIAL
CONSIDERATIONS:****FOR INSTRUCTIONAL PURPOSES**

Suitable Courses: Algebra I or as a review in Algebra II
Student Background Required: Ability to mentally square a binomial
Application: This program affords a student a chance to hone up his skill in rapidly squaring binomials. In particular it should reinforce the idea of getting the correct middle term and the fact that $(a+b)^2 \neq a^2+b^2$. The time factor provides for a good deal of competition among students.

ACKNOWLEDGEMENTS:

Michael Bolduan
Clackamas High School

RUN

RUN
BISQAR

SQUARING BINOMIALS

DO YOU WANT DIRECTIONS? YEEES--S

YOU ARE GOING TO PRACTICE SQUARING BINOMIALS OF THE FORM

$A * X + B$. IN EACH CASE YOUR ANSWER WILL BE A TRI-
NOMIAL OF THE FORM $P * X^2 + Q * X + R$. WHEN I ASK FOR YOUR
ANSWER, YOU SHOULD TYPE IN THE VALUES OF P, Q, AND R SEPAR-
ATED BY COMMAS. AFTER YOU HAVE TYPED IN 'R' YOU SHOULD HIT
THE 'RETURN' KEY. NOTE THAT YOU ARE ONLY TYPING IN THE
COEFFICIENTS OF THE ANSWER. YOU WILL BE ASKED TO DO FIVE
PROBLEMS AND THEN YOU WILL BE TOLD HOW WELL YOU DID.

NO. 1 :

WHAT IS THE SQUARE OF 3 *X + 1

?9,6,1

NO. 2 :

WHAT IS THE SQUARE OF -10 *X + 1

?100,-20,1

NO. 3 :

WHAT IS THE SQUARE OF 10 *X + 2

?100,40,4

NO. 4 :

WHAT IS THE SQUARE OF 5 *X + 1

?25,5,1

NO. 5 :

WHAT IS THE SQUARE OF -9 *X + -9

?81,162,81

YOU GOT 4 OUT OF 5 CORRECT. YOU MISSED THE FOLLOWING:

NO. 4

IT TOOK YOU 2 MINUTES.

CORRECT YOUR ERRORS ON THIS PAPER AND TURN IT IN FOR
CREDIT. MAYBE NEXT TIME YOU WILL GET 100%. BYE!

DONE

CONTRIBUTED PROGRAM **BASIC**

CADA11
36205

TITLE: COMPUTER ASSISTED ARITHMETIC DRILL

DESCRIPTION: These programs give students drill problems in the four operations of arithmetic. All problems have integer answers. All problems of one drill session are of the same operation. The program stores the raw score data from a drill session in a record for up to twenty five students. Record management is accomplished by using a special program designed for this purpose.

INSTRUCTIONS:

To use the program for the first time open a file, (CRE-CADA1F,25). Next RUN CADA11 to format the records of the file. Once the file is set, this program never needs to be used again unless the file is to be obliterated and restarted. When CADA11 is run, there will be no output on the teleprinter.

To use the arithmetic drill program, get CADA1P and type run. The computer will type some preliminary remarks and then ask for a student ID number. Reply with the correct student number if known, otherwise any number less than twenty five will do except zero. Student number zero is reserved for students who do not wish to have a permanent record on file.

The computer will type OPERATION 1=ADDITION, ETC. to which you respond 1, 2, 3, or 4 for addition, subtraction, multiplication, or division respectively.

Next CORRECT PROBLEMS? will be typed. Your response must be a number greater than zero and will determine the number of correct problems your student must get correct on his first attempt to complete his drill.

Finally the computer will ask what is the LARGEST ADDEND? Your answer will determine the largest possible addend in the addition drill. Similar results are obtained for subtraction, multiplication, and division.

Arithmetic drill problems will now appear and answers must be supplied by the student. Commentary will be supplied for incorrect student responses. A student has two chances to answer correctly. Failure to give a correct response after two tries will cause a new problem to be typed.

At the end of the practice a summary of the current practice will be typed and then questions will be asked to which you reply with yes, no, or the student name. When the proper student record has been located and revised, the program will end.

Using a student number of zero will cause the computer to skip the record revising routine of this program.

For management of student records there is a special file management program called CADA1M entitled File Manager for CADA1F.

The management program allows for opening, altering, closing, printing one record, or printing all records. Instructions are conversational. The sample run will show how to open, alter, and close a record.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Arithmetic from grade one
Student Background Required: Knowledge of arithmetic operations.

This program can be used for drill work in the four arithmetic operations. Daily sessions with the computer are best if they are kept fairly short, i.e. ten to twenty problems.

ACKNOWLEDGEMENTS: William H. Jones
Chatham Township High School

RUN

CRE-CADA1P,25
 GET-CADA11
 RUN
 CADA11

DONE
 GET-CADA1P
 RUN
 CADA1P

THIS PROGRAM IS A CAI-DRILL IN INTEGER ARITHMETIC. TO STOP PRACTICE BEFORE COMPLETE, HOLD CTRL KEY DOWN AND DEPRESS THE LETTER C, THEN RETURN. A PERMANENT SUMMARY OF THIS WORK CAN BE OBTAINED THROUGH MR. JONES.

STUDENT #?3

OPERATION 1=ADDITION, ETC.
 ?2

CORRECT PROBLEMS?10

LARGEST MINUEND?25

24 - 23 =?14

YOUR ANSWER IS WRONG, TRY IT AGAIN.

?1

THAT IS BETTER. TRY THIS PROBLEM.

15 - 10 =?5

17 - 16 =?1

23 - 11 =?12

12 - 7 =?5

10 - 7 =?3

YOU HAVE ANSWERED HALF OF YOUR PROBLEMS CORRECTLY.

KEEP UP THE GOOD WORK.

22 - 21 =?1

18 - 14 =?4

24 - 17 =?7

8 - 2 =?6

YOU NEED TO GET ONE MORE PROBLEM CORRECT TO FINISH

YOUR WORK.

25 - 22 =?3

THIS STUDENT HAS ATTEMPTED 11 PROBLEMS.

10 WERE CORRECT ON THE FIRST TRY.

1 WERE CORRECT ON THE SECOND TRY.

0 WERE NOT ANSWERED CORRECTLY ON EITHER TRY.

NO RECORD LISTED FOR STUDENT # 3

DO YOU WISH TO OPEN A RECORD?YES

STUDENT NAME?JOHN DOE

JOHN DOE IS THE STUDENT NAME, IS THAT CORRECT?YES

WHEN I FINISH TYPING YOU MAY TEAR OFF THE PAGE AND GIVE IT TO YOUR TEACHER.

DONE

GET-CADAIM
 RUN
 CADAIM

1=UPDATE RECORD OF STUDENT, 2=OPEN STUDENT RECORD, 3=ERASE STUDENT RECORD, 4=PRINT ONE STUDENT RECORD, 5=PRINT ALL STUDENT RECORDS.

?2

STUDENT NUMBER IS 1 STUDENT NAME IS?JACK SMITH

DO YOU WISH FURTHER MAINTANENCE?YES

?1

STUDENT # ?4

A

0

OPERATION	ATTEMPTED	1 ST TRY	2 ND TRY	INCORRECT
ADD.	0	0	0	0
SUB.	0	0	0	0
MULT.	0	0	0	0
DIV.	0	0	0	0

HOW SHOULD THE FILE READ
 ?16,10,5,1,0,0,0,0,0,0,0,0,5,1,1,3
 DO YOU WISH FURTHER MAINTANENCE?YES
 ?4
 WHAT IS STUDENT #?
 ??4
 A 0

OPERATION	ATTEMPTED	1 ST TRY	2 ND TRY	INCORRECT
ADD.	16	10	5	1
SUB.	0	0	0	0
MULT.	0	0	0	0
DIV.	5	1	1	3

DO YOU WISH FURTHER MAINTANENCE?NO
 DONE

CRVLEN
36333**TITLE:**

CRVLEN: Computes Length of Any Curve

DESCRIPTION:

This program approximates the length of any curve between two fixed points on the curve, by taking an increasing number of subintervals and computing the sum of the secants involved.

OBJECTIVES:

- A. Time saving factor for computations.
- B. By typing out successive approximations, the machine displays the manner by which the limit is approached.
- C. The attendant discussion focuses attention upon the techniques needed to build up the analytic method for finding the length of a curve.

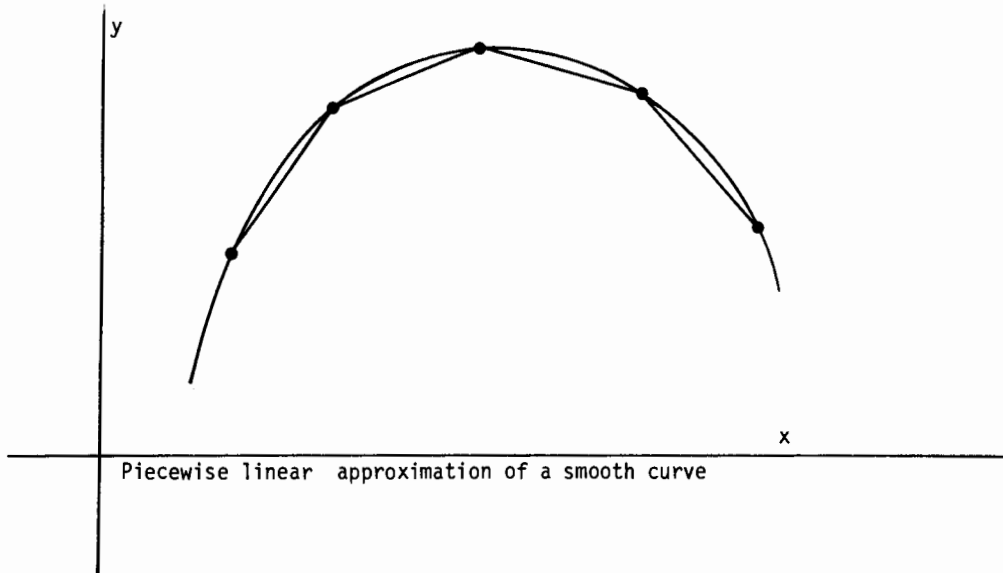
INSTRUCTIONS:PRELIMINARY PREPARATION: None.DISCUSSION: See following page.**ACKNOWLEDGEMENTS:**

Huntington Project
Polytechnic Institute of Brooklyn

INSTRUCTIONS: continued

DISCUSSION:

The operator inserts any function, sets up his own limits, and the computer proceeds to print out several approximations to the actual length a diagram (such as below) should be displayed, indicating the geometric basis for the computations.



RUN

RUN
CRVLEN

LENGTH OF A CURVE

THIS PROGRAM APPROXIMATES THE LENGTH OF ANY CURVE BETWEEN TWO POINTS HAVING P AND Q AS THEIR RESPECTIVE ABSCISSAS. THE PROGRAM DIVIDES THE CURVE INTO INCREASING NUMBERS OF SUBINTERVALS, JOINS THESE WITH SECANTS AND FINDS THE SUM OF THESE SECANTS.

TO INPUT THE FUNCTION WHICH YOUR CURVE REPRESENTS, TYPE AS FOLLOWS AFTER THE PROGRAM STOPS:
(TYPE THE 'RETURN' KEY AFTER EACH LINE INCLUDING 'RUN')

```
1 GO TO 200
300 DEF FNY(X)=.....(YOUR FUNCTION OF X).....
RUN
```

FOR EXAMPLE, TO USE THE FUNCTION $2*X^3+3*X^2-2*X+3$ YOU WOULD TYPE:

```
1 GO TO 200
300 DEF FNY(X)=2*X^3+3*X^2-2*X+3
RUN
```

YOU MIGHT TRY THAT AS YOUR FIRST RUN.

```
DONE
1 GO TO 200
300 DEF FNY(X)=2*X^3+3*X^2-2*X+3
RUN
CRVLEN
```

WHAT ARE THE ABSCISSAS OF THE END POINTS OF THE INTERVAL WHOSE LENGTH YOU WANT (SMALLER ONE FIRST:P,Q)?-1,6

NUMBER OF SUBINTERVALS	SUM OF SECANT LENGTHS	% CHANGE IN LENGTH
1	525.047	NO PREVIOUS VALUE
2	525.158	.02125
4	529.652	.855745
8	531.017	.257691
16	531.964	.178364
32	532.017	9.82135E-03
64	532.042	4.72664E-03
128	532.049	1.28485E-03
256	532.05	2.06491E-04

WOULD YOU LIKE TO TRY NEW END POINTS (1=YES, 0=NO)?0

TO TRY ANOTHER FUNCTION, RETYPE LINE 300, AND 'RUN'.
SEE INSTRUCTIONS FOR MORE DETAILS. IF YOU ARE FINISHED,
TYPE '1' AND 'RETURN' KEY AFTER THE PROGRAM STOPS.

DONE

TITLE:

AREA UNDER CURVE

DESCRIPTION:

By numerical methods, this program evaluates the definite integral of $f(x)$, from $x=a$ to $x=b$, by four different methods of successive approximation:

- I Rectangles (starting with $f(a)$ as height)
- II Rectangles (starting with $f(a+h)$ as height)
- III Trapezoids
- IV Parabolas (Simpson's Rule)

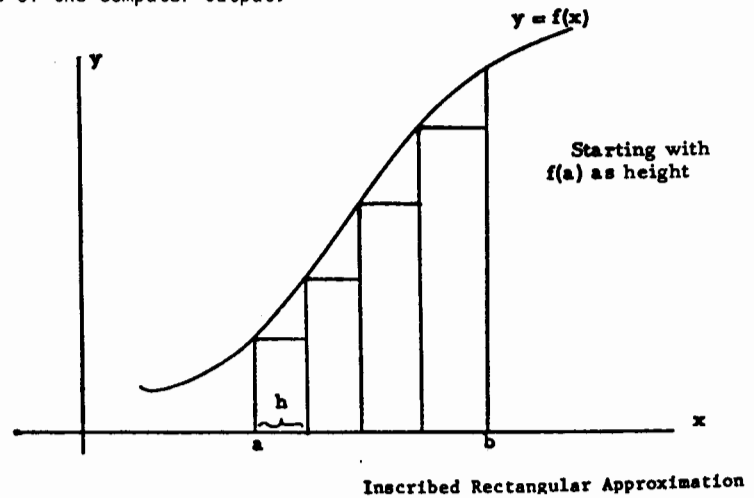
OBJECTIVES:

- A. Enhances comprehension of the analytic procedures for finding the area under a curve.
- B. Dramatizes the limiting processes involved.
- C. Decreases the time needed for lengthy computations.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

Prior to the computer run, diagrams should appear on the board, or on the overhead projector screen to demonstrate the geometric significance of the computer output.

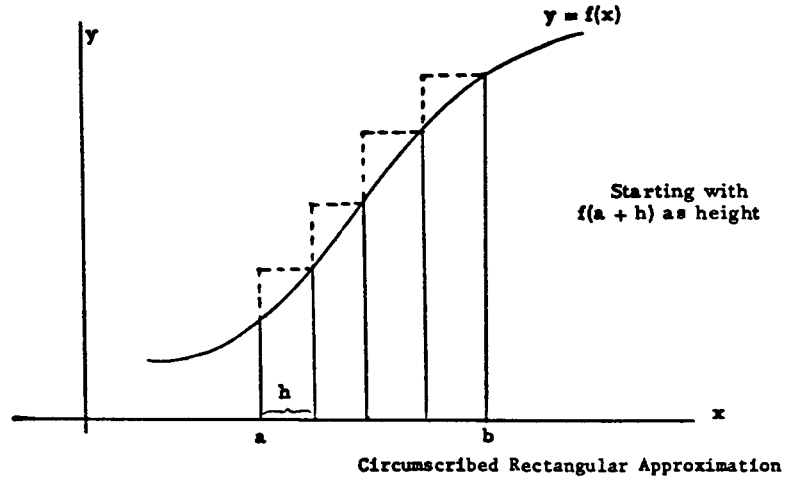


Continued on following page.

ACKNOWLEDGEMENTS:

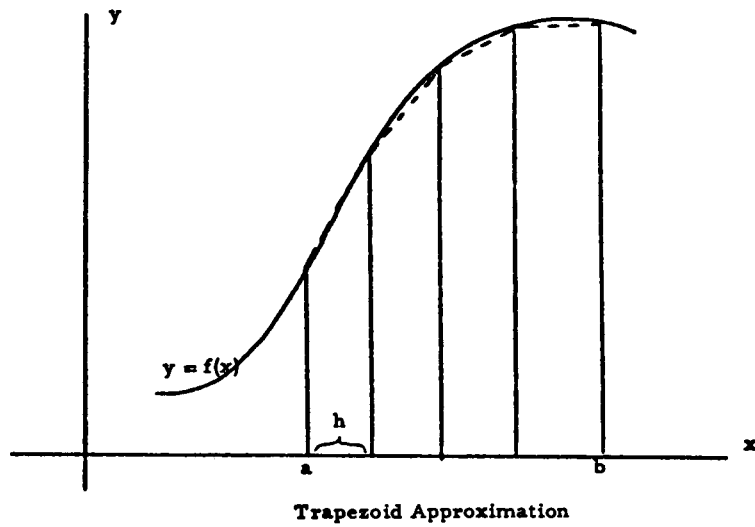
Huntington Project
Polytechnic Institute of Brooklyn

PRELIMINARY PREPARATION: continued



DISCUSSION:

This program may be run as an introduction to the problem of finding the area under a curve. In some classes, the consideration of Simpson's Rule may be omitted or briefly hinted at. With the more mathematically talented classes, an explanation of this parabolic approximation should precede the running of the program.



RUN
CVAREA

AREA UNDER A CURVE - INTEGRATION

THIS PROGRAM EVALUATES THE DEFINITE INTEGRAL OF F(X)
FROM X=A TO X=B BY FOUR METHODS OF NUMERICAL APPROXIMATION:

- I RECTANGLES (INITIAL HEIGHT OF F(X))
- II RECTANGLES (INITIAL HEIGHT OF F(X+H))
- III TRAPEZOIDS
- IV PARABOLAS (SIMPSON'S RULE)

AFTER THE PROGRAM STOPS, YOU MAY ENTER YOUR FUNCTION AS FOLLOWS:

```
1 GO TO 200
300 DEF FNY(X)=...(YOUR FUNCTION OF X)...
RUN
```

FOR EXAMPLE, TO FIND THE AREA UNDER THE CURVE $Y=X^3$ YOU
WOULD TYPE:

```
1 GO TO 200
300 DEF FNY(X)=X^3
RUN
```

YOU MIGHT TRY THAT AS YOUR FIRST RUN.
END EACH LINE, INCLUDING 'RUN', WITH THE 'RETURN' KEY.

DONE

```
1 GOTO 200
300 DEF FNY(X)=X^3
RUN
CVAREA
```

WHAT ARE YOUR VALUES FOR A AND B (SMALLER FIRST:A,B)?1,10

NUMBER OF SUBINTERVALS	I. SUM OF RECTANGLES	II. SUM OF RECTANGLES	III. SUM OF TRAPEZOIDS	IV. SUM OF PARABOLAS
2	753.187	5248.69	3000.94	2499.75
4	1501.17	3748.92	2625.05	2499.75
8	1969.14	3093.01	2531.07	2499.75
16	2226.61	2788.55	2507.58	2499.75
32	2361.22	2642.19	2501.71	2499.75
64	2430.	2570.48	2500.24	2499.75

NOTE THAT SIMPSON'S RULE (IV) CONVERGES FASTEST.

WOULD YOU LIKE TO TRY NEW VALUES FOR A AND B (1-YES, 0-NO)?0

TO USE A NEW FUNCTION YOU NEED ONLY RETYPE LINE 300
AND 'RUN'. SEE INSTRUCTIONS FOR MORE DETAILS.
IF YOU ARE FINISHED, TYPE '1' AND THE 'RETURN' KEY.

DONE

CONTRIBUTED PROGRAM **BASIC**

CXSYSS
36262

TITLE:

SOLVING SYSTEMS OF COMPLEX LINEAR EQUATIONS

DESCRIPTION:

This program will solve systems like $AX=V_1, AX=V_2, \dots, AX=V_s$ where A is an m by n matrix with complex coefficients of the form $a_{ij}+I*(b_{ij}f+1/(c_{ij}f))$, where the a_{ij}, b_{ij} , and c_{ij} are real numbers, and f is a real number that can be varied by the user. The V_j are m-dimensional vectors, with complex components of the form $v_{ij}+I*w_{ij}$ being the i-th component of the j-th vector. X is an n-dimensional vector. The X's will be printed out for each different V_j and each different value of f. The components of each vector X will in general be complex numbers, and will be printed out in both rectangular and polar form. If the system of equations is under-determined, the vectors of the null space will also be printed out. These vectors will be orthonormalized, and their elements will have their rectangular form and the argument of their polar forms printed out.

INSTRUCTIONS:

Enter the above defined data as follows:

8900 DATA m, n, s

8901 DATA $a_{11}, b_{11}, c_{11}, a_{12}, b_{12}, c_{12}, \dots, a_{1n}, b_{1n}, c_{1n}, v_{11}, w_{11}, \dots, v_{1s}, w_{1s}$

8902 DATA $a_{21}, b_{21}, c_{21}, a_{22}, b_{22}, c_{22}, \dots, a_{2n}, b_{2n}, c_{2n}, v_{21}, w_{21}, \dots, v_{2s}, w_{2s}$

:

89xx DATA $a_{m1}, b_{m1}, c_{m1}, a_{m2}, b_{m2}, c_{m2}, \dots, a_{mn}, b_{mn}, c_{mn}, v_{m1}, w_{m1}, \dots, v_{ms}, w_{ms}$

When you run the program you will be asked what frequencies for which you wish the system solved. Enter the values of f, one per line. When you have entered as many values as you wish, type a 999 to end input.

SPECIAL
CONSIDERATIONS:

I and J (capitalized) are used interchangeably for the square root of negative one. The maximum values of m and n are ten each, and the maximum value of s is five. These values may be increased by redimensioning in line 10.

ACKNOWLEDGEMENTS:

Phillip Short
Burnsville Senior High School

RUN

8900 DATA 2,2,2
8901 DATA 1,3,2,5,6,-1,-1,1,-3,2
8902 DATA 1,1,1,-1,3,1,-2,1,2,-2
RUN
CXSYSS

WHAT FREQUENCIES WOULD YOU LIKE THE SYSTEMS SOLVED FOR?
: ?1
: ?2
: ?4
: ?999

FREQUENCY = 1

SOLUTIONS

SYSTEM # 1

-.386785 + .560838 *J ARG = 2.17455 MOD = .68128
.314263 + 4.43191E-02 *J ARG = .140102 MOD = .317372

SYSTEM # 2

1.46011 +- .717163 *J ARG = 5.82663 MOD = 1.62673
-.936342 + .457695 *J ARG = 2.68693 MOD = 1.04222

FREQUENCY = 2

SOLUTIONS

SYSTEM # 1

-.117966 +- .500021 *J ARG = 4.4807 MOD = .513748
1.24792 +- .298069 *J ARG = 6.04872 MOD = 1.28302

SYSTEM # 2

.222502 + .212826 *J ARG = .763175 MOD = .3079
-.383427 + 2.51306E-02 *J ARG = 3.07614 MOD = .38425

FREQUENCY = 4

SOLUTIONS

SYSTEM # 1

-7.55172E-02 +- .211878 *J ARG = 4.37001 MOD = .224933
 .599648 +- .233392 *J ARG = 5.91201 MOD = .643467

SYSTEM # 2

.114965 + 9.72171E-02 *J ARG = .701949 MOD = .150559
 -.177335 + 2.16664E-02 *J ARG = 3.02002 MOD = .178654

DONE
 8900 DATA 2,2,2
 8901 DT-ATA 1,1,0,3,5,0,1,-3,3,9
 8902 DATA -1,1,0,-5,3,0,3,1,2,1
 RUN
 CXSYSS

WHAT FREQUENCIES WOULD YOU LIKE THE SYSTEMS SOLVED FOR?

: ?1
 : ?999

FREQUENCY = 1

VECTOR 1 OF NULL SPACE.

-.942809 +- .235702 *J ARG = 3.38657
 .235702 + 0 *J ARG = 0

VECTOR 2 OF NULL SPACE.

-.235701 + .942809 *J ARG = 1.81577
 0 +- .235702 *J ARG = 4.71239

SOLUTIONS

SYSTEM # 1

-5.55554E-02 +- .111111 *J ARG = 4.24874 MOD = .124226
 -.333333 +- .388889 *J ARG = 4.00376 MOD = .512197

SYSTEM # 2 IS INCONSISTENT.

DONE

TITLE:

COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program estimates the value of the derivative of $\text{SIN}(X)$ for input value of X .

INSTRUCTIONS:

The user is asked to input the value of X .



**SPECIAL
CONSIDERATIONS:**

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

RUN

RUN
DERSIN

PROGRAM TO ESTIMATE THE DERIVATIVE OF
SIN(X) FOR ANY VALUE OF X.

WHAT IS X?-1

X = -1 SIN(X) = -.841471

H	(SIN(X+H)-SIN(X))/H
.1	.581441
-.1	.497364
.01	.544488
-.01	.536096
.001	.540733
-.001	.540018
.0001	.538826
-.0001	.54121

WHAT IS X?0

X = 0 SIN(X) = 0

H	(SIN(X+H)-SIN(X))/H
.1	.998334
-.1	.998334
.01	.999983
-.01	.999983
.001	1
-.001	1
.0001	1.
-.0001	1.

WHAT IS X?1

X = 1 SIN(X) = .841471

H	(SIN(X+H)-SIN(X))/H
.1	.497364
-.1	.581441
.01	.536084
-.01	.544488
.001	.540018
-.001	.540733
.0001	.540018
-.0001	.538826

WHAT IS X?
DONE

DERTIV
36662

TITLE:

COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program computes a set of approximations to the derivative of a supplied function, for an input value of X, the independent variable.

INSTRUCTIONS:

The function to be studied must be supplied as line 330, in the form:

330 LET Y=f(X)

During the program run, you will be asked to input a value for X.

**SPECIAL
CONSIDERATIONS:**

This program is one of 7 which accompany the Project Solo Computer Topics entitled "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Elem. Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

RUN

```
330 LET Y=EXP(X)
RUN
DERTIV
```

THIS PROGRAM WILL COMPUTE A SET OF APPROXIMATIONS TO THE DERIVATIVE OF ANY FUNCTION F(X) WHICH YOU GIVE IT FOR ANY VALUE YOU ASSIGN TO THE INDEPENDENT VARIABLE X, PROVIDED THE FUNCTION HAS A DERIVATIVE FOR THAT X.

FOR EACH X YOU WILL GET AS OUTPUT THE VALUES OF X AND F(X), AS WELL AS A SET OF APPROXIMATIONS TO F'(X) FOR H= .1, -.1, .01, -.01, .001, -.001, .0001, AND -.0001.

WHAT IS X?0

H	APPROXIMATION TO F'(X)
.1	1.05171
-.1	.951624
.01	1.00501
-.01	.995028
.001	1.0004
-.001	.999212
.0001	.998974
-.0001	1.00017

X = 0 Y = 1

WHAT IS X?1

H	APPROXIMATION TO F'(X)
.1	2.85884
-.1	2.58678
.01	2.73194
-.01	2.70472
.001	2.7194
-.001	2.71702
.0001	2.7132
-.0001	2.71797

X = 1 Y = 2.71828

WHAT IS X?
DONE

DESCAL
36674

TITLE:

DESK CALCULATOR SUBROUTINE

DESCRIPTION:

This routine simulates a desk calculator. It is designed to be appended to an interactive program to give the user the ability to calculate needed values in "direct mode", then return to the interactive program and continue. Access to the subroutine is generally performed through a modification of INPUT statements.

INSTRUCTIONS:

The program requests the user to input: one number for unary operations, two numbers for binary operations, and a three-letter mnemonic code for the operation (e.g., SQR for square root). Return to the main program is achieved with the code EXT for Exit.

See REFLEC (HP 36672) as an example of appending DESCAL to an existing program.

DESCAL may be used alone, or added to a program. DESCAL is written as a subroutine beginning at line 9000 and ending at line 9414. It also includes line 9999 END. Total size is 7000 words.

To run DESCAL as a separate program, type:

```
GET- DESCAL
1 GOSUB 9000
2 STOP
RUN
```

To add DESCAL to an existing program, load your program as you would normally, then make these changes:

- a) No line number in your program can be 9000 or greater. Renumber if necessary.
- b) The END statement in your program should be changed to STOP.
- c) Provide access to DESCAL at the appropriate point(s) in your program by inserting GOSUB 9000 instructions (e.g., new lines).

continued on following page

**SPECIAL
CONSIDERATIONS:**

This program was written to be used with some of the Project Solo Computer Topics, a group of units in the Hewlett Packard Curriculum Series.

Uses string variables X\$(3) and Z\$(60), dimensioned in the subroutine.

ACKNOWLEDGEMENTS:

People's Computer Company
Menlo Park, California

INSTRUCTIONS continued

Suppose your program contains an interaction like:

```
100 PRINT "GIVE ME YOUR ANSWER"
110 INPUT A
120 (program continues here)
```

You could modify this interaction as follows:

```
100 PRINT "GIVE ME YOUR ANSWER, OR TYPE 9000 FOR DESCAL."
110 INPUT A
112 IF A#9000 THEN 120
114 GOSUB 9000
116 GO TO 100
120 (program continues here)
```

NOTE: 9000 is used as the "flag" in line 112. Any number which is unlike the true answer may be used instead.

d) DESCAL uses the following variables:

Numeric: Z0, Z1, Z2

Subscripted: none

String: X\$(3), Z\$(60) (Dimensions specified in line 9001)

You should avoid using any of these variable names anywhere else in your program.

When these four modifications have been completed, type

```
APPEND- DESCAL
RUN
```

Functions available

<u>Function</u>	<u>Abbreviation</u>	<u>Result</u>
Exit	EXT	[return]
Clear	CLR	Z1=Z2=0
Exchange	EXC	Z1 \leftrightarrow Z2
Addition	ADD	Z1=Z1+Z2
Subtraction	SUB	Z1=Z1-Z2
Multiplication	MUL	Z1=Z1*Z2
Division	DIV	Z1=Z1/Z2
Power	POW	Z1=Z1^Z2
Hypotenuse of a right triangle	HYP	Z1=SQR(Z1*Z1+Z2*Z2)
Reciprocal	RCP	Z1=1/Z1
Negative	NEG	Z1=-Z1
Exponentiation	EXP	Z1=e^Z1
Logarithm (natural)	LOG	Z1=Ln(Z1)
Square root	SQR	Z1=SQR(Z1)
Sine	SIN	Z1=SIN(Z1)
Cosine	COS	Z1=COS(Z1)
Tangent	TAN	Z1=TAN(Z1)
Arctangent	ATN	Z1=ATN(Z1)
Radians to degrees	RTD	Z1=Z1*57.2958
Degrees to radians	DTR	Z1=Z1/57.2958

NOTE:

- To select a function, type the abbreviation of the function.
- In the Result column above, "=" means "is replaced by".
- Z1 is the "1st number," and also accumulates the answer. Z2 is the "2nd number."

RUN

```
1 PRINT "MAIN PROGRAM BEGINS."  
2 GOSUB 9000  
3 PRINT "MAIN PROGRAM ENDS."  
4 STOP
```

```
RUN  
DESCAL
```

```
MAIN PROGRAM BEGINS.  
CALCULATOR MODE.  
CLEARED TO ZERO  
1ST NUMBER?3  
FUNCTION?ADD  
2ND NUMBER?50  
ADD= 53
```

```
FUNCTION?MUL  
2ND NUMBER?2  
MUL= 106
```

```
FUNCTION?CLR  
CLEARED TO ZERO  
1ST NUMBER?144  
FUNCTION?SQR  
SQR= 12
```

```
FUNCTION?DIV  
2ND NUMBER?3  
DIV= 4
```

```
FUNCTION?DIV  
2ND NUMBER?0  
DIVISION BY ZERO IS UNDEFINED.  
DIV= 4
```

```
FUNCTION?SIN  
SIN=-.756803
```

```
FUNCTION?SQR  
SQR OF NEGATIVE NUMBER IS UNDEFINED.  
SQR=-.756803
```

```
FUNCTION?EXC  
2ND NUMBER?10  
EXC= 10
```

```
FUNCTION?NEG  
NEG=-10
```

```
FUNCTION?EXT  
EXIT.  
MAIN PROGRAM ENDS.
```

```
DONE
```


MATHEMATICS (EDUCATION) (801)
CONTRIBUTED PROGRAM **BASIC**

DIFFEQ
36159

TITLE:

CAI IN SOLUTION OF LINEAR FIRST-ORDER DIFFERENTIAL
EQUATIONS

DESCRIPTION:

This program solves a set of linear first-order differential equations
using the Runge-Kutta-Gill Algorithm.

INSTRUCTIONS:

Instructions and a sample run are included within the program.

**SPECIAL
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Differential equations and engineering courses.
Student Background Required: General knowledge of differential equations.
Intended as a general purpose program.

ACKNOWLEDGEMENTS:

Anthony Q. Baxter
University of Virginia

RUN

RUN
DIFFEQ

FOURTH ORDER RUNGE-KUTTA-GILL INTEGRATION ALGORITHM
THE FOLLOWING INFORMATION MUST BE SPECIFIED:

9900 DATA T1,T2,N,H,NP
 WHERE T1=INITIAL TIME
 T2=FINAL TIME
 N =NUMBER OF DIFFERENTIAL EQUATIONS
 H =INTEGRATION STEP SIZE
 NP=NUMBER OF CALCULATIONS BETWEEN PRINTINGS
 (PRINTING AT:T1,T1+NP*H,T1+2*NP*H,...,T2)
 9901 DATA <INITIAL CONDITIONS>
 (IE. X(T1) FOR 1ST. EQUATION,
 X(T1) FOR THE 2ND. EQUATION,
 ETC.)

THE EQUATIONS WILL BE ENTERED AS FOLLOWS:
 8900 LET D(1)=FUNCTION OF (X(1),X(2),...,X(N-1),X(N),T)
 8901 LET D(2)=FUNCTION OF (X(1),X(2),...,X(N-1),X(N),T)
 89--
 89-- LET D(N)=FUNCTION OF (X(1),X(2),...,X(N-1),X(N),T)
 WHERE X(1)=SOLUTION TO D(1) AT TIME T,
 X(2)=SOLUTION TO D(2) AT TIME T,
 ETC.

FOR EXAMPLE TO SOLVE: $X' = 2/Y$
 $Y' = -1/X$
 $X(1) = Y(1) = 1$
 ON THE INTERVAL [1,3] WITH STEP SIZE .0625

WE NEED ONLY SPECIFY THE FOLLOWING:

1. SPECIFY THE EQUATIONS
 8900 LET D(1)=2/X(2)
 8901 LET D(2)=-1/X(1)
2. INTERVAL, # EQUATIONS, STEP SIZE, AND PRINTING INSTRUCTIONS
 9900 DATA 1,3, 2, .0625, 8
3. INITIAL CONDITIONS
 9901 DATA 1, 1

DONE
 8900 LET D(1)=2/X(2)
 8901 LET D(2)=-1/X(1)
 9900 DATA 1,3,2,.0625,8
 9901 DATA 1,1
 RUN
 DIFFEQ

FOURTH ORDER RUNGE-KUTTA-GILL INTEGRATION ALGORITHM

SOLUTION ON THE INTERVAL: 1 3 STEP SIZE: .0625
 SOLUTION TO BE PRINTED EVERY .5 UNITS

TIME	EQUATION: 1	EQUATION: 2
1	1	1
1.5	2.25	.666667
2	4	.5
2.5	6.25	.4
3	9.	.333333

DONE

TITLE:

X-Y AXIS SEGMENT PROGRAM

DESCRIPTION:

This program finds the distance, midpoint, and slope of a line on the coordinate X-Y axis. The line is determined by the two endpoints, P1 and P2. The program is useful to users who do not want their answers in decimal form. Fractions are left as fractions but are reduced to lowest terms. Square roots are left as square roots but are rationalized as far as possible.

INSTRUCTIONS:

Run the program and input the coordinates of the two endpoints on the X-Y axis. After solving a problem it will ask for another.

**SPECIAL
CONSIDERATIONS:**

The Aardvarkand Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

ACKNOWLEDGEMENTS:

John C. Ridges
Aardvark and Company
2130 Bell Court
Lakewood, Colorado 80215

RUN

RUN
DIMIS

INPUT P1(X1,Y1) AND P2(X2,Y2)?1,0,1,25
THE DISTANCE IS 25
THE MIDPOINT IS P(+1,+25/2)
THE SLOPE IS UNDEFINED

INPUT P1(X1,Y1) AND P2(X2,Y2)?0,0,3,4
THE DISTANCE IS 5
THE MIDPOINT IS P(+3/2,+2)
THE SLOPE IS +4/3

INPUT P1(X1,Y1) AND P2(X2,Y2)?28,4,93,2
THE DISTANCE IS SQR(4229)
THE MIDPOINT IS P(+121/2,+3)
THE SLOPE IS -2/65

INPUT P1(X1,Y1) AND P2(X2,Y2)?6,3,2,1
THE DISTANCE IS 2*SQR(5)
THE MIDPOINT IS P(+4,+2)
THE SLOPE IS +1/2

INPUT P1(X1,Y1) AND P2(X2,Y2)?
DONE

MATHEMATICS (EDUCATION) (801)
CONTRIBUTED PROGRAM **BASIC**

DRILL
36129

TITLE:

SUPER DRILL IN ARITHMETIC FACTS

DESCRIPTION:

DRILL provides students 30 seconds of drill in the so-called arithmetic facts. The student initiates the drill in addition, subtraction, multiplication, or division. DRILL scores each response and tallies his total number correct. DRILL then loops and provides students with the option to practice some more.

Since the machine provides a limited response time, the students are encouraged in both speed and accuracy.

All problems resolve to positive whole numbers between 0 and 20.

INSTRUCTIONS:

The student is able to choose his area of drill. Inasmuch as the machine recognizes only the first letter of his response to this choice, "ADDITION," "ADD," or simply "A" are equivalent.

The teacher may alter the time-out factor--the number of seconds allotted by the machine before continuing to the next problem--by changing line 9 to some other value for Z. DRILL is initially set for 5 seconds.

**SPECIAL
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES:
Suitable Courses: General Math, Arithmetic

Student Background: 1) to supplement the CAI Drill & Practice Program
2) to supplement typical high school general math class
3) to supplement any elementary school class

ACKNOWLEDGEMENTS:

Tim Aaronson
Woodrow Wilson High School/San Francisco

RUN

RUN
DRILL

DO YOU WANT DRILL IN ADDITION, SUBTRACTION,
MULTIPLICATION, OR DIVISION (TYPE WHAT YOU WANT)? SUBTRACTIN

- C 11 - 9 = 2
- C 17 - 8 = 9
- C 4 - 3 = 1
- C 17 - 8 = 9
- C 13 - 7 = 6
- C 9 - 4 = 5
- C 11 - 6 = 5
- C 18 - 9 = 9
- X 12 - 4 = 5
- C 9 - 3 = 6
- C 6 - 1 = 5
- C 18 - 9 = 9
- C 17 - 8 = 9
- C 3 - 1 = 2
- C 8 - 4 = 4
- C 4 - 3 = 1
- C 6 - 5 = 1
- C 10 - 2 = 8
- C 13 - 5 = 8
- C 11 - 5 = 6
- C 4 - 1 = 3
- C 10 - 3 = 7
- C 12 - 5 = 7
- C 7 - 5 = 2
- C 8 - 3 = 5
- C 5 - 3 = 2
- C 6 - 1 = 5
- C 15 - 7 = 8

YOU GOT 27 CORRECT AND 1 WRONG IN 30 SECONDS OF SUPERDRILL

DO YOU WANT MORE? YES

DO YOU WANT DRILL IN ADDITION, SUBTRACTION,
MULTIPLICATION, OR DIVISION (TYPE WHAT YOU WANT)? DIV

- C 24 / 3 = 8
- C 36 / 4 = 9
- C 18 / 2 = 9
- 54 / 6 = X
- C 8 / 8 = 1
- C 9 / 9 = 1
- C 3 / 1 = 3
- C 6 / 2 = 3
- C 10 / 2 = 5
- 49 / 7 = X
- C 16 / 8 = 2

YOU GOT 9 CORRECT AND 2 WRONG IN 30 SECONDS OF SUPERDRILL

DO YOU WANT MORE? YES

DO YOU WANT DRILL IN ADDITION, SUBTRACTION,
MULTIPLICATION, OR DIVISION (TYPE WHAT YOU WANT)? M

- C 3 X 1 = 3
- C 1 X 2 = 2
- 6 X 2 = 12X
- C 1 X 6 = 6
- C 0 X 7 = 0
- X 1 X 8 = 1
- 7 X 9 = 63X
- C 3 X 8 = 24
- C 2 X 2 = 4
- C 1 X 7 = 7
- C 1 X 0 = 0
- C 6 X 5 = 30
- C 9 X 8 = 72

YOU GOT 10 CORRECT AND 3 WRONG IN 30 SECONDS OF SUPERDRILL

DO YOU WANT MORE? P

.....LATER, MAN

DONE

CONTRIBUTED PROGRAM **BASIC**EXTEND
36253

TITLE: "INFINITE" PRECISION MATH UTILITY PROGRAM

DESCRIPTION: This program does division, exponentiation, finds factorials, and finds prime factors with complete accuracy.

INSTRUCTIONS: Run the program. The instructions are self explanatory.

SPECIAL CONSIDERATIONS: This program can be used on a 2000B system by reducing matrix A to 1800 elements and changing line 1040 to:
1040 L=J1=1800

The Aardvark and Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

ACKNOWLEDGEMENTS: Aardvark and Company
2130 Bell Court
Lakewood, Colorado 80215

RUN

RUN
EXTEND

THE FOLLOWING INSTRUCTIONS CAN BE USED:

FACTORIAL
DIVIDE
FACTOR
EXPONENTIATE
STOP

WHAT IS YOUR INSTRUCTION?FACTORIAL
INPUT FROM, TO AND STEP?1,100,25

25 FACTORIAL = 15,511,210,043,330,985,984,000,000

50 FACTORIAL = 30,414,093,201,713,378,043,612,608,166,064,768,844,377,
641,568,960,512,000,000,000,000

75 FACTORIAL = 24,809,140,811,395,398,091,946,477,116,594,033,660,926,
243,886,570,122,837,795,894,512,655,842,677,572,867,409,443,815,424,000,
000,000,000,000,000

100 FACTORIAL = 93,326,215,443,944,152,681,699,238,856,266,700,490,715,
968,264,381,621,468,592,963,895,217,599,993,229,915,608,941,463,976,156,
518,286,253,697,920,827,223,758,251,185,210,916,864,000,000,000,000,000,
000,000,000

WHAT IS YOUR INSTRUCTION?DIVIDE

INPUT A/B?11,7
HOW MANY DIGIT ACCURACY (MIN. OF 1)?100

11 / 7 = 1.571428571428571428571428571428571428571428571428571428571428571
71428571428571428571428571428571428571428571428571

WHAT IS YOUR INSTRUCTION?FACTOR

INPUT NUMBER TO BE FACTORED?1234567890
2 * 3 * 3 * 5 * 3607 * 3803

WHAT IS YOUR INSTRUCTION?EXPONENTIATE

INPUT THE BASE & EXPONENT?2,24
2 ^ 24 = 16,777,216

WHAT IS YOUR INSTRUCTION?STOP

DONE

TITLE:

COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program uses the trapezoid method to compute approximations to the definite integral of a specified function, and compares the approximation to $g(B)-g(A)$, where

A is the lower bound
B is the upper bound
g(X) is a primitive of f(X), the specified function.

INSTRUCTIONS:

f(X) and g(X) must be specified as lines 300 and 500 respectively.

During the program run, the user is asked to input A, B, and the number of approximating trapezoids.

When the program has printed the result, the user may select option 1, 2, or 3, which represent:

1. Change the number of approximating trapezoids.
2. Change the values of A and B.
3. Terminate the program.

**SPECIAL
CONSIDERATIONS:**

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

f(X) must be supplied as line 300 as follows:

```
300 LET Y=f(X)
Similarly, g(X) must be supplied as line 500
500 LET Z=g(X)
```

before the program is run.

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Calculus (can be concurrent), BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

RUN

300 LET Y=SIN(X)
 500 LET Z=-COS(X)
 RUN
 FUNDTH

THIS PROGRAM COMPUTES APPROXIMATIONS TO THE DEFINITE INTEGRAL OF THE FUNCTION $Y=F(X)$ WHICH YOU SUPPLIED ON LINE 300, OVER THE INTERVAL (A,B) , AND COMPARES THE APPROXIMATION TO $G(B)-G(A)$, WHERE $Z=G(X)$ IS A PRIMITIVE OF $F(X)$ SUPPLIED BY YOU ON LINE 500.

WHAT IS A?-3.14159
 WHAT IS B?0
 HOW MANY SUBINTERVALS ON [A,B]?64
 INTERVAL [-3.14159 , 0]. 64 TRAPEZOIDS.

APPROXIMATION TO INTEGRAL IS *****-1.9996 *****

$G(B)-G(A) = -1. \quad - 1. \quad = -2. \quad .$

TYPE THE CODE?1
 HOW MANY SUBINTERVALS ON [A,B]?256
 INTERVAL [-3.14159 , 0]. 256 TRAPEZOIDS.

APPROXIMATION TO INTEGRAL IS *****-1.99997 *****

$G(B)-G(A) = -1. \quad - 1. \quad = -2. \quad .$

TYPE THE CODE?2

WHAT IS A?-3.14159
 WHAT IS B?3.14159
 HOW MANY SUBINTERVALS ON [A,B]?64
 INTERVAL [-3.14159 , 3.14159]. 64 TRAPEZOIDS.

APPROXIMATION TO INTEGRAL IS *****-2.57787E-06 *****

$G(B)-G(A) = 1. \quad - 1. \quad = 0 \quad .$

TYPE THE CODE?3

DONE

GAME
36265**TITLE:**

CLASSIC MATRIX OF GAME THEORY

DESCRIPTION:

This program accepts as input an $n \times m$ matrix, and checks for a minimax solution to the game. If no solution exists it then generates a mixed strategy using linear programming. The game is then played with the computer having columns and paying the value of the chosen matrix element.

INSTRUCTIONS:

The first inputs concern the game matrix - how many rows are there in the matrix followed by how many columns. Then enter the matrix row by row. If the value of the game is positive, it will be subtracted from each of your winnings, and added to the computers'. If it is negative, the player has five seconds after the matrix is printed to type in CAESAR. This action insures that the value of the game, (which is negative) will be subtracted from the players winnings and added to the computers' winnings. The player is now asked how many times he wants to play. For each play he is asked which row he wants to play.

**SPECIAL
CONSIDERATIONS:**

The game matrix can be of dimensions up to 20 by 20.

ACKNOWLEDGEMENTS:

Phillip Short
Burnsville Senior High School

RUN

RUN
GAME

THIS PROGRAM PLAYS THE CLASSIC MATRIX GAME. SEE S. VAJDA
AN INTRODUCTION TO LINEAR PROGRAMMING AND THE THEORY OF GAMES
OR ANY BOOK ON FINITE MATHEMATICS FOR A DESCRIPTION.

INPUT NUMBER OF YOUR STRATEGIES?4
AND THE NUMBER OF MINE?4

INPUT THE GAME MATRIX ROW BY ROW, YOU HAVE ROW STRATEGIES,
AND RECEIVE PAYOFFS?-1,6,-6,1
??1,3,-2,1
??7,7,7,-15
??1,3,-5,16

HERE IS A COPY OF THE GAME MATRIX.

-1	6	-6	1
1	3	-2	1
7	7	7	-15
1	3	-5	16

YOU PAY ME .860466 FOR EACH PLAY.

HOW MANY TIMES WILL WE PLAY THE GAME?6

WHAT ROW DO YOU PLAY?4

I CHOSE COLUMN 3 .

PAY-OFF IS -5 .
MY NET GAIN IS 5.86047 UNITS.
YOU HAVE A TOTAL OF -5.86047 POINTS,
I HAVE 5.86047 POINTS.

WHAT ROW DO YOU PLAY?3

I CHOSE COLUMN 3 .

PAY-OFF IS 7 .
YOUR NET GAIN IS 6.13953 UNITS.
YOU HAVE A TOTAL OF .279068 POINTS,
I HAVE -.279068 POINTS.

WHAT ROW DO YOU PLAY?4

I CHOSE COLUMN 3 .

PAY-OFF IS -5 .
MY NET GAIN IS 5.86047 UNITS.
YOU HAVE A TOTAL OF -5.5814 POINTS,
I HAVE 5.5814 POINTS.

WHAT ROW DO YOU PLAY?2

I CHOSE COLUMN 4 .

PAY-OFF IS 1 .
YOUR NET GAIN IS .139534 UNITS.
YOU HAVE A TOTAL OF -5.44186 POINTS,
I HAVE 5.44186 POINTS.

WHAT ROW DO YOU PLAY?4

I CHOSE COLUMN 3 .

PAY-OFF IS -5 .
MY NET GAIN IS 5.86047 UNITS.
YOU HAVE A TOTAL OF -11.3023 POINTS,
I HAVE 11.3023 POINTS.

WHAT ROW DO YOU PLAY?4

I CHOSE COLUMN 4 .

PAY-OFF IS 16 .
YOUR NET GAIN IS 15.1395 UNITS.
YOU HAVE A TOTAL OF 3.8372 POINTS,
I HAVE -3.8372 POINTS.

YOU WIN BY A TOTAL OF 3.8372 TO -3.8372
GOOD GOING..

DONE

MATHEMATICS (EDUCATION) (801)
CONTRIBUTED PROGRAM **BASIC**

GRAPH1
36665

TITLE:

COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program is designed to provide information to the student about functions. The program prints values of $f(x)$, $d(f(x))$, and $d'(f(x))$, given $f(x)$ and x . The student should graph the values and attempt to discover what the nature of $f(x)$ is.

The program contains five different functions, on lines

220, 390, 490, 580, and 680

All functions are in the form $Y=f(X)$.

INSTRUCTIONS:

The user is asked to select one of the five functions by typing 100, 200, 300, 400 or 500, and then entering a value for x .

The program provides five opportunities to see the values of the function, the first derivative, and the second derivative for input values of x . After five values of x have been evaluated, the program asks the user to type 1 or 2, representing:

1. Enough information has been obtained.
2. Not enough information has been obtained; let me try 5 more values of x .

If option 1 is selected, the program will begin again at the beginning.

**SPECIAL
CONSIDERATIONS:**

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

To change the functions, retype lines 220, 390, 490, 580, and/or 680. Functions are in the form $LET Y=f(X)$.

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

RUN

RUN
GRAPH1

PLEASE TYPE THE CODE NUMBER (100, 200, 300, 400, 500)
OF THE FUNCTION THAT YOU WANT TO WORK WITH.

FUNCTION?100

TYPE A VALUE FOR X.

?-2

X = -2 Y = 4 D1 = -4 D2 = 2

TYPE A VALUE FOR X.

?-1

X = -1 Y = 1 D1 = -2 D2 = 2

TYPE A VALUE FOR X.

?0

X = 0 Y = 0 D1 = 0 D2 = 2

TYPE A VALUE FOR X.

?1

X = 1 Y = 1 D1 = 2 D2 = 2

TYPE A VALUE FOR X.

?2

X = 2 Y = 4 D1 = 4 D2 = 2

IF YOU HAVE ENOUGH INFORMATION ABOUT THIS FUNCTION,

TYPE 1; FOR MORE INFORMATION, TYPE 2

?1

TO OBTAIN ANOTHER FUNCTION TYPE ITS CODE NUMBER
(100, 200, 300, 400, OR 500). TO STOP THE PROGRAM,
PRESS CTRL/C, THEN PRESS RETURN.

FUNCTION?400

TYPE A VALUE FOR X

?-10

X = -10 Y = .544022 D1 = -.839072 D2 = -.544022

TYPE A VALUE FOR X

?-2.5

X = -2.5 Y = -.598472 D1 = -.801144 D2 = .598472

TYPE A VALUE FOR X

?0

X = 0 Y = 0 D1 = 1. D2 = 0

TYPE A VALUE FOR X

?2.5

X = 2.5 Y = .598472 D1 = -.801144 D2 = -.598472

TYPE A VALUE FOR X

?10

X = 10 Y = -.544022 D1 = -.839071 D2 = .544022

IF YOU HAVE ENOUGH INFORMATION ABOUT THIS FUNCTION,

TYPE 1; FOR MORE INFORMATION, TYPE 2

?1

TO OBTAIN ANOTHER FUNCTION TYPE ITS CODE NUMBER
(100, 200, 300, 400, OR 500). TO STOP THE PROGRAM,
PRESS CTRL/C, THEN PRESS RETURN.

FUNCTION?

DONE

MATHEMATICS (EDUCATION) (801)
CONTRIBUTED PROGRAM **BASIC**

GRAPH2
36666

TITLE:

COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program is designed to provide information to students about functions. For a selected $f(X)$ and input value of X , the program prints the values of the first and second derivatives of $f(X)$. The student should graph the values and attempt to discover what $f(X)$ is.

INSTRUCTIONS:

The program contains five different functions, on lines 220, 390, 490, 580 and 680. All functions are in the form $Y=f(X)$.

The user is asked to select one of the five functions by typing 100, 200, 300, 400, or 500.

Then the program asks for a value for X , and the user has 5 opportunities to input values of X , and obtain the values of the first and second derivative of the unknown $f(X)$. After five values of X have been evaluated, the program asks for an input of 1 or 2, representing:

1. Enough information has been obtained.
2. Not enough information has been obtained; let me try 5 more values of X .

If option 1 is selected, another function may be selected.

**SPECIAL
CONSIDERATIONS:**

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

To change the functions, retype lines 220, 390, 490, 580, and/or 680. Functions are in the form $LET Y=f(X)$.

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

RUN

RUN
GRAPH2

PLEASE TYPE THE CODE NUMBER (100, 200, 300, 400, 500)
OF THE FUNCTION THAT YOU WANT TO WORK WITH.

FUNCTION?200

TYPE A VALUE FOR X.

?-1

X = -1 D1 = -6 D2 = 2

TYPE A VALUE FOR X.

?0

X = 0 D1 = -4 D2 = 2

TYPE A VALUE FOR X.

?1

X = 1 D1 = -2 D2 = 2

TYPE A VALUE FOR X.

?5

X = 5 D1 = 6 D2 = 2

TYPE A VALUE FOR X.

?100

X = 100 D1 = 196 D2 = 2

IF YOU HAVE ENOUGH INFORMATION ABOUT THIS FUNCTION,

TYPE 1; FOR MORE INFORMATION, TYPE 2

?1

TO OBTAIN ANOTHER FUNCTION TYPE ITS CODE NUMBER
(100, 200, 300, 400, OR 500). TO STOP THE PROGRAM,
PRESS CTRL/C, THEN PRESS RETURN.

FUNCTION?300

TYPE A VALUE FOR X.

?-1

X = -1 D1 = .367879 D2 = .367879

TYPE A VALUE FOR X.

?0

X = 0 D1 = 1 D2 = 1

TYPE A VALUE FOR X.

?1

X = 1 D1 = 2.71828 D2 = 2.71828

TYPE A VALUE FOR X.

?-10

X = -10 D1 = 4.53999E-05 D2 = 4.53999E-05

TYPE A VALUE FOR X.

?10

X = 10 D1 = 22026.5 D2 = 22026.5

IF YOU HAVE ENOUGH INFORMATION ABOUT THIS FUNCTION,

TYPE 1; FOR MORE INFORMATION, TYPE 2

?1

TO OBTAIN ANOTHER FUNCTION TYPE ITS CODE NUMBER
(100, 200, 300, 400, OR 500). TO STOP THE PROGRAM,
PRESS CTRL/C, THEN PRESS RETURN.

FUNCTION?

DONE

TITLE:

COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program computes an approximation to the definite integral of a function over a supplied interval on the X-axis, using the trapezoidal method of approximation.

INSTRUCTIONS:

The desired function is supplied as program line 250, in the form

250 LET Y=f(X)

During the run, the user is asked to input A and B, which are the lower and upper bounds of the desired interval on the X-axis.

The program then asks the number of approximating trapezoids (N must be greater than 0).

When the program has printed the resulting approximation, the user is asked to select option 1, 2, or 3 which represent:

1. Change the number of approximating trapezoids.
2. Change A and B.
3. Terminate the program.

**SPECIAL
CONSIDERATIONS:**

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

To change the function, line 250 must be retyped before running the program.

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Mathematics (Secondary, College): Elem. Computer Science

Student Background Required: Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

RUN

```
250 LET Y=X^2-2*X
RUN
INTEGR
```

THIS PROGRAM COMPUTES APPROXIMATIONS TO THE
DEFINITE INTEGRAL OF THE FUNCTION WHICH YOU
SUPPLIED ON LINE 250, OVER AN INTERVAL (A,B).

NOW TYPE A VALUE FOR A?1
TYPE A VALUE OF B?3
HOW MANY SUBINTERVALS DO YOU WANT [A,B] DIVIDED INTO?16

THE INTERVAL IS [1 , 3].
THE NUMBER OF APPROXIMATING TRAPEZOIDS IS 16

THE APPROXIMATION IS ***** .671875 *****

TYPE THE CHANGE CODE?1
HOW MANY SUBINTERVALS DO YOU WANT [A,B] DIVIDED INTO?256

THE INTERVAL IS [1 , 3].
THE NUMBER OF APPROXIMATING TRAPEZOIDS IS 256

THE APPROXIMATION IS ***** .666687 *****

TYPE THE CHANGE CODE?2
NOW TYPE A VALUE FOR A?-2
TYPE A VALUE OF B?2
HOW MANY SUBINTERVALS DO YOU WANT [A,B] DIVIDED INTO?32

THE INTERVAL IS [-2 , 2].
THE NUMBER OF APPROXIMATING TRAPEZOIDS IS 32

THE APPROXIMATION IS ***** 5.34375 *****

TYPE THE CHANGE CODE?1
HOW MANY SUBINTERVALS DO YOU WANT [A,B] DIVIDED INTO?64

THE INTERVAL IS [-2 , 2].
THE NUMBER OF APPROXIMATING TRAPEZOIDS IS 64

THE APPROXIMATION IS ***** 5.33594 *****

TYPE THE CHANGE CODE?3

DONE

TITLE:

LIMIT OF (SIN X)/X

DESCRIPTION:

This program demonstrates that the limit of $\frac{\sin x}{x}$, as x approaches 0, equals 1, provided x is measured in radians. If x is measured in degrees, the limit equals approximately .017.

OBJECTIVES:

- A. To demonstrate the manner by which the limit of $\frac{\sin x}{x}$ is approached.
- B. To show that degree measure does not yield the same solution as radian measure.

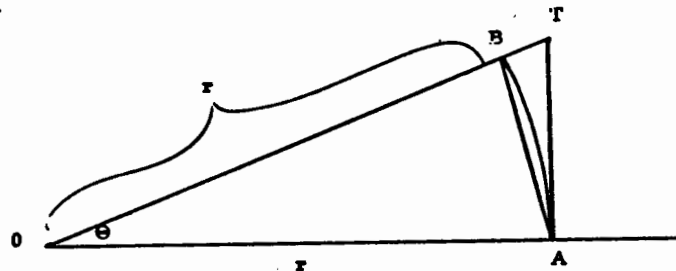
INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - Knowledge of degree vs. radian measure
- B. Materials - None

DISCUSSION:

Following the computer type-out, the teacher will use the analytic method to evaluate the limit. Prior to this discussion, the student should be reminded of the area formulas for a triangle and for a sector in terms of the central angle measured in radians. A geometric diagram should be presented showing the sector lying between two triangles.



$$\text{Here, } \frac{1}{2}r^2 \sin \theta \leq \frac{1}{2}r^2 \theta \leq \frac{1}{2}r^2 \tan \theta$$

Circular Sector with Circumscribed and Inscribed Triangles

The teacher can modify the type-out by inserting: 195 GO TO 300. This decreases the number of lines typed out to the final eleven appearing on the program "run".

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN

RUN
LIMSIN

THIS PROGRAM DEMONSTRATES THAT THE LIMIT OF
 $F(X) = (\sin X)/X$, AS X APPROACHES 0, IS EQUAL TO 1,
 PROVIDED X IS MEASURED IN RADIANS.

$$\lim_{X \rightarrow 0} \frac{\sin(X)}{X} = 1$$

WHEN X IS IN DEGREES,

WHEN X IS IN RADIANS,

X IS	F(X) IS	X IS	F(X) IS
90	1.11111E-02	1.5708	.63662
85	1.17199E-02	1.48353	.671504
80	1.23101E-02	1.39626	.705317
75	.012879	1.309	.737913
70	1.34242E-02	1.22173	.769149
65	1.39432E-02	1.13446	.798887
60	1.44338E-02	1.0472	.826994
55	1.48937E-02	.95993	.853345
50	1.53209E-02	.872664	.877823
45	1.57135E-02	.785398	.900317
40	1.60697E-02	.698131	.920726
35	1.63879E-02	.610865	.938958
30	1.66667E-02	.523598	.95493
25	1.69047E-02	.436332	.96857
20	.017101	.349066	.979816
15	1.72546E-02	.261799	.988616
10	1.73648E-02	.174533	.994931
5	1.74311E-02	8.72664E-02	.998731
1	1.74524E-02	1.74533E-02	.999949
.9	1.74526E-02	.015708	.999959
.8	1.74527E-02	1.39626E-02	.999968
.7	1.74528E-02	1.22173E-02	.999975
.6	.017453	.010472	.999982
.5	1.74531E-02	8.72664E-03	.999987
.4	1.74531E-02	6.98131E-03	.999992
.3	1.74532E-02	5.23598E-03	.999996
.2	1.74532E-02	3.49066E-03	.999998
.1	1.74533E-02	1.74533E-03	1.
.09	1.74533E-02	1.57079E-03	1.
.08	1.74533E-02	1.39626E-03	1.
.07	1.74533E-02	1.22173E-03	1.
.06	1.74533E-02	1.04720E-03	1
.05	1.74533E-02	8.72664E-04	1.
.04	1.74533E-02	6.98131E-04	1
.03	1.74533E-02	5.23598E-04	1
.02	1.74533E-02	3.49066E-04	1
.01	1.74533E-02	1.74533E-04	1.

DONE

MATHEMATICS (EDUCATION) (801)
CONTRIBUTED PROGRAM **BASIC**

LINES
36700

TITLE:

CONVERSATIONAL COMPUTER GENERATED CALCULUS QUIZ

DESCRIPTION:

Conversational computer generated calculus quiz. Values are random so the program can be used several times by a student.

INSTRUCTIONS:

Conversational

ACKNOWLEDGEMENTS:

Babson College
Babson Park, Massachusetts

RUN

RUN
LINES

TYPE ANSWER TO EACH QUESTION, THEN PRESS RETURN KEY.
FRACTIONAL VALUES MUST BE ENTERED IN DECIMAL FORM - ONE
DECIMAL PLACE IS O.K.

GIVEN THE POINTS (-3, 7), AND (3, 10),
WHAT IS THE SLOPE OF THE LINE PASSING THROUGH THESE POINTS?.5

CORRECT

WHAT IS THE SLOPE OF THE STRAIGHT LINE WHOSE EQUATION IS
 $Y = -1 X + 2$?-1

CORRECT

WHAT IS THE SLOPE OF THE LINE WHOSE EQUATION IS
 $6 X + -8 Y = -1$?.7

CORRECT

WHAT IS THE Y-INTERCEPT OF THE ABOVE LINE?.1

CORRECT

THE LINE L HAS EQUATION $9 X + -3 Y = -7$

WHAT IS THE VALUE OF X AT WHICH L CROSSES THE X-AXIS?-.7

CORRECT

WHAT IS THE VALUE OF Y AT WHICH L CROSSES THE Y-AXIS?2.3

CORRECT

GIVEN THAT THE POINT P IS ON L AND THAT THE X-COORDINATE
OF P IS -3, WHAT IS THE Y-COORDINATE OF P?-.6

CORRECT ANSWER IS-.6.7

CONSIDER THE STRAIGHT LINE WHOSE EQUATION IS

$$Y = 10 X + 2$$

WHAT IS THE SLOPE OF A LINE PASSING THROUGH THE POINT
P (4, 7) WHICH IS PERPENDICULAR TO THE

GIVEN LINE?10

CORRECT ANSWER IS-.1

YOU HAVE ANSWERED 6 QUESTIONS CORRECTLY OUT OF A TOTAL OF
8 QUESTIONS.

YOU SHOULD PRACTICE A LITTLE MORE. RUN THE PROGRAM AGAIN
EITHER NOW OR AFTER REVIEWING THE MATERIAL.

DONE

CONTRIBUTED PROGRAM **BASIC**

LOGIC
36251

TITLE: LOGIC EXAMINATION PROGRAMS (LOGIC1,2,3,4,5)

DESCRIPTION: These programs teach the basics of logic. At the end of each program, the score and percent right is printed. The package consists of five programs, LOGIC1, LOGIC2, LOGIC3, LOGIC4, and LOGIC5.

INSTRUCTIONS: Instructions are contained in the program.

SPECIAL CONSIDERATIONS: The Aardvark and Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

ACKNOWLEDGEMENTS: Aardvark and Company
2130 Bell Court
Lakewood, Colorado 80215

RUN

RUN
LOGIC1

IF PAUL PLAYS THEN THE TEAM WINS.

O.K.--
NOW ASSUME PAUL DOES NOT PLAY.
CAN WE CONCLUDE THE TEAM DOES NOT WIN?NO
CORRECT.

O.K.--
NOW ASSUME THE TEAM DOES NOT WIN.
CAN WE CONCLUDE PAUL DOES NOT PLAY?YES
CORRECT.

O.K.--
NOW ASSUME THE TEAM WINS.
CAN WE CONCLUDE PAUL PLAYS?YES
WRONG, THE CONCLUSION IS INVALID.
YOU DENIED THE ANTECEDENT.

O.K.--
NOW ASSUME PAUL PLAYS.
CAN WE CONCLUDE THE TEAM WINS?YES
CORRECT.

IF ABCD IS A SQUARE THEN IT HAS FOUR RIGHT ANGLES.

O.K.--
NOW ASSUME ABCD IS A SQUARE.
CAN WE CONCLUDE IT HAS FOUR RIGHT ANGLES?YES
CORRECT.

O.K.--
NOW ASSUME IT HAS FOUR RIGHT ANGLES.
CAN WE CONCLUDE ABCD IS A SQUARE?NO
CORRECT.

O.K.--
NOW ASSUME IT HASN'T FOUR RIGHT ANGLES.
CAN WE CONCLUDE ABCD IS NOT A SQUARE?YES
CORRECT.

O.K.--
NOW ASSUME ABCD IS NOT A SQUARE.
CAN WE CONCLUDE IT HASN'T FOUR RIGHT ANGLES?NO
CORRECT.

IF JOE STUDIES THEN HE PASSES THE COURSE.

O.K.--
NOW ASSUME HE PASSES THE COURSE.
CAN WE CONCLUDE JOE STUDIES?YES
WRONG, THE CONCLUSION IS INVALID.
YOU DENIED THE ANTECEDENT.

O.K.--
NOW ASSUME JOE STUDIES.
CAN WE CONCLUDE HE PASSES THE COURSE?YES
CORRECT.

O.K.--
NOW ASSUME JOE DOESN'T STUDY.
CAN WE CONCLUDE HE FAILS THE COURSE?YES
WRONG, THE CONCLUSION IS INVALID.
YOU AFFIRMED THE CONSEQUENT.

O.K.--
 NOW ASSUME HE FAILS THE COURSE.
 CAN WE CONCLUDE JOE DOESN'T STUDY?YES
 CORRECT.

IF A MAN IS PRESIDENT THEN HE IS AT LEAST 40.

O.K.--
 NOW ASSUME HE IS AT LEAST 40.
 CAN WE CONCLUDE A MAN IS PRESIDENT?NO
 CORRECT.

O.K.--
 NOW ASSUME A MAN IS PRESIDENT.
 CAN WE CONCLUDE HE IS AT LEAST 40?YES
 CORRECT.

O.K.--
 NOW ASSUME A MAN IS NOT PRESIDENT.
 CAN WE CONCLUDE HE IS YOUNGER THAN 40?NO
 CORRECT.

O.K.--
 NOW ASSUME HE IS YOUNGER THAN 40.
 CAN WE CONCLUDE A MAN IS NOT PRESIDENT?YES
 CORRECT.

IF X AND Y ARE BOTH POSITIVE THEN $X*Y>0$.

O.K.--
 NOW ASSUME X AND Y ARE NOT BOTH POSITIVE.
 CAN WE CONCLUDE $X*Y\leq 0$?YES
 WRONG, THE CONCLUSION IS INVALID.
 YOU AFFIRMED THE CONSEQUENT.

O.K.--
 NOW ASSUME X AND Y ARE BOTH POSITIVE.
 CAN WE CONCLUDE $X*Y>0$?YES
 CORRECT.

O.K.--
 NOW ASSUME $X*Y>0$.
 CAN WE CONCLUDE X AND Y ARE BOTH POSITIVE?NO
 CORRECT.

O.K.--
 NOW ASSUME $X*Y\leq 0$.
 CAN WE CONCLUDE X AND Y ARE NOT BOTH POSITIVE?YES
 CORRECT.

IF THE WEATHER IS WINDY THEN THE BOAT SINKS.

O.K.--
 NOW ASSUME THE BOAT SINKS.
 CAN WE CONCLUDE THE WEATHER IS WINDY?YES
 WRONG, THE CONCLUSION IS INVALID.
 YOU DENIED THE ANTECEDENT.

O.K.--
 NOW ASSUME THE WEATHER IS WINDY.
 CAN WE CONCLUDE THE BOAT SINKS?YES
 CORRECT.

O.K.--
 NOW ASSUME THE WEATHER IS CALM.
 CAN WE CONCLUDE THE BOAT FLOATS?NO
 CORRECT.

O.K.--
NOW ASSUME THE BOAT FLOATS.
CAN WE CONCLUDE THE WEATHER IS CALM?YES
CORRECT.

IF YOU RUN THIS PROGRAM THEN YOU LEARN SOMETHING.

O.K.--
NOW ASSUME YOU LEARN SOMETHING.
CAN WE CONCLUDE YOU RUN THIS PROGRAM?NO
CORRECT.

O.K.--
NOW ASSUME YOU RUN THIS PROGRAM.
CAN WE CONCLUDE YOU LEARN SOMETHING?YES
CORRECT.

O.K.--
NOW ASSUME YOU LEARN NOTHING.
CAN WE CONCLUDE YOU DON'T RUN THIS PROGRAM?YES
CORRECT.

O.K.--
NOW ASSUME YOU DON'T RUN THIS PROGRAM.
CAN WE CONCLUDE YOU LEARN NOTHING?NO
CORRECT.

YOU ANSWERED 23 OUT OF 28 QUESTIONS CORRECTLY FOR A
FINAL SCORE OF 82 %.

DONE

IF IT IS A WARM NIGHT OR I AM OVER MY COLD,
THEN I AM GOING TO THE GAME.

O.K. --- NOW ASSUME I AM NOT GOING TO THE GAME.

CAN WE CONCLUDE:
IT IS NOT A WARM NIGHT OR I AM NOT OVER MY COLD?Y
CORRECT.
IT IS NOT A WARM NIGHT AND I AM NOT OVER MY COLD?Y
CORRECT.

IF IT IS A WARM NIGHT AND I AM OVER MY COLD,
THEN I AM GOING TO THE GAME.

O.K. --- NOW ASSUME I AM NOT GOING TO THE GAME.

CAN WE CONCLUDE:
IT IS A WARM NIGHT AND I AM NOT OVER MY COLD?N
CORRECT.
IT IS NOT A WARM NIGHT AND I AM OVER MY COLD?N
CORRECT.

IF JOE ATTENDS CLASS OR HE STUDIES DILIGENTLY,
THEN HE PASSES THE COURSE.

O.K. --- NOW ASSUME HE FAILS THE COURSE.

CAN WE CONCLUDE:
 JOE DOES NOT ATTEND CLASS OR HE DOES NOT STUDY DILIGENTLY?Y
 CORRECT.
 JOE DOES NOT ATTEND CLASS OR HE STUDIES DILIGENTLY?N
 CORRECT.

IF JOE ATTENDS CLASS AND HE STUDIES DILIGENTLY,
 THEN HE PASSES THE COURSE.

O.K. --- NOW ASSUME HE FAILS THE COURSE.

CAN WE CONCLUDE:
 JOE ATTENDS CLASS AND HE DOES NOT STUDY DILIGENTLY?N
 CORRECT.
 JOE DOES NOT ATTEND CLASS AND HE STUDIES DILIGENTLY?N
 CORRECT.

IF GLEEBBS ARE SEERY OR MODULS ARE TRUNE,
 THEN FLORTZ ARE ARTIFERAKE.

O.K. --- NOW ASSUME FLORTZ ARE NOT ARTIFERAKE.

CAN WE CONCLUDE:
 GLEEBBS ARE NOT SEERY?N
 WRONG --- GO BACK AND STUDY THE NEGATION OF A DISJUNCTION.
 GLEEBBS ARE NOT SEERY AND MODULS ARE NOT TRUNE?N
 WRONG --- GO BACK AND STUDY THE NEGATION OF A DISJUNCTION.

IF GLEEBBS ARE SEERY AND MODULS ARE TRUNE,
 THEN FLORTZ ARE ARTIFERAKE.

O.K. --- NOW ASSUME FLORTZ ARE NOT ARTIFERAKE.

CAN WE CONCLUDE:
 GLEEBBS ARE NOT SEERY AND MODULS ARE NOT TRUNE?N
 CORRECT.
 GLEEBBS ARE NOT SEERY AND MODULS ARE TRUNE?N
 CORRECT.

IF EDGAR INHERRITS MONEY OR HE INVESTS WISELY,
 THEN HE BECOMES WEALTHY.

O.K. --- NOW ASSUME HE DOES NOT BECOME WEALTHY.

CAN WE CONCLUDE:
 HE DOES NOT INVEST WISELY?Y
 CORRECT.
 EDGAR DOES NOT INHERIT MONEY OR HE DOES NOT INVEST WISELY?Y
 CORRECT.

IF EDGAR INHERRITS MONEY AND HE INVESTS WISELY,
 THEN HE BECOMES WEALTHY.

O.K. --- NOW ASSUME HE DOES NOT BECOME WEALTHY.

CAN WE CONCLUDE:
 EDGAR DOES NOT INHERIT MONEY?N

CORRECT.

EDGAR DOES NOT INHERIT MONEY AND HE INVESTS WISELY?N
CORRECT.

YOU ANSWERED 14 OUT OF 16 QUESTIONS CORRECTLY FOR A
FINAL SCORE OF 87 %.

DONE

TITLE:

CALCULATES PI

DESCRIPTION:

This program computes the area of a circle and "pi" by using the areas of inscribed and circumscribed regular polygons.

OBJECTIVES:

As an introduction to the limit process and a method for approximating "pi".

INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - Students must know how to calculate the area of a circle and a triangle using the formulas: $A = \pi R^2$ and $A = 1/2bh$.
- B. Materials - Chalkboard, board compass, and straight edge.

DISCUSSION:

Ask students to find the area of a circle without using the formula. The instructor may suggest to the class to inscribe and/or circumscribe an equilateral triangle. Have students compare the area of their figures to that of the circle. Some students will suggest to increase the number of sides and the instructor should suggest that a regular hexagon be used for convenience of drawing. This can be illustrated on the chalkboard for the class. Another comparison is made between the areas and then the students will observe that to obtain any satisfactory results, the number of sides must increase greatly. At this moment the instructor should introduce this program and explain to the class that the program will increase the number of sides of a regular polygon and compute the area of each new figure. A table is printed giving the areas of both inscribed and circumscribed regular polygons and also the number of sides for each area. The students can readily see that the machine has eliminated the tedious calculations. Now, have the students calculate the area of the circle using the formula and make a comparison of results; thus, the students can observe that the areas of the polygons approach the area of the circle.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN

RUN
PI

AREA OF A CIRCLE USING INSCRIBED AND CIRCUMSCRIBED REGULAR POLYGONS.

WHAT IS THE RADIUS OF THE CIRCLE?10

INSCRIBED AREA	CIRCUMSCRIBED AREA	NUMBER OF SIDES	INSCRIBED % ERROR	CIRCUMSCRIBED % ERROR
129.904	519.614	3	-58.65	65.4
259.807	346.41	6	-17.3	10.27
300.	321.539	12	-4.51	2.35

HOW MANY SIDES DO YOU THINK ARE NEEDED TO APPROXIMATE THE AREA OF THIS CIRCLE?100

313.952 314.262 100 -.07 .03

WOULD YOU LIKE TO TRY ANOTHER NUMBER OF SIDES (1=YES, 0=NO)?1

HOW MANY SIDES DO YOU THINK ARE NEEDED TO APPROXIMATE THE AREA OF THIS CIRCLE?1E6

THAT MANY SIDES IS VALID, BUT NOT NECESSARY FOR A GOOD APPROXIMATION. USE 10000 AS THE MAXIMUM NUMBER.

HOW MANY SIDES DO YOU THINK ARE NEEDED TO APPROXIMATE THE AREA OF THIS CIRCLE?10000

314.159 314.159 10000 0 0

WOULD YOU LIKE TO TRY ANOTHER NUMBER OF SIDES (1=YES, 0=NO)?0

WOULD YOU LIKE TO TRY ANOTHER RADIUS (1=YES, 0=NO)?1

WHAT IS THE RADIUS OF THE CIRCLE?1000000

ANY RADIUS WILL WORK, BUT USE A NUMBER LESS THAN 1000.

WHAT IS THE RADIUS OF THE CIRCLE?999

INSCRIBED AREA	CIRCUMSCRIBED AREA	NUMBER OF SIDES	INSCRIBED % ERROR	CIRCUMSCRIBED % ERROR
1.29644E+06	5.18576E+06	3	-58.65	65.4
2.59288E+06	3.45717E+06	6	-17.3	10.27
2.99400E+06	3.20896E+06	12	-4.51	2.35

HOW MANY SIDES DO YOU THINK ARE NEEDED TO APPROXIMATE THE AREA OF THIS CIRCLE?10000

3.13531E+06 3.13531E+06 10000 0 0

WOULD YOU LIKE TO TRY ANOTHER NUMBER OF SIDES (1=YES, 0=NO)?0

WOULD YOU LIKE TO TRY ANOTHER RADIUS (1=YES, 0=NO)?0

DONE

TITLE:

POLYNOMIAL SUBTRACTION

DESCRIPTION:

This program presents the student with a list of polynomials of degree one through four which are to be subtracted in pairs. The student types in the coefficient of the answer and is then told whether or not he is correct. At the end of the list he is told what percent he got right.

INSTRUCTIONS:

Directions to the student are included in the program on an optional basis. The student is asked to subtract polynomial No. 2 from polynomial No. 1. After each question mark, the coefficients of the answer are typed, starting with the coefficient of the highest degree term and going in descending order. If a coefficient is zero, a zero must be typed in for it.

**SPECIAL
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Algebra I and as a review in Algebra II

Student Background Required: Familiarity with polynomial subtraction

Application: This program is best used as a drill for makeup with those students who have difficulty remembering the rules for subtraction of signed numbers.

ACKNOWLEDGEMENTS:Michael Bolduan
Clackamas High School

RUN

RUN
POLSUB

DO YOU WANT DIRECTIONS?YES
NOW LET'S SUBTRACT SOME POLYNOMIALS. WHEN YOU ARE ASKED FOR
YOUR ANSWER YOU ARE TO SUBTRACT POLYNOMIAL NO. 2 FROM
POLYNOMIAL NO. 1 . AFTER EACH QUESTION MARK YOU ARE TO TYPE IN
THE COEFFICIENTS OF YOUR ANSWER STARTING WITH THE COEFFICIENT
OF THE HIGHEST DEGREE TERM AND GOING IN DESCENDING ORDER.
IF A COEFFICIENT IS ZERO, YOU MUST TYPE IN A ZERO FOR IT.
AFTER EACH COEFFICIENT BE SURE TO HIT THE 'RETURN' KEY.
HERE WE GO. GOOD LUCK!
HOW MANY PROBLEMS DO YOU WANT TO TRY?3
HERE ARE THE POLYNOMIALS:

$$-3 \quad *X + 30$$

$$41 \quad *X + 0$$

ANSWER PLEASE.

?38

?30

SORRY,WRONG!

HERE ARE THE POLYNOMIALS:

$$8 \quad *X^2 + 0 \quad *X + 28$$

$$34 \quad *X^2 + 0 \quad *X + 5$$

ANSWER PLEASE.

?-26

?0

?7

?23

RIGHT!

HERE ARE THE POLYNOMIALS:

$$1 \quad *X^2 + 44 \quad *X + -9$$

$$1 \quad *X^2 + 22 \quad *X + 4$$

ANSWER PLEASE.

?0

?22

?-14

SORRY,WRONG!

YOU DID 3 SUBTRACTIONS AND GOT 1 RIGHT. THIS
IS 33.3333 PER CENT CORRECT.
I THINK YOU'D BETTER RE-STUDY THE RULES FOR SUBTRACTION
AND THEN TRY ME AGAIN. I'LL BE WAITING. BYE!

DONE

MATHEMATICS (EDUCATION) (801)
CONTRIBUTED PROGRAM **BASIC**

QUADT
36335

TITLE:

QUADT: Nature of Graph of $Ax^2+Bxy+Cy^2+Dx+Ey+F=0$

DESCRIPTION:

This program determines the nature of the graph of $Ax^2+Bxy+Cy^2+Dx+Ey+F=0$, after the operator inputs the six constants (A, B, C, D, E, F). Limiting cases, such as point or a line, are separated from the general cases so that the computer type-out gives the exact nature of the graph.

OBJECTIVE:

To permit exploration of the properties of the second-degree equation.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - should have a reasonable knowledge of conic section, second-degree equations in two unknowns, invariant functions of the coefficients under transformations, etc.
- B. Materials - An overhead projector along with a transparency of the flow chart would be desirable.

DISCUSSION:

Before running the program, the teacher should discuss the general form of a second-degree equation in two variables, the functions of the coefficients used in the program, and the implications of the flow chart.

The discussion of the flow chart for this program enhances the understanding of the problem.

The type-out serves as a check on students' efforts in identifying second-degree equations.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN
RUN
QUADT

THIS PROGRAM DETERMINES THE NATURE OF THE GRAPH OF:
 $A*X^2+B*X*Y+C*Y^2+D*X+E*Y+F=0$
ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?5,8,5,0,0,0
THE GRAPH OF YOUR EQUATION IS A SINGLE POINT.

ANOTHER RUN (1=YES, 0=NO) : ?5,8---1

ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?5,8,5,0,0,36
THERE IS NO REAL LOCUS FOR YOUR EQUATION.

ANOTHER RUN (1=YES, 0=NO) : ?1

ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?0,50-,0,0,0,9
THE GRAPH OF YOUR EQUATION IS A HYPERBOLA.

ANOTHER RUN (1=YES, 0=NO) : ?1

ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?1,0,1,0,-16,-16
THE GRAPH OF YOUR EQUATION IS A CIRCLE.

ANOTHER RUN (1=YES, 0=NO) : ?1

ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?0,0,0,5,-10,6
THE GRAPH OF YOUR EQUATION IS A SINGLE STRAIGHT LINE.

ANOTHER RUN (1=YES, 0=NO) : ?1

ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?1,0,0,6,0,-4
THE GRAPH OF YOUR EQUATION CONSISTS OF 2 PARALLEL LINES.

ANOTHER RUN (1=YES, 0=NO) : ?1

ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?1,0,0,6,1,-4
THE GRAPH OF YOUR EQUATION IS A PARABOLA.

ANOTHER RUN (1=YES, 0=NO) : ?0

DONE

MATHEMATICS (EDUCATION) (801)
CONTRIBUTED PROGRAM **BASIC**

RATIO
36336

TITLE:

RATIO: Solves Proportions

DESCRIPTION:

This program solves a proportion of the type $A/B = C/D$. A, B, C, or D can be unknown.

OBJECTIVES:

- A. To teach the student(s) the relationships in a proportion.
- B. To aid in teaching the solution of proportions.



INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - no particular preparation necessary
- B. Materials - see discussion

DISCUSSION:

The student is given the opportunity to see any number of solutions to proportions. The program then asks a series of questions designed to allow the student to discover that in a proportion, the product of the means equals the product of the extremes. The program can be used either with individual students or with an entire class depending upon the availability of equipment to display the output. The running time varies, depending upon the number of proportions you wish to solve. In 10 to 15 minutes, the program can be run with about 100 proportion problems. Included in this time is a built-in variable pause for observation of the tabulated results. Another value of using this program is that the teacher can easily handle numbers in proportions that heretofore were too difficult.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN
RUN
RATIO

THIS PROGRAM SOLVES FOR THE UNKNOWN IN THE PROPORTION
A/B AS C/D. USE A ZERO AS A DUMMY VALUE FOR THE UNKNOWN.

HOW MANY PROPORTIONS DO YOU WISH TO SOLVE?4
WHAT ARE THE VALUES FOR A,B,C,D?3,4,6,0

3 / 4 AS 6 / 8

WHAT ARE THE VALUES FOR A,B,C,D?1,10,5,50
YOU FORGOT TO INPUT A ZERO FOR YOUR
UNKNOWN. TRY AGAIN.?1,10,0,50

1 / 10 AS 5 / 50

WHAT ARE THE VALUES FOR A,B,C,D?5,15,72,0

5 / 15 AS 72 / 216

WHAT ARE THE VALUES FOR A,B,C,D?6,0,3,39

6 / 78 AS 3 / 39

TAKE A GOOD LOOK AT THE PROPORTIONS. THE TWO MIDDLE
POSITION NUMBERS ARE CALLED THE 'MEANS', THE TWO
END POSITION NUMBERS ARE CALLED THE 'EXTREMES'.

LOOK AT THE 'MEANS' AND THE 'EXTREMES' - SEE IF
YOU CAN FIND SOME KIND OF RELATIONSHIP BETWEEN THEM.
WHEN YOU THINK YOU HAVE FOUND A RELATIONSHIP BETWEEN
THE 'MEANS' AND THE 'EXTREMES', TYPE 1 AND HIT THE RETURN KEY.
?1

DID YOU SEE THAT IF YOU MULTIPLY THE 'MEANS'
AND MULTIPLY THE 'EXTREMES', THE PRODUCTS ARE EQUAL?

IN THE LAST PROPORTION 78 X 3 EQUALS 6 X 39
CHECK THE OTHERS, TOO. WHEN YOU ARE READY TO CONTINUE,
TYPE 1 AND HIT THE RETURN KEY.
?1

IF YOU WISH TO USE THIS PROGRAM AGAIN TYPE 1, IF NOT TYPE 0
?0

DONE

TITLE:

QUADRATIC EQUATION SOLVER

DESCRIPTION:

This program describes the nature of the roots of a quadratic equation, and finds the roots whether real or complex.

OBJECTIVES:

- A. To familiarize the student with quadratic function.
- B. To review and drill exercise... to study the nature of roots.
- C. To emphasize that roots of $f(x) = 0$ are the same as x-intercepts of $f(x) = y$.
- D. To impress the student with geometric interpretation(s) of the nature of roots.
- E. To provide "lead-in" material for the introduction of further study of the real number line, the real cartesian plane, complex numbers, quadratic inequalities, etc.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - The teacher can use the program to introduce the students to the quadratic formula, to conclude discussion of the quadratic formula...or both.
- B. Materials - None

DISCUSSION:

The program uses the "discriminant" to determine the nature of the roots of the quadratic equation. Regardless of the nature of the roots, the student is asked to graph $y = F(x)$, and to compare his graph with the kind of roots he finds for a specific $F(x) = 0$. He should be impressed with the picture; and he should understand (ultimately) the reasonableness and validity of the analytic methods presented in class.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN

RUN
ROOTS2

THIS PROGRAM HANDLES ALL THE POSSIBLE CASES OF SOLUTION OF THE EQUATION :

$$A * X^2 + B * X + C = 0$$

TYPE IN YOUR VALUES FOR A, B, AND C : ?1,2,3

DISCRIMINANT IS LESS THAN ZERO, SO ROOTS ARE IMAGINARY.
THEY ARE OF THE FORM : $P+I*Q$, $P-I*Q$, WHERE :
P=-1 Q= 1.41421

DO YOU WANT ANOTHER RUN (0 = NO , 1 = YES) : ?1

TYPE IN YOUR VALUES FOR A, B, AND C : ?1,7,3

DISCRIMINANT IS GREATER THAN ZERO, SO ROOTS ARE REAL.
ROOTS ARE X1 AND X2 .
X1 =-.458619 X2 =-6.54138

DO YOU WANT ANOTHER RUN (0 = NO , 1 = YES) : ?1

TYPE IN YOUR VALUES FOR A, B, AND C : ?1,6,9

DISCRIMINANT IS EQUAL TO ZERO, SO ROOTS ARE EQUAL. X =-3

DO YOU WANT ANOTHER RUN (0 = NO , 1 = YES) : ?1

TYPE IN YOUR VALUES FOR A, B, AND C : ?2,8,6

DISCRIMINANT IS GREATER THAN ZERO, SO ROOTS ARE REAL.
ROOTS ARE X1 AND X2 .
X1 =-1 X2 =-3

DO YOU WANT ANOTHER RUN (0 = NO , 1 = YES) : ?0

DONE

TITLE:	TRIGONOMETRIC SOLUTIONS OF TRIANGLES
DESCRIPTION:	The program is a compilation of several programs which solve for the remaining parts of a triangle given three parts. The program uses the Law of Sines, the Law of Tangents, and the Half-Angle Formulas. The user must know the given information.
INSTRUCTIONS:	Instructions are included in the program and input is conversational.
SPECIAL CONSIDERATIONS:	If this is used with the Educational system on a single terminal the program is too long unless the matrix package is deleted.
ACKNOWLEDGEMENTS:	Robert Watson/William Smith Haddonfield Memorial High School

RUN

RUN
SAT

THIS PROGRAM WILL SOLVE ANY TRIANGLE GIVEN;
 (1)AAS (2)SSA (3)SAS (4)ASA (5)SSS
 WHEN ENTERING ANGLES, ENTER THE DEGREES AND MINUTES
 SEPERATED BY A COMMA; I.E. 36,50 FOR 36 DEG50MIN AND 26,0 FOR 26 DEGREES.
 THE ORDER THE PARTS ARE ENTERED IS IMPORTANT!
 PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.
 ?3

ENTER THE TWO SIDES AND THE INCLUDED ANGLE. IN THAT ORDER!
 ?7,9,60,0
 THIS IS AN ACUTE TRIANGLE.

	ANGLES		SIDES
	DEGREES	MINUTES	
A1=	47	47.02	A= 7
B1=	72	12.98	B= 9
C1=	60	0	C= 8.18535

PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.

?4
 INPUT THE TWO ANGLES AND THEN THE INCLUDED SIDE.
 ?48,31,75,11,284.8
 THIS IS AN ACUTE TRIANGLE.

	ANGLES		SIDES
	DEGREES	MINUTES	
A1=	48	31	A= 256.453
B1=	56	17.99	B= 284.8
C1=	75	11	C= 330.944

PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.

?2
 INPUT THE TWO SIDES AND THEN THE ANGLE OPPOSITE THE SECOND SIDE.
 ?18.25
 ??26.43,56,16

THERE IS ONLY ONE TRIANGLE FORMED.
 THIS IS AN ACUTE TRIANGLE.

	ANGLES		SIDES
	DEGREES	MINUTES	
A1=	35	2.8	A= 18.25
B1=	56	16	B= 26.43
C1=	88	41.19	C= 31.7726

PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.

?5
 ENTER THE THREE SIDES!
 ?2,3,5

DIVIDE BY ZERO - WARNING ONLY IN LINE 5060

UNDERFLOW - WARNING ONLY IN LINE 5060
 THIS IS AN OBTUSE TRIANGLE.

	ANGLES		SIDES
	DEGREES	MINUTES	
A1=	0	0	A= 2
B1=	0	0	B= 3
C1=	180	0	C= 5

PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.

?5
 ENTER THE THREE SIDES!
 ?2,3,4

THIS IS AN OBTUSE TRIANGLE.

	ANGLES		SIDES
	DEGREES	MINUTES	
A1=	28	57.3	A= 2
B1=	46	34.05	B= 3
C1=	104	28.65	C= 4

PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.

?1
 INPUT THE TWO ANGLES AND THEN THE SIDE OPPOSITE THE SECOND SIDE.
 ?39,46,81,54,36.92

THIS IS AN ACUTE TRIANGLE.

	ANGLES		SIDES
	DEGREES	MINUTES	
A1=	39	46	A= 23.8543
B1=	81	53.99	B= 36.92
C1=	58	19.99	C= 31.7399

PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.

?
 DONE

MATHEMATICS (EDUCATION) (801)
CONTRIBUTED PROGRAM **BASIC**

SETS
36337

TITLE:

SETS: Union and Intersection of Sets

DESCRIPTION:

This program finds the intersection and union of any two numerical sets.

OBJECTIVES:

- A. To motivate students to find the union and intersection of any two sets.
- B. To learn the logic involved in finding the union and intersection.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - no special preparation necessary.
- B. Materials - see discussion

DISCUSSION:

This program may be used with individuals, small groups, or class-size groups. The elements of the two sets are entered as per instructions. Incidentally, one or both of the sets may be empty. The computer then types back the elements in the union and intersection. The speed with which the computer operates enables the students to see a great many examples, giving them the opportunity to make discoveries about what is the union and what is an intersection of two sets. The teacher may use the flow chart that follows to explain the logic behind finding the union and intersection.

It is suggested that when used with large groups, a supplementary device be used to display output.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN

RUN
SETS

THIS PROGRAM FINDS THE UNION AND INTERSECTION OF ANY TWO
NUMERICAL SETS.

HOW MANY ELEMENTS IN THE FIRST SET?5

THESE ARE - (HIT THE RETURN KEY AFTER ENTERING EACH ELEMENT)?2

?4

?6

?8

?10

HOW MANY ELEMENTS IN THE SECOND SET?6

THESE ARE:

?1

?2

?3

?4

?5

?6

THE INTERSECTION CONTAINS 2 4 6
THE UNION CONTAINS 1 2 3 4 5 6 8 10

DO YOU WANT ANOTHDR RUN (1=YES, 0=NO) : ?0

DONE

CONTRIBUTED PROGRAM **BASIC**

SIPRAC
36238

TITLE: PRACTICE WITH SIGNED NUMBERS

DESCRIPTION: This program presents the student with a random number of problems dealing with addition, subtraction, or multiplication of signed numbers. The student has a set amount of time in which to answer before the next problem is posed. (As written this time is set to 5 seconds). At the end of his list he is told the number correct, the percent correct, and the problems which he missed.

INSTRUCTIONS: Instructions are included on an optional basis within the program. The student is asked his "lucky" number and told how many problems will be stated. The time constant is set in line 20 (variable K).

SPECIAL CONSIDERATIONS: FOR INSTRUCTIONAL PURPOSES
 Suitable Courses: Algebra I or General Mathematics
 Student Background Required: Knowledge of the sign rules for addition, subtraction and multiplication of signed numbers.
 Application: This program provides good drill on an individual basis (since each student gets a list of different problems and of different length. The time constant may be adjusted to make this a challenge for even the best students or a success experience for the slower ones.

ACKNOWLEDGEMENTS: Michael Bolduan
Clackamas High School

RUN

RUN
SIPRAC

SIGNED NUMBER MANIPULATION PRACTICE

DO YOU WANT DIRECTIONS?YES
IN THIS PROGRAM YOU WILL BE PRACTICING ADDITION,SUBTRACTION,
AND MULTIPLICATION OF SIGNED NUMBERS . YOU WILL HAVE
5 SECONDS AFTER THE PROBLEM IS STATED IN WHICH TO
TYPE IN YOUR ANSWER. (MULTIPLICATION WILL BE SHOWN
BY USING AN 'X'.
WHAT'S YOUR LUCKY NUMBER?8
YOU'LL BE DOING 10 PROBLEMS. GOOD LUCK!!

NO. 1	:	-9	+	14	=5
NO. 2	:	17	X	-19	=
TOO LATE! TRY THE NEXT ONE.					
NO. 3	:	8	X	11	=88
NO. 4	:	-8	-	16	=-
TOO LATE! TRY THE NEXT ONE.					
NO. 5	:	10	-	8	=2
NO. 6	:	-18	X	12	=6
NO. 7	:	14	+	-4	=10
NO. 8	:	-7	X	14	=
TOO LATE! TRY THE NEXT ONE.					
NO. 9	:	19	X	10	=190
NO. 10	:	14	+	0	=14

HERE'S HOW YOU DID:

YOU GOT 6 RIGHT OUT OF 10
THIS IS 60 PERCENT.
YOU MISSED THE FOLLOWING PROBLEMS:

NO. 2 NO. 4 NO. 6 NO. 8
CORRECT YOUR ERRORS AND TURN IN YOUR PAPER FOR CREDIT.

DONE

GET-SIPRAC
RUN
SIPRAC

SIGNED NUMBER MANIPULATION PRACTICE

DO YOU WANT DIRECTIONS?NO
WHAT'S YOUR LUCKY NUMBER?5
YOU'LL BE DOING 5 PROBLEMS. GOOD LUCK!!

NO. 1	:	5	X	8	=40
NO. 2	:	-1	-	19	=
TOO LATE! TRY THE NEXT ONE.					
NO. 3	:	19	+	7	=26
NO. 4	:	16	-	18	=-2
NO. 5	:	-1	X	7	=-7

HERE'S HOW YOU DID:

YOU GOT 4 RIGHT OUT OF 5
THIS IS 80 PERCENT.
YOU MISSED THE FOLLOWING PROBLEMS:

NO. 2
CORRECT YOUR ERRORS AND TURN IN YOUR PAPER FOR CREDIT.

DONE

TITLE:

FINDS DERIVATIVES

DESCRIPTION:

This program considers a function which is differentiable at $x=a$, and at all points in the interval $[a,a+1]$. The value of the derivative at $x=a$ is approximated through secant slopes.

OBJECTIVES:

- A. The preliminary discussion of the method whereby the machine solves the problem enhances the students' comprehension of the techniques. These techniques are then used in developing the analytic method for finding the slope of the tangent line.
- B. The type-out of successive approximations to the tangent slope clarifies and dramatizes the nature of the limiting processes.
- C. Time-saving factor through the elimination of lengthy computations.

INSTRUCTIONS:

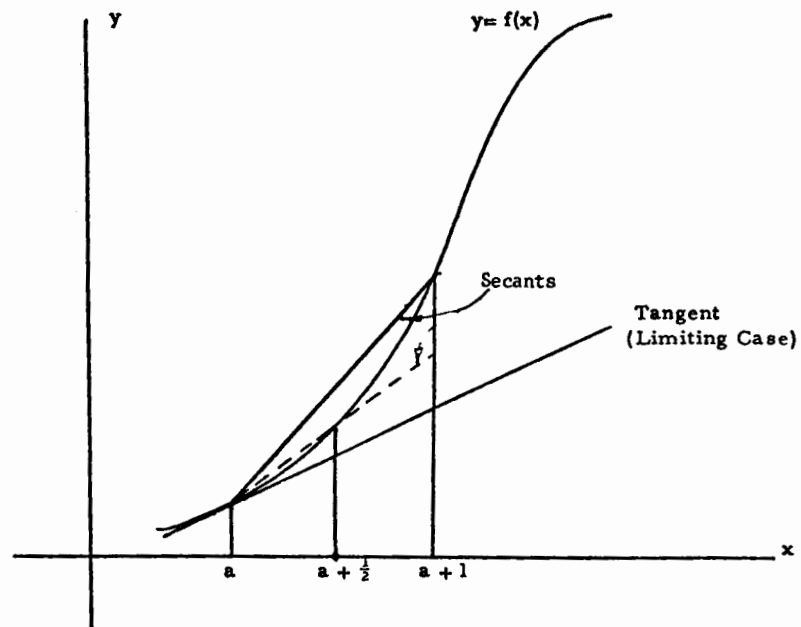
PRELIMINARY PREPARATION:

- A. Materials - The diagram below may be shown to the students on a blackboard, or an overhead projector, to explain the computations geometrically.

(continued on following page)

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

Math
SLOPEDISCUSSION:

The use of the computer and the attendant discussion of the program dramatically introduces the idea of differentiation.

RUN

RUN
SLOPE

SECANT SLOPE OF A CURVE - THE DERIVATIVE

THIS PROGRAM CONSIDERS A FUNCTION OF X ($Y=F(X)$) WHICH IS DIFFERENTIABLE AT $X=A$ AND AT ALL POINTS IN THE INTERVAL $(A,A+1)$. THE VALUE OF THE DERIVATIVE AT $X=A$ IS APPROXIMATED THROUGH SECANT SLOPES.

AFTER THE PROGRAM STOPS, TYPE IN THE FOLLOWING:
(END EACH LINE, INCLUDING 'RUN', WITH A 'CARRIAGE RETURN')

```
1 GO TO 300
300 DEF FNY(X)=....(YOUR FUNCTION OF X)....
RUN
```

FOR EXAMPLE, TO FIND THE SLOPE OF THE EQUATION $Y=X+3$ YOU WOULD TYPE AS FOLLOWS:

```
1 GO TO 300
300 DEF FNY(X)=X+3
RUN
```

YOU MIGHT TRY THAT AS YOUR FIRST RUN.
FOR SUBSEQUENT RUNS, YOU NEED ONLY CHANGE LINE 300 FOR A NEW FUNCTION, FOLLOWED BY 'RUN'.

DONE

```
1 GOTO 300
300 DEF FNY(X)=X+3
RUN
SLOPE
```

FOR WHAT VALUE OF A IS THE SLOPE TO BE EVALUATED?2

'CHANGE IN X' IS THE DISTANCE FROM 'A', AND 'CHANGE IN Y' IS THE DISTANCE FROM 'F(A)' UPON WHICH THE SLOPE IS CALCULATED.

CHANGE IN X	CHANGE IN Y	SECANT SLOPE	% CHANGE IN SLOPE
1/ 1	19	19	NO PREVIOUS VALUE
1/ 2	7.625	15.25	19.7368
1/ 4	3.39062	13.5625	11.0656
1/ 8	1.5957	12.7656	5.87558
1/ 16	.773682	12.3789	3.02938
1/ 32	.38089	12.1885	1.53834
1/ 64	.188969	12.094	.775178
1/ 128	9.41162E-02	12.0469	.389608
1/ 256	4.69666E-02	12.0234	.194553
1/ 512	2.34604E-02	12.0117	9.74659E-02
1/ 1024	1.17245E-02	12.0059	4.87805E-02
1/ 2048	5.86128E-03	12.0039	1.62681E-02

DO YOU WISH TO USE A DIFFERENT VALUE OF X (1=YES, 0=NO)?0
TO CHANGE YOUR FUNCTION SEE THE INSTRUCTIONS.
IF YOU ARE FINISHED, TYPE '1', AND THE 'RETURN' KEY
AFTER THE PROGRAM STOPS.

DONE

SQRT
36627**TITLE:**

FINDS SQUARE ROOT

DESCRIPTION:

This program finds the square root of counting numbers up to five decimal places.

OBJECTIVES:

- A. To demonstrate and familiarize the students with square roots.
- B. The method utilizes "pinching" \sqrt{Z} between the endpoints of smaller and smaller domains.

INSTRUCTIONS:PRELIMINARY PREPARATION:

- A. Student - 1) The definition of square root as the inverse operation of squaring; and 2) Drill in estimating square roots to the nearest tenth, hundredth, etc.
- B. Materials - None

DISCUSSION:

This program provides an "introduction to", and a "review of" evolution and involution. Limiting the neighborhood of \sqrt{Z} to find successively closer approximations of the square root of a number, demonstrates to the student that he is able to determine the square root to any degree.

The program may be effectively utilized for introducing the limiting process.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN

RUN
SQRT

PROGRAM FINDS SQUARE ROOT OF ANY POSITIVE NUMBER
BY 'PINCHING' IT WITHIN A SMALLER AND SMALLER INTERVAL.

WHAT IS THE NUMBER WHOSE SQUARE ROOT YOU SEEK?54

LOWER LIMIT -----		UPPER LIMIT -----
0	< SQ-RT. OF 54 <	54
5.4	< SQ-RT. OF 54 <	10.8
7.02	< SQ-RT. OF 54 <	7.56
7.344	< SQ-RT. OF 54 <	7.398
7.344	< SQ-RT. OF 54 <	7.3494
7.34832	< SQ-RT. OF 54 <	7.34886
7.34843	< SQ-RT. OF 54 <	7.34848
7.34847	< SQ-RT. OF 54 <	7.34847

APPROXIMATION NOW CORRECT TO AN ACCURACY OF .0001
YOU MAY USE EITHER 7.34847 OR 7.34847 AS THE SQUARE ROOT OF 54

WANT TO TRY ANOTHER NUMBER (1=YES, 0=NO) : ?1

WHAT IS THE NUMBER WHOSE SQUARE ROOT YOU SEEK?39

LOWER LIMIT -----		UPPER LIMIT -----
0	< SQ-RT. OF 39 <	39
3.9	< SQ-RT. OF 39 <	7.8
6.24	< SQ-RT. OF 39 <	6.63
6.24	< SQ-RT. OF 39 <	6.279
6.2439	< SQ-RT. OF 39 <	6.2478
6.24468	< SQ-RT. OF 39 <	6.24507
6.245	< SQ-RT. OF 39 <	6.24503
6.245	< SQ-RT. OF 39 <	6.245

APPROXIMATION NOW CORRECT TO AN ACCURACY OF .0001
YOU MAY USE EITHER 6.245 OR 6.245 AS THE SQUARE ROOT OF 39

WANT TO TRY ANOTHER NUMBER (1=YES, 0=NO) : ?0

DONE

TITLE:

ARITHMETIC MEAN

DESCRIPTION:

This program finds the average (arithmetic mean), median, and standard deviation of up to one hundred numbers.

OBJECTIVES:

- A. To familiarize the student with the concepts of arithmetic mean (average), median, and standard deviation of a group of numbers.
- B. To impress him with the speed and accuracy of the computer as a calculating device.
- C. To provide teachers with handy means of computing averages.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - "Arithmetic mean", "average", "median", and "standard deviation" must be well-defined.
- B. Materials - None

DISCUSSION:

Given N terms, "A(1), A(2), ..., A(N-1), A(N)", students will have learned the average of these N terms is $\frac{A(1)+A(2)+\dots+A(N-1)+A(N)}{N}$.

The program prints out the median value of the user's data when there is an odd number of data values. When there is an even number, the median value printed is the average between the $N/2$ and the $(N+2)/2$ terms.

The program serves as an excellent vehicle for drill in division and addition, and helps strengthen the concept of arithmetic mean (average).

This program is useful in demonstrating a simple "loop" routine for students interested in programming.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN

RUN
STATAL

MEAN, MEDIAN, AND DEVIATION OF A SET OF NUMBERS.

ENTER YOUR NUMBERS IN DATA STATEMENTS ON LINES
1000 - 2000. FOR EXAMPLE, YOU MIGHT TYPE :

1000 DATA 1,2,3,4 ETC. (YOUR DATA GOES HERE)

WHEN YOUR DATA HAS BEEN ENTERED, TYPE :

1 GO TO 300
RUN

THEN RELAX WHILE THE MACHINE GRINDS OUT THE ANSWERS.

IF A 'SUBSCRIPT ERROR' APPEARS, INCREASE THE SIZE OF THE
ARRAY IN LINE 295.

WARNING -- THE NUMBER 9999 IS USED AS AN INTERNAL DATA
VALUE. IF THIS VALUE IS ONE OF YOUR DATA VALUES, SIMPLY
RE-TYPE LINES 999 AND 2001 WITH A COMMON DATA VALUE WHICH
YOU WILL NOT USE.

DONE

1000 DATA 244,182,112,2,198,10,314,169,18,38
1 GOTO 300

RUN
STATAL

THESE ARE YOUR NUMBERS :

244 182 112 2 198 10 314 169 18 38

THESE ARE YOUR NUMBERS (HIGHEST TO LOWEST) :

314 244 198 182 169 112 38 18 10 2

NUMBER OF VALUES IS 10

SUM OF THE VALUES IS 1287

THE MEAN VALUE IS 128.7

THE MEDIAN VALUE IS 140.5

THE STANDARD DEVIATION IS 209.541

FOR ANOTHER RUN, RE-ENTER DATA ON LINES

1000 - 2000, TAKING CARE TO ELIMINATE OLD DATA

BY TYPING THOSE LINE NUMBERS WHICH YOU DO NOT USE AGAIN;

THEN TYPE 'RUN'.

DONE

TITLE:

SURFAC: Area of Surface of Revolution

DESCRIPTION:

This program approximates the area of a surface of revolution, by computing lateral areas of frustrums of cones of revolution.

OBJECTIVES:

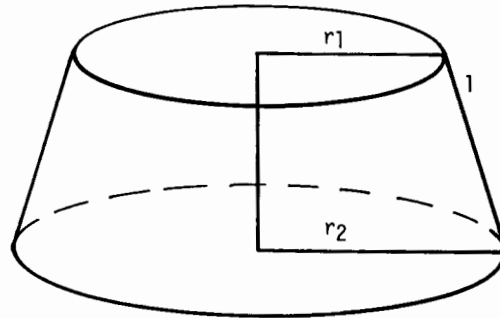
- A. The saving of time in computations.
- B. The speedy demonstration of limiting processes.
- C. The focusing of attention upon those processes needed to develop the analytic approach.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

Before running this program, the lateral area of a frustrum of a cone should be discussed. Many students in the Advanced Placement Program have not taken a course in Solid Geometry and may be unfamiliar with the formula:

$$\text{Lateral Area} = \pi l (r_1 + r_2)$$



Frustrum of a Cone

Whether or not this formula is derived in class will depend on the amount of time available. Most likely it will merely be stated; students who have not taken Solid Geometry may be asked to look up the derivation on their own.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN

RUN
SURFAC

AREA OF A SURFACE OF REVOLUTION

THIS PROGRAM APPROXIMATES THE AREA OF A SURFACE OF REVOLUTION BY COMPUTING LATERAL AREAS OF FRUSTUMS OF CONES OF REVOLUTION. TYPE IN YOUR FUNCTION OF X ($Y=F(X)$), WHOSE GRAPH WILL BE ROTATED ABOUT THE X AXIS, AS FOLLOWS:

```
1 GO TO 200
300 DEF FNY(X)=...(YOUR FUNCTION OF X)...
RUN
```

FOR EXAMPLE, TO USE THE FUNCTION $Y=X^2$ YOU WOULD TYPE:

```
1 GO TO 200
300 DEF FNY(X)=X^2
RUN
```

YOU MIGHT TRY THAT AS YOUR FIRST RUN.
END EACH LINE, INCLUDING 'RUN', WITH THE 'RETURN' KEY.

```
DONE
1 GO TO 200
300 DEF FNY(X)=X^2
RUN
SURFAC
```

WHAT ARE THE ABSCISSAS OF THE END POINTS OF THE SECTION TO BE CONSIDERED (SMALLER FIRST: P,Q)?-3,2

NUMBER OF SUBINTERVALS	SUM OF APPROXIMATING AREAS	% CHANGE IN SUM
1	288.787	NO PREVIOUS VALUE
2	324.623	11.6841
4	317.682	2.16125
8	315.335	.741601
16	314.743	.187694
32	314.593	4.76964E-02
64	314.556	1.18549E-02
128	314.546	3.08522E-03

WOULD YOU LIKE TO TRY NEW END POINTS (1=YES, 0=NO)?0
TO ENTER A NEW FUNCTION YOU NEED ONLY RETYPE LINE
300 AND 'RUN'. SEE INSTRUCTIONS FOR MORE DETAILS.
IF YOU ARE FINISHED, TYPE '1' AND THE 'RETURN' KEY.

DONE

SYSSOL
36278

TITLE: SOLVING SYSTEMS OF LINEAR EQUATIONS

DESCRIPTION: This program solves systems of linear equations for up to twenty equations in twenty variables. It will solve even over- or underdetermined systems. It employs Gaussian Elimination, and will automatically round the difference of two numbers to zero if six significant digits of accuracy have been lost. Also, if the system is underdetermined, the solution is in the form $X+A_1X_1+A_2X_2+\dots$, where the X_i and X are vectors, and A_1, A_2, \dots are arbitrary constants. The user has the option of having the X_1 orthogonalized or orthonormalized.

INSTRUCTIONS: The program asks if the user wishes printouts (text) in terms of Linear Transformations or Simultaneous equations (LIN or SIM). Since this program will solve at the same time up to five systems with the same coefficient matrix, like:

$$\begin{bmatrix} 1 & +2 \\ x & y \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \quad \text{and} \quad \begin{bmatrix} x+2 \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

The next input is how many of these systems there are (in this case 2). The next input is the elements of the coefficient matrix and the elements of the constant(s) array, in this case 1, 3, 2, 2 (these are the elements to the right of the equals sign). The program gives the user the option of verifying this input, and also seeing a copy of the reduced matrix.

SPECIAL CONSIDERATIONS: This program is subject to the same accuracy problems as any using the Gaussian Elimination method.

ACKNOWLEDGEMENTS: Phillip Short
Burnsville Senior High School

RUN

RUN
SYSSOL

DO YOU WANT PRINTOUTS TO BE IN TERMS OF LINEAR TRANSFORMATIONS OR
IN TERMS OF SIMULTANEOUS EQUATIONS?SIM

DO YOU WISH A DESCRIPTION?YES

THIS PROGRAM SOLVES SYSTEMS OF LINEAR EQUATIONS. IT CAN
FIND THE SOLUTIONSET OF A GIVEN SET OF COEFFICIENTS WITH UP TO
5 DIFFERENT SETS OF CONSTANT TERMS. IF THE SOLUTION IS NOT
UNIQUE, IT CONSISTS OF A LINEAR COMBINATION OF ORDERED N-TUPLES
V,W, ETC, ADDED TO A CONSTANT N-TUPLE, THE LATTER OF WHICH DEPENDS
ON THE ABOVE MENTIONED CONSTANT TERMS. THE V,W, ARE GIVEN
(OUTPUTTED) FIRST, THEN THE CONSTANT N-TUPLES ONE BY ONE.

HOW MANY EQUATIONS ARE THERE?3

HOW MANY VARIABLES?3

HOW MANY SETS OF CONSTANTS?2

INPUT THE COEFFICIENT MATRIX ROW BY ROW?1,2,3,4,4,4,5,6,7

INPUT THE ARRAY OF CONSTANTS ROW BY ROW?2,8,8,31,10,40

DO YOU WANT VERIFICATION OF INPUT?YES

HERE IS A COPY OF THE COEFFICIENT MATRIX.

X	X	X
1	2	3

1 2 3

4 4 4

5 6 7

HERE IS A COPY OF THE MATRIX OF CONSTANTS.

C	C
1	2

2 8

8 31

10 40

DO YOU WISH A COPY OF THE REDUCED MATRIX?YES

X X X
 1 2 3

1 0 -1
 0 1 2
 0 0 0

C C
 1 2

2 7.5
 0 .25
 0 1

DO YOU WISH THE BASIS TO BE ORTHOGONALIZED?NO

THE SOLUTION CONSISTS OF ANY LINEAR COMBINATION OF THE FOLLOWING
 N-TUPLES, PLUS THE CONSTANT N-TUPLE, TO BE GIVEN SHORTLY.
 [1 -2 1]

THE CONSTANT N-TUPLE IN SYSTEM 1 IS:

[2 0 0]

SYSTEM# 2 IS INCONSISTENT.

DONE

RUN
 SYSSOL

DO YOU WANT PRINTOUTS TO BE IN TERMS OF LINEAR TRANSFORMATIONS OR
 IN TERMS OF SIMULTANEOUS EQUATIONS?LIN

DO YOU WISH A DESCRIPTION?NO

WHAT IS THE DIMENSION OF THE IMAGE SPACE?3

WHAT IS THE DIMENSION OF THE PRE-IMAGE SPACE?3

HOW MANY IMAGE VECTORS?2

INPUT THE TRANSFORMATION MATRIX ROW BY ROW?1,2,3,0,0,0,0,0,0

INPUT THE IMAGE VECTORS, FIRST ALL THE FIRST COMPONENTS,
 THEN ALL THE SECOND COMPONENTS, ETC...OK?1,3,0,0,0,1

DO YOU WANT VERIFICATION OF INPUT?NO

DO YOU WISH A COPY OF THE REDUCED MATRIX?NO
DO YOU WISH THE BASIS TO BE ORTHOGONALIZED?YES
DO YOU WISH IT ORTHOGONALIZED OR ORTHONORMALIZED?ORTHONORMALIZED

HERE IS A BASIS OF THE NULL SPACE AS SPECIFIED.

[-.894427 .447214 0]

+ [-.358569 -.717137 .597614]

THE PRE-IMAGE VECTOR FOR IMAGE VECTOR 1 IS:

[.794082 -1.18368E-02 7.65306E-02]

IMAGE VECTOR # 2 HAS NO CORRESPONDING PRE-IMAGE.

DONE

MATHEMATICS (EDUCATION) (801)
CONTRIBUTED PROGRAM **BASIC**

TITLE: DRILL IN MULTIPLICATION OF NUMBERS WITH TRAILING ZEROES TENS
36128

DESCRIPTION: TENS drills students in the multiplication of numbers of the form $A \times 10^n$, e.g. $3000 \times 400 =$
By affording the student only a few seconds to answer, it encourages him to use a short-cut method.
TENS gives 25 problems and scores the student responses.

INSTRUCTIONS: The teacher may vary the Time-Out factor by changing the value of Z in line 100.

ACKNOWLEDGEMENTS: Tim Aaronson
Woodrow Wilson High School / San Francisco

RUN

RUN
TENS

C	60	X	5	=	300
X	9000	X	5	=	4500
C	3	X	4000	=	12000
	70	X	9000	=	X
C	3	X	3	=	9
C	7	X	200	=	1400
X	7000	X	4000	=	280000000
C	5000	X	9	=	45000
C	6000	X	8000	=	48000000
C	70	X	500	=	35000
C	2	X	800	=	1600
X	30	X	900	=	21000
C	4000	X	800	=	3200000
C	9000	X	4	=	36000
C	90	X	800	=	72000
C	900	X	60	=	54000
C	6	X	20	=	120
C	600	X	20	=	12000
X	50	X	6	=	3000
C	8	X	4	=	32
C	700	X	400	=	280000
C	50	X	600	=	30000
X	60	X	700	=	43000
C	400	X	600	=	240000
C	3	X	50	=	150

YOU GOT 19 RIGHT AND 6 WRONG

DONE

CONTRIBUTED PROGRAM **BASIC**TRIFAC
36237**TITLE:**

FACTORING QUADRATIC TRINOMIALS

DESCRIPTION:

This program asks a student for his "lucky" number. It then presents him with a random number of factoring problems based on this number (minimum of 6). When the student has his list he returns to his seat to work out the problems. When he has finished the set he prepares a DATA tape with his answers on it, feeds the tape into the program and RUNs it again. He is then informed of his errors and what percent he worked correctly.

INSTRUCTIONS:

Instructions to the student are included on an optional basis within the program. 25 lines may be used for DATA; it is suggested that one DATA line be used per problem. Data lines are 600 through 625. Enter data as follows: coefficient of trinomial, then coefficients of each factor.

**SPECIAL
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Algebra I or as a review in Algebra II

Student Background Required: Knowledge of trinomial factoring

Application: This program may be used effectively to provide different students with completely different sets of problems (both in length and in content). It may be used with an entire class (average time per student at the terminal is 2-3 minutes) or with individuals for extra practice or makeup work.

ACKNOWLEDGEMENTS:Michael Bolduan
Clackamas High School

RUN

RUN
TRIFAC

DO YOU WANT DIRECTIONS?YES
IN THIS PROGRAM YOU'LL BE GIVEN SOME TRINOMIALS
WHICH ARE TO BE FACTORED. IN EACH CASE THE FACTORS
WILL BE TWO BINOMIALS. (WE'LL IGNORE ANY COMMON
FACTORS WHICH MAY APPEAR.) AFTER YOU HAVE YOUR
LIST OF PROBLEMS, RETURN TO YOUR SEAT TO SOLVE THEM
THEN SEE YOUR TEACHER FOR THE WAY TO MAKE A TAPE WITH
YOUR ANSWERS ON IT. WHEN YOU HAVE YOUR TAPE DO
THE FOLLOWING SERIES OF STEPS:

- A) AT THE ON-LINE TTY TYPE GET-TRIFAC
- B) TYPE TAPE
- C) PUT YOUR TAPE IN THE READER AND TURN IT ON
- D) WHEN TAPE IS THROUGH, TYPE KEY
- E) TYPE RUN-600

WHAT'S YOUR LUCKY NUMBER?4

YOU WILL BE DOING 6 PROBLEMS

NO. 1
21 *X+2 + 34 *X + -35
NO. 2
8 *X+2 + 26 *X + 6
NO. 3
18 *X+2 + -39 *X + 20
NO. 4
25 *X+2 + 0 *X + -9
NO. 5
20 *X+2 + 25 *X + 5
NO. 6
25 *X+2 + 0 *X + -1

NOW RETURN TO YOUR SEAT TO WORK ON THESE.

DONE

600 DATA 21,34,-35,7,-5,3,+7
601 DATA 8,26,6,8,2,1,3
602 DATA 18,-39,1+20,3,-4,6,-5
603 DATA 25,0,-9,5,-3,5,3
6:4 \
604 DATA 20,25,5,4,1,5,5
605 DATA 25,0,-1,5,-1,5,1

RUN-600
TRIFAC

HOW MANY PROBLEMS DID YOU DO?6

NO. 1
21 *X+2 + 34 *X + -35
7 *X + -5 AND 3 *X + 7 ARE CORRECT.
NO. 2
8 *X+2 + 26 *X + 6
8 *X + 2 AND 1 *X + 3 ARE CORRECT.
NO. 3
18 *X+2 + -39 *X + 20
3 *X + -4 AND 6 *X + -5 ARE CORRECT.
NO. 4
25 *X+2 + 0 *X + -9
5 *X + -3 AND 5 *X + 3 ARE CORRECT.
NO. 5
20 *X+2 + 25 *X + 5
4 *X + 1 AND 5 *X + 5 ARE CORRECT.
NO. 6
25 *X+2 + 0 *X + -1
5 *X + -1 AND 5 *X + 1 ARE CORRECT.
YOU GOT 6 RIGHT OUT OF 6 . THIS IS 100 PERCENT.
YOU SURE KNOW HOW TO FACTOR TRINOMIALS! GOOD WORK!

DONE

TITLE:

TRUTH TABLES FOR BOOLEAN EXPRESSIONS

DESCRIPTION:

This is a program to produce truth tables for Boolean expressions. The expression is analyzed into reverse polish form, and for all possible values of the variables in the expression, a truth value for the expression is computed.

INSTRUCTIONS:

Instructions are provided in the program.

Any single letter may be used as a variable. The Boolean operators are:

priority	symbol	mnemonic	description
1	'	NOT	negation
2	&	AND	conjunction
3	+	OR	disjunction
4	#	XOR	exclusive or
5	>	IF	conditional
5	=	IFF	biconditional

Note that OR and XOR have the same priority, these are evaluated left to right. All operators except NOT are binary operators and are placed between two quantities. Negation is indicated by an apostrophe (prime ?) following the quantity. Parentheses may be used at will to change the order of evaluation. Blanks in the expression are ignored.

**SPECIAL
CONSIDERATIONS:**

Very little syntax checking is done. The program will try to evaluate any expression that is entered. It will only give an error message if it is impossible to evaluate the expression. Thus the user must take care that his expression is correct, otherwise the resultant truth table may not reflect his wishes.

Up to 26 separate variables are allowed. However, this would produce a truth table of $2^{26} = 67,108,864$ lines if all 26 variables were used. This table would take about 10 years to print on a conventional teletype! The use of any of the 26 letters is to increase the user's choice of which ones he wishes to use.

Continued on following page.

ACKNOWLEDGEMENTS:

Lawrence E. Turner, Jr.
Pacific Union College

SPECIAL CONSIDERATIONS: continued

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Introductory Programming, Elementary Logic, Boolean Algebra

Student Background Required: Elementary concepts of logic or Boolean Algebra

This program was specifically written for a course in introductory programming. One to two lectures are devoted to number systems and the elementary Boolean operators of: NOT, AND, and OR. Applications to circuit analysis and logic problems are illustrated both in the lectures and in the homework assignments. Typically the student would reduce a set of english statements to a Boolean expression and then evaluate the truth table for the result. The text in use is Introduction to Computers and Computer Science, by Richard C. Dorf (Boyd and Fraser Publishing Co., San Francisco, 1972).

In writing the program the operators: XOR, IF, and IFF were added to the above. Thus the program contains the commonly used Boolean operators and is applicable to elementary logic courses.

The program can quickly produce truth tables for very elaborate Boolean expressions, and may be used to reduce the tedious evaluations or as a check on the results. In addition many theorems that two expressions are equal may be easily checked by producing the truth tables for the two expressions and comparing them.

RUN

RUN
TRUTH

TRUTH

'BEAUTY IS TRUTH, TRUTH BEAUTY--THAT IS ALL
YE KNOW ON EARTH, AND ALL YE NEED TO KNOW.

KEATS

INSTRUCTIONS ?YES

THIS PROGRAM PRODUCES TRUTH TABLES FOR BOOLEAN EXPRESSIONS.

ANY SINGLE LETTER MAY BE USED AS A VARIABLE.

THE BOOLEAN OPERATORS ARE:

PRIORITY	SYMBOL	MNEMONIC	DESCRIPTION
1	'	NOT	NEGATION (UNARY OPERATOR)
2	&	AND	CONJUNCTION
3	+	OR	DISJUNCTION
3	#	XOR	EXCLUSIVE OR
4	>	IF	CONDITIONAL
5	=	IFF	BICONDITIONAL

WITHIN A PRIORITY GROUP EVALUATION IS LEFT TO RIGHT.

ALL OPERATORS EXCEPT 'NOT' ARE BINARY AND ARE PLACED BETWEEN VARIABLES.

NEGATION IS INDICATED BY AN APOSTROPHE FOLLOWING THE QUANTITY.

PARENTHESIS MAY BE USED AT WILL TO CHANGE THE ORDER OF EVALUATION.

EXP=?F&B'+(C'+H&F)'

F&B'+(C'+H&F)'

F	B	C	H	EXP
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1

1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

EXP=?
DONE

MATHEMATICS (EDUCATION) (801)
CONTRIBUTED PROGRAM **BASIC**

TWQUES
36130

TITLE:

MATHEMATICAL GAME OF TWENTY QUESTIONS

DESCRIPTION:

TWQUES challenges the student to a game of mathematical twenty questions. The student must try to outwit the machine in finding out what number the machine is "thinking of." He communicates his guess by one of three assertions: the number is greater than, less than, or equal to a certain number.

The program encourages students to develop a strategy for narrowing the range of possibilities and enhances his understanding of the number-line.

INSTRUCTIONS:

TWQUES is initially set for a range of 0 to 100, but this may be changed at the discretion of the teacher by altering the value of Z in line 100.

**SPECIAL
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: General Math, Elementary Arithmetic

1. Used to supplement Hewlett-Packard drill and practice program
2. Used to supplement any arithmetic class

REFERENCES: John Holt's book, HOW CHILDREN FAIL, has a lucid description of the use of this game in a class situation.

ACKNOWLEDGEMENTS:

Tim Aaronson
Woodrow Wilson High School/San Francisco

RUN

RUN
TWQUES

TWENTY QUESTIONS

I'M THINKING OF A NUMBER
BETWEEN 1 AND 100
TRY TO GUESS MY NUMBER!!!!!!!

YOU MAY ASK ME IF MY NUMBER IS
GREATER OR LESS THAN OR EQUAL TO SOME NUMBER

TYPE IN > OR< OR = AND YOUR GUESS

FOR EXAMPLE, IF YOU THINK THAT
MY NUMBER IS GREATER THAN 73, YOU WOULD
TYPE >73 (THEN HIT THE RETURN KEY)

UP, UP, AND AWAY.....

YOUR GUESS
>50 NO... YOU NOW HAVE 19 QUESTIONS LEFT
YOUR GUESS
>25 NO... YOU NOW HAVE 18 QUESTIONS LEFT
YOUR GUESS
>12 NO... YOU NOW HAVE 17 QUESTIONS LEFT
YOUR GUESS
>6 YES... YOU NOW HAVE 16 QUESTIONS LEFT
YOUR GUESS
>9 NO... YOU NOW HAVE 15 QUESTIONS LEFT
YOUR GUESS
=7 !!!!!!! YOU GOT IT !!!!!!!
DO YOU WANT ANOTHER TRY?NO
SO LONG, AND THANKS FOR THE GAME

DONE

VOLSOL
36339

TITLE:

VOLSOL: Volume of Solid of Revolution

DESCRIPTION:

Through the use of cylindrical discs, the program approximates the volume of a solid of revolution generated by rotating about the x-axis the area bounded by $y=f(x)$, the x-axis, and the vertical lines $x=a$ and $x=b$.

OBJECTIVES:

To help the student understand the analytic procedures and to appreciate the nature of the limiting process.

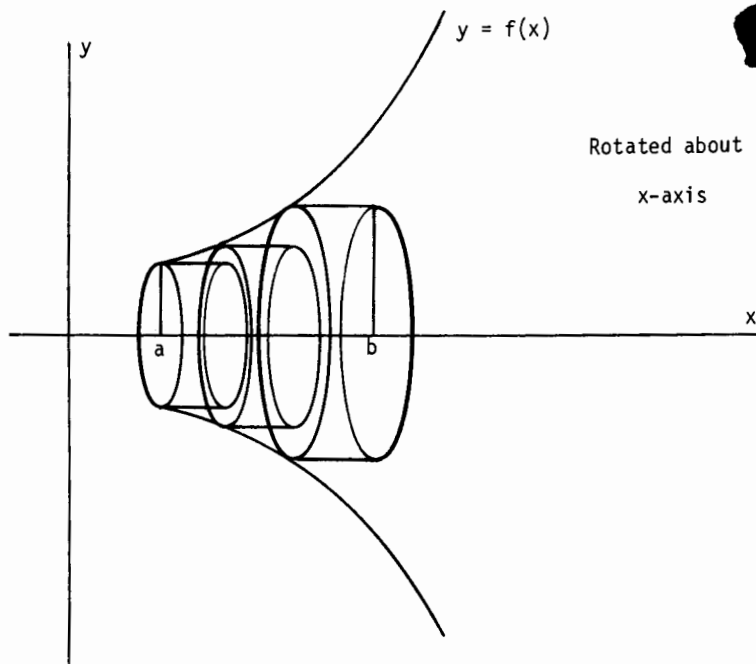
INSTRUCTIONS:

PRELIMINARY PREPARATION:

The class should be reminded of the formula for the volume of a cylinder, and the way in which a cylinder is generated by rotating a rectangle about one of its sides.

DISCUSSION:

It would be desirable to make use of an overhead projector transparency to display the cylindrical discs generated.



Approximation of Volume of Revolution by Cylindrical Discs

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN
 RUN
 VOLSQL

VOLUME OF A SOLID OF REVOLUTION

THIS PROGRAM USES CYLINDRICAL DISCS TO APPROXIMATE THE VOLUME OF A SOLID OF REVOLUTION. THE SOLID IS GENERATED BY ROTATING ABOUT THE X-AXIS THE AREA BOUNDED BY $Y=F(X)$, THE LINES $X=A$ AND $X=B$, AND THE X-AXIS.

TO INPUT YOUR FUNCTION OF X ($Y=F(X)$) TYPE AS FOLLOWS:

```
1 GO TO 200
220 DEF FNY(X)=....(YOUR FUNCTION OF X)....
RUN
```

FOR EXAMP, TO USE THE FUNCTION $Y=X+2$ YOU WOULD TYPE:

```
1 GO TO 200
220 DEF FNY(X)=X+2
RUN
```

YOU MIGHT TRY THAT AS YOUR FIRST EXAMPLE.
 END EACH LINE, INCLUDING 'RUN', WITH THE 'RETURN' KEY.

```
DONE
1 GO TO 200
220 DEF FNY(X)=X+2
RUN
VOLSQL
```

WHAT ARE YOUR VALUES FOR A AND B (SMALLER FIRST: A,B)?0,5

NUMBER OF CYLINDERS	SUM OF CYLINDER VOLUMES	% CHANGE IN SUM
1	0	NO PREV. VALUE, OR IT WAS ZERO
2	306.796	NO PREV. VALUE, OR IT WAS ZERO
4	939.562	206.25
8	1400.95	49.1071
16	1669.48	19.167
32	1813.29	8.61439
64	1887.59	4.09763
128	1925.34	1.99994
256	1944.37	.988143
512	1953.92	.491114

WOULD YOU LIKE TO TRY YOUR OWN 'NUMBER OF CYLINDERS' (1-YES, 0-NO)?0

WOULD YOU LIKE TO TRY NEW VALUES OF A AND B (1-YES, 0-NO)?0
 TO USE A NEW FUNCTION YOU NEED ONLY RETYPE LINE 220 AND
 'RUN'. SEE INSTRUCTIONS FOR MORE DETAILS.
 IF YOU ARE FINISHED, TYPE '1' AND THE 'RETURN' KEY.

DONE

TITLE:

GENERATES MATH WORKSHEETS

DESCRIPTION:

Program generates a worksheet on basic math operations (addition, subtraction, multiplication, or division) of a specified level of difficulty (determined by the maximum number of digits in each of the two numbers with which the operation is to be performed). Spacing on the worksheet is such that it may be duplicated using ditto masters and run on 8 1/2" x 11" paper.

INSTRUCTIONS:

Teacher will be asked to input four types of information before the worksheet is generated:

1. Type of problem (addition, subtraction, multiplication, or division).
2. Maximum number of digits desired in each number (1,2, or 3).
3. Number of problems on the worksheet (up to 25).
4. Choice of whether answers are to be printed at the bottom of the page for student reference or whether additional blank print lines are to be inserted (so that when the answers are printed on the teletype roll, they will be positioned too low to be included on an 8 1/2" x 11" page, but will be available for teacher reference).

Subtraction problems with negative differences will not be generated.

Division problems involving division by zero will not be generated.

The two numbers with which the operation is to be performed will always be positive integers.

**SPECIAL
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Basic mathematics in junior or senior high school, or mathematics for elementary grades.

This program can be used whenever the teacher wishes to have several sets of problems available that are similar in type and difficulty. This allows for much more individualizing of instruction. The teacher has the option (at the time that he originally generates the worksheets) of making the problem answers available to the students if he wishes to.

ACKNOWLEDGEMENTS:

Donald E. Gettinger
Stillwater Senior High School

RUN

RUN
WKSHT

TYPE 1 FOR ADDITION, 2 FOR SUBTRACTION, 3 FOR
MULTIPLICATION AND 4 FOR DIVISION.

?4

TYPE A 1, 2, OR 3 FOR THE NUMBER OF DIGITS DESIRED
IN EACH NUMBER.

HOW MANY DIGITS DO YOU WANT PER NUMBER? 1,2, OR 3?3

HOW MANY PROBLEMS DO YOU WANT ON THIS WORKSHEET?

PLEASE NO MORE THAN 25!

?10

TYPE A 1 IF YOU WANT THE ANSWERS PRINTED AT THE
BOTTOM OF THE WORKSHEET OR A 2 IF ANSWERS ARE TO BE
PRINTED SEPARATELY. 1 OR 2?1

MATH PROBLEMS

- 1 621 / 215 = ?
- 2 886 / 754 = ?
- 3 433 / 81 = ?
- 4 193 / 739 = ?
- 5 876 / 505 = ?
- 6 446 / 331 = ?
- 7 912 / 283 = ?
- 8 117 / 791 = ?
- 9 266 / 283 = ?
- 10 328 / 372 = ?

ANSWERS

- | | | | | |
|---------|---------|---------|---------|---------|
| 1 | 2.88837 | 2 | 1.17507 | 3 |
| 5.34568 | 4 | .261164 | 5 | 1.73465 |
| 6 | 1.34743 | 7 | 3.22261 | 8 |
| .147914 | 9 | .939929 | 10 | .88172 |

DONE

CONTRIBUTED PROGRAM **BASIC**BRAIN
36219

TITLE:

BRAIN SIMULATOR PROGRAM

DESCRIPTION:

This program simulates machine language in HP BASIC. Each BRAIN instruction consists of 16 binary digits or 4 hexadecimal digits. The first hexadecimal digit is called the operation code and specifies which operation is to be performed, such as add, subtract, print, etc. The other three digits specify which information in the machine is to be involved in the operation by specifying registers, addresses, or constants. Instructions are stored in the memory of the computer.

INSTRUCTIONS:

There are two principal sections of the program BRAIN. The load phase of the program allows the operator to type BRAIN instructions which are stored. The execute phase is a deterministic simulation of the execution of the BRAIN instructions stored. The program begins by requesting of the operator which phase is to be used.

If the operator types the request "LOAD", the program fetches from the disk the permanent copy of memory and the first address into which instructions are to be stored. After the operator has typed BRAIN instructions, the new version of memory is saved on the disk.

If the operator types the request "START", the program fetches from the disk the copy of memory and the address of the first instruction to be executed and simulates execution of the BRAIN program. A maximum of 10000 BRAIN instructions will be simulated and execution will be terminated by an overflow, divide by 0, attempt to execute the illegal instructions 6, 7, 8, or 9, or a halt instruction. In all but the last case, the contents of the registers and memory will be printed. Any values not printed are 0.

After either the load or execute phase, the program will again ask the operator for instructions. Either phase of the program may then be run again. After the execute phase, the status of the memory is not saved, so if the same program is rerun, the memory will contain the original values.

Refer to Appendix C on page 11 for flowcharts, descriptions of variable names, and comments.

SPECIAL
CONSIDERATIONS:

The documentation for this program contains excerpts from Fundamental Programming Concepts, by Gross and Brainerd, (Harper and Row, 1972); reprinted by permission of the authors.

ACKNOWLEDGEMENTS:

Walter S. Brainerd
Harvey Mudd College

Instructions:Arithmetic Instructions:

The first instruction to be considered is the "add" instruction. Its operation code is $A=1010_2$ and the other three hexadecimal digits of the instructions specify registers. As an example, when the instruction A2F3 is executed, the numbers in registers 15 (or hexadecimal F) and 3 are added and the result is placed in register 2. The contents of registers 15 and 3 are not changed when the instruction is executed.

If the instruction A2F3 were one of the instructions of a program to be executed by the BRAIN, it would be stored as one word in memory as



Each hexadecimal digit of the instructions represents four binary digits or four switch settings.

There are three similar instructions "subtract", "multiply", and "divide" with operation codes 2, 5, and D, respectively. Division is integer division; the remainder is ignored: $3/7=0$, $9/5=1$, and $-7/3=-3$. If an arithmetic operation is attempted which would produce overflow, that is, a number greater than 32767 or less than -32768, or which would cause division by zero, execution is terminated.

The instruction 2BBB sets register 11 to 0. The instruction DBBA causes the contents of register 11 to be divided by the contents of register 10. The quotient is placed in register 11. The contents of register 11 will, of course, generally be changed by this instruction, but the contents of register 10 will not be changed. The instruction 5999 squares the number in register 9. The instruction AAAA doubles the number in register 10.

The following instructions raise the number stored in register 0 to the fifth power.

```
5100
5111
5010
```

The Enter Instruction:

The "enter" instruction (operation code E) causes a constant to be entered into a register. The second hexadecimal digit of the instruction specifies the register and the third and fourth digits specify an eight-binary-digit constant using two's complement representation. The instruction E452 enters $52_{16} = 82_{10}$ into register 4. The instruction EEFF enters -1 into register 14, since $FF_{16} = 1111111_2$, which is the two's complement representation of -1 using eight switches.

Suppose the numbers a, b, and c are in registers 1, 2, and 3. The following instructions compute $b^2 - 4ac$ and put the result in register 12 without changing registers 1, 2, or 3. Register 11 is used to hold some intermediate results and so its value will be changed.

<u>Instructions</u>	<u>Comments</u>
5C22	LET R(12) = R(2)*R(2)
EB04	LET R(11) = 4
5BB1	LET R(11) = R(11)*R(1)
5BB3	LET R(11) = R(11)*R(3)
2CCB	LET R(12) = R(12)+R(11)

Load and Store:

The "load" and "unload" (or "store") instructions (operation codes 3 and 4) move data from the memory to a register and vice versa. The instruction 3942 moves the 16-binary-digit word in address 42 into register 9 without changing the contents of address 42. From the programmer's point of view, the 16 bits in the memory may represent an integer, two characters, the answers to 16 true-false questions or even a BRAIN instruction. The instruction 4F9A moves the information in register 15 into address 9A without changing register 15.

Input and Output:

The "output" instruction (operation code 0) prints in decimal on the teletypewriter the number whose two's complement representation is stored in the address specified. The "input" instruction (operation code 1) types a question mark on the typewriter, then accepts any integer from -32768 to 32767 typed in decimal and stores it in two's complement form in the memory location specified.

BRAIN machine instructions are written as four hexadecimal digits, which are an abbreviation for 16 switch settings in the machine. The input and output instructions accept and print numbers in decimal.

Instructions: (continued)Halt:

The "halt" instruction causes execution to terminate. Its operation code is F and the other three digits have no effect. Like the STOP instruction in BASIC, it may appear at any point in a program.

The following is a complete program to compute and print $d = b^2 - 4ac$.

Instructions	Comments
E504	LET R(5) = 4
1050	INPUT A
1051	INPUT B
1052	INPUT C
3651	LET R(6) = B
5666	LET R(6) = R(6)*R(6)
3150	LET R(1) = A
5551	LET R(5) = R(5)*R(1)
3152	LET R(1) = C
5551	LET R(5) = R(5)*R(1)
2665	LET R(6) = R(6)-R(5)
4653	LET D = R(6)
0053	PRINT D
F000	STOP

Table 2 summarizes the BRAIN instructions. The "branch" (B) and "count" (C) instructions will be discussed later. There are no instructions with operation codes 6, 7, 8, or 9.

Instruction	Op-Code	Prototype	Description
Output	0	00AA	Print contents of address AA
Input	1	10AA	Store number typed into address AA
Subtract	2	2R ₁ R ₂ R ₃	Put R ₂ - R ₃ in R ₁ unless overflow
Load	3	3RAA	Move contents of AA into R
Unload	4	4RAA	Move contents of R into address AA
Multiply	5	5R ₁ R ₂ R ₃	Put R ₂ X R ₃ in R ₁ unless overflow
Add	A	AR ₁ R ₂ R ₃	Put R ₂ + R ₃ in R ₁ unless overflow
Branch	B	ECAA	If result of last arithmetic operation satisfies condition C, branch to AA
Count	C	CRAA	Put R - 1 into R, if contents of R = 0, branch to AA
Divide	D	DR ₁ R ₂ R ₃	Put INT (R ₂ /R ₃) in R ₁ unless R ₃ = 0
Enter	E	ERNN	Put number NN in R
Halt	F	FXXX	Halt

Problems:

- What is the maximum number of instructions that could be stored in the BRAIN computer?
- Describe the result of executing each of the following instructions.
ABAA
DABA
D000
- What is in register 4 after the following three instructions are executed?
E222
E310
A432
- Write instructions that will compute $a^2 + 2ab + b^2$, where a and b are the numbers in registers 1 and 2. Leave the result in register 10.

5. Write instructions that compute the BASIC expression $A - B * A + 2 + 22$, where A and B are the numbers stored in registers 1 and 2. Leave the result in register 10.
6. Write instructions that will place into register 7 the remainder when the number in register 1 is divided by the number in register 2.
7. a. Write instructions that will raise the number in register 0 to the sixth power. Use as few instructions as possible.
b. What are the largest and smallest numbers that could be in register 0 without causing the instructions in the preceding paragraph to produce an overflow?

Running a BRAIN Program:

If the BRAIN were an actual computer with a teletypewriter as its input/output device, the instructions for operating the computer might be something like the following.

1. Plug it in and turn the power switch on.
2. Push the button labeled "LOAD" on the console.
3. Type in a program, one hexadecimal instruction per line.
4. Push the button marked "START" on the console.

The program typed in would then be executed. Whenever an input instruction were executed, a question mark would be typed on the teletypewriter and the decimal number typed by the operator would be converted to binary and stored in the appropriate memory location. The output instruction would cause a decimal number to be typed on the teletypewriter. There might be a little red light which comes on when the program halts and another program could be loaded into memory by pushing the LOAD button or the same program could be rerun by pushing the START button again.

The BRAIN Simulator:

There is no BRAIN computer, but a program written for the BRAIN computer may be run using a BASIC program named BRAIN. The program BRAIN will type:

```
TYPE 'LOAD' OR 'START' OR 'STOP'
```

The operator responds with one of those commands, which are equivalent to pushing the START button, pushing the LOAD button, or turning the power off.

Typing STOP will halt execution of the BASIC program BRAIN. Typing START will cause the current BRAIN program to be executed with all registers set initially to zero.

If LOAD is typed, the program will type a 2-digit hexadecimal address and request input in the form of a hexadecimal BRAIN instruction. Any number of instructions consisting of up to 64 hexadecimal digits may be typed on one line. The number of digits must be a multiple of 4, since 4 digits are needed to specify each instruction. Any characters following the first blank are ignored and may be used to write comments.

In addition to hexadecimal digits representing machine instructions and data, three "system commands" may be given: SET, SEE, and END. If, for example, SEE-2E is typed, the contents of eight words beginning with the one stored in 2E will be printed. In this way, a part of a program already typed may be examined. SET-50 indicates that the next instruction to be typed is to be placed into address 50. END-B1 indicates that the program is complete and whenever the program is executed, the instruction stored in address B1 is to be executed first. If the dash and 2-digit address are omitted, address 00 is assumed. A system command may not be written on the same line with any BRAIN instruction.

Whenever instructions are loaded into the BRAIN memory, the only memory locations affected are those into which instructions are entered. The memory is not cleared (i.e., memory locations are not set to 0) at the beginning of the load operation, therefore loading may be used to correct or revise a program already stored in memory. A copy of memory and the program's starting address will be saved each time the LOAD operation is terminated by typing an END command. This copy is then fetched whenever a LOAD or START operation is to be performed.

If the BASIC system being used has a permanent storage capability, then the copy of memory and the starting address will be saved in the permanent memory. It will then be available at a later time or if execution of the BRAIN program is interrupted for some reason. If execution of the BRAIN program begins at statement 12 by typing RUN-12, all memory locations and the starting address are set to 0.

If the program is terminated by any cause other than execution of a halt instruction (e.g., due to overflow), a diagnostic message will be typed and the contents of all registers and memory which do not contain a zero will be given.

The following example shows how a program to multiply any number by 19 is entered. Note how the constant 19 = 1316 can be entered in exactly the same way that an instruction is entered. The program is executed twice, then modified so that it will multiply any number by 20, and executed once more.

Note: RUN-12 must be done once to initialize the file MEM. It is referenced in line 9810 and must be opened before the RUN.

RUN-12
BRAIN

MEMORY HAS BEEN CLEARED

TYPE 'LOAD' OR 'START' OR 'STOP'
?LOAD

ADDRESS	INSTRUCTIONS/DATA	COMMENTS
00	?102A	INPUT A
01	?312A	LET R(1)=A
02	?3220	LET R(2)=N
03	?5121	LET R(1)=R(1)*R(2)
04	?412A	LET A=R(1)
05	?002A	PRINT A
06	?SET-20\ F000	STOP
07	?SET-20	
20	?0013	
21	?END	

TYPE 'LOAD' OR 'START' OR 'STOP'
?START

EXECUTION BEGINS WITH INSTRUCTION AT ADDRESS 00

?-368
-6992

HALT INSTRUCTION AT ADDRESS 06 EXECUTED

TYPE 'LOAD' OR 'START' OR 'STOP'
?LOAD

ADDRESS	INSTRUCTIONS/DATA	COMMENTS
00	?SET-20	
20	?0014	
21	?END	

TYPE 'LOAD' OR 'START' OR 'STOP'
?-20

TYPE 'LOAD' OR 'START' OR 'STOP'
?START

EXECUTION BEGINS WITH INSTRUCTION AT ADDRESS 00

?-20
-400

HALT INSTRUCTION AT ADDRESS 06 EXECUTED

TYPE 'LOAD' OR 'START' OR 'STOP'
?STOP

DONE

Simulating Actual Computers

The fact that one computer can be used to simulate another is of great importance to a computer designer. Before undertaking the expensive and time-consuming task of building a working model of a new computer, he may use simulation techniques to evaluate his design.

Simulation can also be an important factor in computer sales. If a new computer can efficiently simulate the old computer which it is to replace, the potential buyer will be able to save considerable reprogramming costs, since all old programs could be run on the new machine.

Problems:

1. Write a BRAIN program that will print the sum and difference of any two numbers.
2. Write a BRAIN program that will convert yards, feet, and inches into inches.
3. Write a BRAIN program that will convert any number of inches into yards, feet, and inches.
4. Write a BRAIN program to compute $f(x) = x^3 + 2x^2 + x - 7$, given any integer x as input.
5. Write a BRAIN program to compute $x^3 + 3x^2y + y^3$, given any two integers x and y .

Branching Instructions:

BRAIN instructions are usually executed in sequence. It must be possible to alter the sequence of instructions that are executed if a program is to repeat a list of instructions, as in a BASIC FOR-NEXT loop, or make decisions by taking one of several paths, depending upon some value that has been typed in or previously computed.

Branch:

The basic decision-making instruction for the BRAIN computer is the "branch" (B) instruction. This instruction tests the result of the most recent arithmetic operation, which may be in any of the 16 registers and branches conditionally, depending upon whether that result was positive, negative, or zero. In this instruction, the second hexadecimal digit does not refer to a register, but specifies a combination of conditions to be tested according to the data given in Table 3.

Table 3. Branching Condition Codes	
Second Digit of B Instruction	Branch if Result Was
0	Never branch
1	<0
2	=0
3	<0
4	>0
5	≠0
6	>0
7	Always branch

If the condition is satisfied, the next instruction executed is the one stored in the address indicated in the branch instruction. Otherwise, the next instruction (i.e., the one stored in the address following the branch instruction) is executed. Thus, it becomes important to keep track of the address in which each instruction is stored, because, in order to write a branch instruction, the programmer must know the address of the instruction to which the branch is to be made.

The following program computes the absolute value of any number. Since the branch instruction will test only the result of an arithmetic operation, the program contains the instruction A101 which adds 0 to the value of X. Then, the instruction B606 checks the result of the most recent arithmetic operation (in this case the add instruction in address 03). If the result was positive or zero, the instruction in address 06 is executed next, otherwise the next instruction in address 05 is executed. The instruction BA00 at address 08 causes the program to execute repeatedly.

RUN
BRAIN

TYPE 'LOAD' OR 'START' OR 'STOP'
?LOAD

ADDRESS	INSTRUCTIONS/DATA	COMMENTS
00	?1033	S: I X
01	?3-E000	E 0,0
02	?3133	L 1,X
03	?A101	A 1,0,1
04	?B606	B 6,Q
05	?2101	S 1,0,1
06	?4133	Q: U 1,X
07	?0033	O X
08	?BA00	B A,S
09	?END	

TYPE 'LOAD' OR 'START' OR 'STOP'
?START

EXECUTION BEGINS WITH INSTRUCTION AT ADDRESS 00

?-34
..34
?6785
6785
?3.75

INPUT MUST BE AN INTEGER BETWEEN -32768 AND 32767

PLEASE RETYPE INPUT

?-32768

OVERFLOW RESULTED FROM INSTRUCTION AT ADDRESS 05

CONTENTS OF REGISTERS

REG	HEX	DECIMAL	REG	HEX	DECIMAL
1	8000	-32768.	9	0000	0

CONTENTS OF MEMORY IN HEXADECIMAL

00	1033	E000	3133	A101	B606	2101	4133	0033
08	BA00	0000	0000	0000	0000	0000	0000	0000
20	0014	0000	0000	0000	0000	0000	0000	0000
30	0000	0000	0000	8000	0000	0000	0000	0000

TYPE 'LOAD' OR 'START' OR 'STOP'
?STOP

DONE

In this example the comments are simply the BRAIN instructions written in a form that is a little easier to understand. In place of the operation codes, letters suggesting the operation, such as L for load and S for subtract are used. In place of addresses, symbols (the S and Q) are used to label instructions in the way that line numbers are used to identify the BASIC statements.

This program also illustrates the dump that is given when overflow occurs. The contents of all registers and memory are shown, except some of those which contain zero.

Count

There is one BRAIN instruction designed especially for writing loops in programs. The "count" (C) instruction reduces a specified register by one; then if it is not zero, a branch is made to the specified address. The instruction CBAA is equivalent to the flow-chart shown in Figure 4.

Suppose the number x is stored in address 41 and n is a positive number stored in address F3. The following instructions compute $y = x^n$ and store the result in F1.

ADDRESS	INSTRUCTIONS/DATA	COMMENTS
27	?E001	E 0,1
28	?31F3	L 1,N
29	?3241	L 2,X
2A	?5002	L: M 0,0,2
2B	?C12A	C 1,L
2C	?40F1	U 0,Y

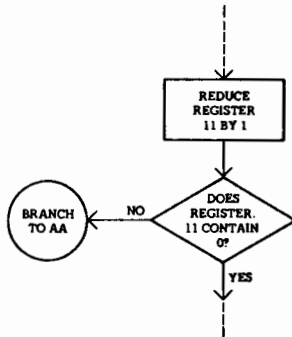


Figure 4. Flowchart for the count instruction.

Register 1 serves as a counter controlling the number of times the multiply instruction 5002 is to be executed. Since n is placed initially in register 1, the multiply instruction will be executed n times.

Suppose the sum $1 + 2 + 3 + 4 + \dots + n$ is to be computed for input n. Again, register 1 is used as the counter.

ADDRESS	INSTRUCTIONS/DATA	COMMENTS
00	?109F	I N
01	?319F	L 1,N
02	?E000	E 0,0
03	?A010	L: A 0,1,0
04	?C103	C 1,L
05	?409E	U 0,A
06	?009E	O A
07	?F000	H

Of course a more efficient program to compute $1 + 2 + \dots + n$ is the following program.

ADDRESS	INSTRUCTIONS/DATA	COMMENTS
00	?1095	I N
01	?309F	L 0,N
02	?E101	E 1,1
03	?A001	A 0,0,1
04	?5001	M 0,0,1
05	?E202	E 2,2
06	?D002	D 0,0,2
07	?409E	U 0,A
08	?009E	O A
09	?F000	H
0A	?END	

Although it has two more instructions than the previous program, it is more efficient because each instruction is executed only once. It uses the fact that $1 + 2 + \dots + n = 1/2(n)(n + 1)$.

Square Roots

It is not possible to compute the square root of 2 precisely, because the BRAIN computer does only integer arithmetic and the square root of 2 is approximately 1.414. With the BRAIN computer it is possible to find the integer part of the square root of any positive integer using the flowchart shown in Figure 5.

If the number N typed in is negative or zero, the same number is printed, otherwise the number printed is the largest integer less than or equal to the square root of N. The answer is computed by setting X initially to the value of N, then repeatedly recomputing X according to the formula

$$\text{LET } X = \text{INT} ((X + \text{INT}(N/X))/2)$$

The computation is repeated until one of the values of X is equal to or larger than the preceding value of X. In the flowchart the variable X1 is used to temporarily hold the new value of X until the new and old values can be compared.

It is not at all obvious that the computation shown in the flowchart will produce the desired answer. One way to be convinced is to try it for several values of N. It is particularly interesting to notice what happens when N is one less than a perfect square, such as 8, 15, 48, or 99.

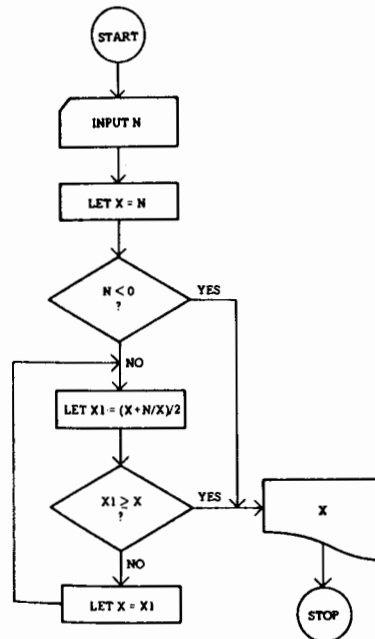


Figure 5. Flowchart for Computation of Square Roots

In the BRAIN program to compute square roots, X is stored in register 0, X1 is stored in register 1, the constant 2 is kept in register 2, the value of N is kept in register 3, register 4 holds the intermediate computational results, and register 15 is used whenever the constant 0 is needed. The value of X1 is printed at each step in order to see how the computation is proceeding.

RUN
BRAIN

TYPE 'LOAD' OR 'START' OR 'STOP'
?LOAD

ADDRESS	INSTRUCTIONS/DATA	COMMENTS
00	?1098	S: I N
01	?3398	L 3,N
02	?A03F	A 0,3,15
03	?B311	B 3,H STOP IF N<=0
04	?E202	E 2,2
05	?D430	L: D 4,3,0 N/X
06	?A404	A 4,0,4 X+N/X
07	?D142	D 1,4,2 (X+N/X)/2
08	?4199	U 1,A
09	?0099	O A
0A	?2410	S 4,1,0 X1-X
0B	?B60E	B 6,P BRANCH IF X1>=X
0C	?A040	A 0,4,0 X1=(X1-X)+X
0D	?BA05	B A,L REPEAT
0E	?4099	P: U 0,X
0F	?0099	O X
10	?BA00	B A,S
11	?F000	H: H
12	?END	

TYPE 'LOAD' OR 'START' OR 'STOP'
?START

EXECUTION BEGINS WITH INSTRUCTION AT ADDRESS 00

?16
8
5
4
4
4
?
3
2
1
2
1
?
31767
15884
7942
3972
1989
1002
516
288
199
179
178
178
178
?
0

HALT INSTRUCTION AT ADDRESS 11 EXECUTED

TYPE 'LOAD' OR 'START' OR 'STOP'
?STOP

DONE

Problems:

1. Write a BRAIN program that computes $\text{SGN}(X)$, that is, prints +1 if X is positive, 0 if X is 0, and -1 if X is negative.
2. Write a program that calculates $n! = 1 \cdot 2 \cdot 3 \cdots (n-1) \cdot n$, where n is any integer from 1 to 7.
3. Write a program that computes $1^2 + 2^2 + 3^2 + \cdots + n^2$ for any given $n \geq 1$.
4. Write a program with inputs s and d that finds integers a and b , whose sum is s and whose difference is d . If there are no such integers, print two zeroes.
5. a. Write a program that finds all right triangles, whose sides are whole numbers less than or equal to 100. In other words, find all integers $a, b, c \leq 100$ such that $a^2 + b^2 = c^2$.
b. Find all integers $a, b, c, \leq 100$ such that $a^3 + b^3 = c^3$.
6. Write a program to test if a number is prime. Print 1 if it is and 0 if it isn't.

APPENDIX C

Flowchart

A flowchart for the BRAIN simulator is shown in Figures C.1, C.2, and C.3. Numbers within the connecting circles represent line numbers in the program.

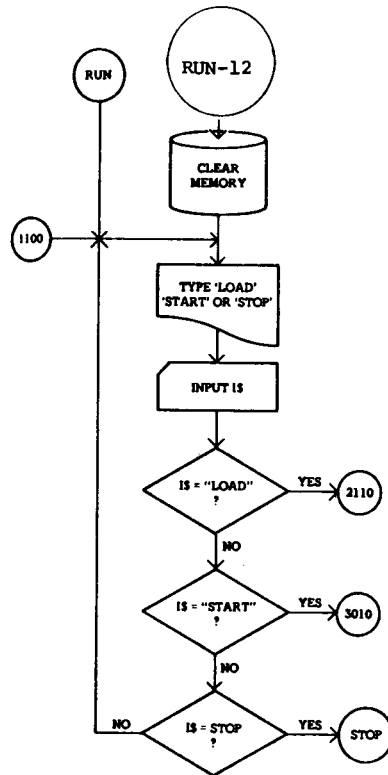


Figure C.1. Flowchart for BRAIN Simulator

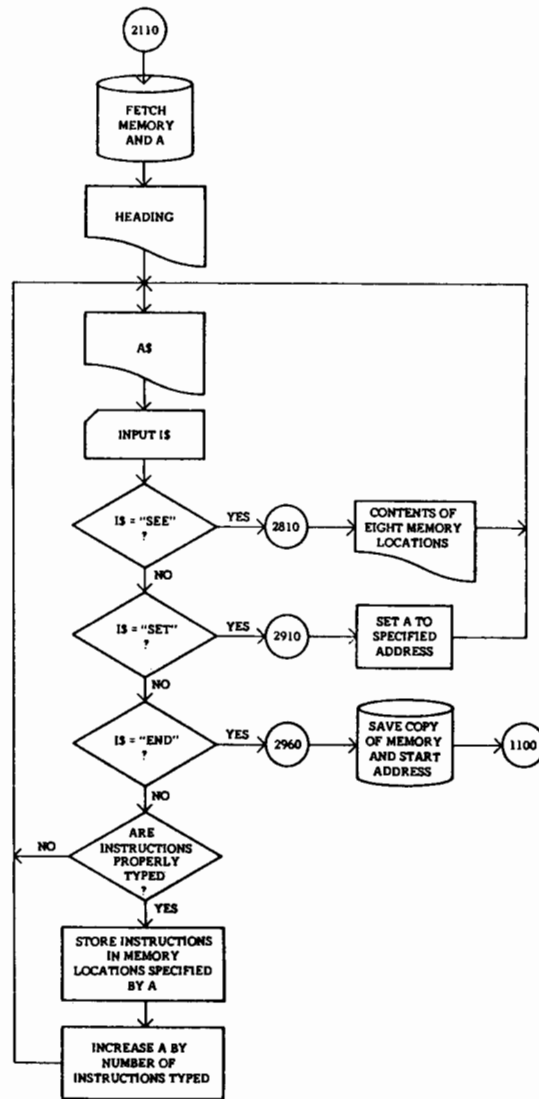


Figure C.2. Flowchart for BRAIN Simulator

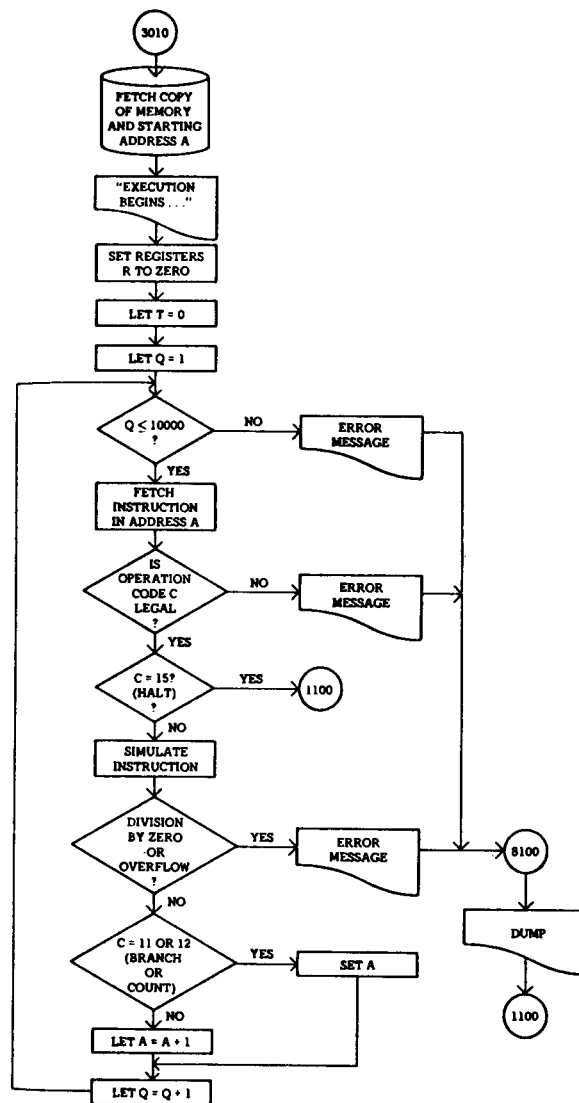


Figure C.3. Flowchart for BRAIN Simulator

Variable Names:

The following is a list of all variable names, a brief description of their use, and some key locations in the BASIC program BRAIN where they are used.

A	an address; 18, 2120, 2830, 2930, 2980, 3012, 5130, 5250, 6210, 9840, 9950
A1	temporarily saves A; 2240-2520
A\$(4)	usually the hexadecimal equivalent of an address or contents of a memory location; 8250-8410, 9100-9150, 9200-9290, 9461-9463
C	operation code of a BRAIN instruction; 3050-3095
C\$	single character; 9300-9320
E	address portion of a BRAIN instruction; 3040
H	numerical value of a hexadecimal digit; 9300-9360
H\$(16)	the hexadecimal digits 012 ... EF; 1020, 9320
I	loop counter; 2-4, 5-7, 2610-2680, 2860-2866, 8140-8220, 9910-9930
I\$(64)	input line typed by operator; 1110, 2230, 9400-9490

J	loop counter; 8260-8280, 9110-9115, 9270-9275
J5	temporary value of J; 8350
K	loop counter; 8340-8395
L	length of input string I\$; 2310-2330, 2440, 2610
M(256)	contents of memory, M(1), ..., M(256) represent the values stored in locations 0, ..., 255; 15-17, 2650, 4160, 4310, 4410, 8360, 9830, 9940
M7	temporary value; 2850
N	temporary value used often; 9100-9150, 9200-9290, 9400-9490
N1	temporary value; 9111
Q	counts number of BRAIN instructions simulated; 3029-6220
R(16)	contents of register, R(1), ..., R(16) represent the values stored in registers 0, ..., 15; 3020, 4310, 4410, 5230, 5430, 6160, 8150
R0	register number or branch condition of a BRAIN instruction; 3030, 3061
R1	one of the register numbers of a BRAIN arithmetic instruction (the other one is then $E - R1 * 16$); 4210, 4510, 5010, 5310
T	result of any arithmetic operation, which is used as test value for branch instruction; 3025, 4220, 4520, 5020, 5110, 5340, 6110

Comments:

1. The program BRAIN can only be run on a BASIC system that allows string variables.
2. The keyword LET is optional on most BASIC systems and has been omitted.
3. A dump may be obtained after the execution of any BRAIN program by using one of the illegal instructions with operation codes 6, 7, 8, or 9 instead of the halt instruction (operation code F).
4. A way to list a BRAIN program is to use the "LIST" instruction.
5. The instructions that read and write on a disk in lines 12-19, 9800-9850, and 9900-9960 are HP BASIC. The instructions 12-19 store 257 zeros on the disk. Subroutine 9800-9850 reads 256 numbers into the array M and the value of A from the disk. Subroutine 9900-9860 stores the 256 values of M and the value of A onto the disk. Consult an instruction manual for the system being used.
6. On most systems, some system commands to establish space on a disk must be executed before the program can be run the first time. Open-filename, n, where n is the number of sectors.
7. If a disk is not available, modify the program in the following ways.
 - a. Replace lines 12-18 with


```
13 DIM D(256)
15 MAT D=ZER
17 D2=A
```
 - b. Replace lines 9800-9850 with


```
9800 REM *** FETCH VALUES OF M AND A
9810 MAT M=D
9820 A=D2
9830 RETURN
```
 - c. Replace lines 9900-9960 with


```
9900 REM *** SAVE M AND A
9910 MAT D=M
9920 D2=4
9930 RETURN
```

TITLE: HP COBOL SIMULATOR COBOL
36845

DESCRIPTION: The COBOL system consists of seven programs written in BASIC which interact as a monitor-compiler-interpreter system. Program names are: CODBG, CODDV, COIDEV, COMON, COPDV1, COSORT, XCORUN and COSC4 (file). The monitor part simulates the normal time-sharing monitor, offering the user various commands such as GET, LIST or RUN, and at the same time allowing him to build his programs as he would a BASIC program. The compiler part of the system takes the user's program and converts it into a series of numbers in four matrices in core. The interpreter then takes these matrices and performs the actions indicated by the user's program.

INSTRUCTIONS: The users program is saved in a file in his catalog. This file must be created before running the COBOL system. Only one program is saved in one file and the user refers to that program via the name of the file. A program may be saved in either compiled or uncompiled form. In this manner, the user can have several programs saved for himself at any one time.

In addition, the COBOL system uses one scratch file that must be supplied by the user. This file, COSCR, must be OPENed before the user starts to use the COBOL system. The minimum size of this file is 8 sectors, the maximum is determined by the largest user program. A suggested starting size is 15-20 sectors; if it needs to be increased later on, the COBOL system will instruct you to do so.

SPECIAL CONSIDERATIONS: Complete user instructions and classroom implementation of this package is available: HP 5951-5664 COBOL/2000 Primer.

For ordering information of curriculum material, contact:
Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

Note: The COBOL system is intended only as an instructional tool to enable students using an HP 2000C or 2000F to learn to use the COBOL language. Since the compiler is written in BASIC, it does not operate fast enough to be used in any production mode.

ACKNOWLEDGEMENTS: Wes Fasnacht/Orland Larson

CONTRIBUTED PROGRAM **BASIC**

HPASMB
36806

TITLE:

HP ASSEMBLER PACKAGE

DESCRIPTION:

This set of programs is designed to assist in teaching the Hewlett-Packard Assembly Language under time-shared BASIC by assembling and simulating the execution of the individual machine instructions in the language. This package may also be used for source tape preparation for input into another Hewlett-Packard system.

INSTRUCTIONS:

There are four programs supplied with this package:

HPASMB, HPEXEC, HPRUN, and ASMB

Note: HPEXEC and HPRUN should be CSAVED.

One work file, ASMWK, must be created. It should be as large as the largest program file you plan to use.

A program file must be opened prior to running HPASMB. Approximately 25 lines of program without comments (about 18 characters per line) can be held in one block. Comments will take more space.

Also, the file ASCII is assumed to be a part of the system library. ASCIIZ (HP 36256) creates the ASCII file.

Continued on following page.

**SPECIAL
CONSIDERATIONS:**

In memory reference instructions, bit 10 specifies base page or current page by 0 or 1 respectively; however, in the HPASMB simulator, base page and page 1 are indicated by 0 and 1 respectively, regardless of the page in which the instruction is located.

The last four locations of core, 3774-3777g when referenced by a JSB instruction specify a call to:

.READ - 3777
.PRNT - 3776
.EXIT - 3775
.EXEC - 3774

Reference HP Assembler Manual (HP 02116-9014); Moving Head Disk Operating System Manual (HP 02116-91779); and, Assembler, FORTRAN and Algol Error Messages (HP 5951-1337).

ACKNOWLEDGEMENTS:

John Kendall
Southern Missionary College

INSTRUCTIONS continued

COMMANDS

Commands are adapted from the DOS-M directives. The reader may wish to refer to Section II of the DOS-M Manual.

The commands may be abbreviated to the first two characters. Options are listed in brackets following the command.

- :JOB
This command must be used at the beginning of each job.
- :STORE,S,file name,l
Loads a program from the terminal into the program file. "Control I" may be used when entering source statements to tab to column 7.
- :STORE,S,file name,5
Loads a program from a tape created by the :DUMP command.
- :LIST,S,l,file name [,m[,n]]
Lists the source program. m and n, if present, specify the first and last statements to be listed. If n is absent, then all statements from m to the end are listed. If neither appears, then the entire program is listed.
- :DUMP,l,file name
Dumps a program file to paper tape. A paper tape created by this command is suitable for input to a HP 2100 series computer.
- :EDIT,file name,l[,new file]
To edit a program. Edit operations are similar to DOS-M edit operations. "Control I" may be used when entering source statements to tab to column 7.

/R,m[,n] or /D,m[,n]
Deletes statements m through n. If n is absent, only m is deleted. Any source statements following either of these operations are inserted in place of the deleted statements.

/I,m
Any source statements which follow this operation are inserted after statement m.

/E
Terminates the editing and HPASMB returns to request more commands.

Note: In all cases n must be greater than or equal to m, and m must be greater than the n (or m) of the previous operation.
- :PROGRAM,ASMB
To assemble the program in the file specified by the :JFILE command.
- :PROGRAM,LOADR
To load a program. The loader can be run only once during each job.
- :RUN
To execute a program after it has been assembled and loaded.
- :JFILE,file name
To specify the file to be used as input to the assembler.
- :EJOB
Used for terminating HPASMB and returning to BASIC time sharing.

GENERAL DESCRIPTION

ASSEMBLY PROCESSING

During source program entry from the teletype, the source statements are loaded into the program file.

The Assembler is a two-pass system. A pass is defined as a processing cycle down a program file. In the first pass, the Assembler creates a symbol table on ASMRK from the names used in the source statements. It also checks for certain possible error conditions and generates diagnostic messages if necessary. During pass two, the Assembler again examines each statement in the source program along with the symbol table in ASMRK and produces the binary program and a program listing. Additional diagnostic messages may also be produced. The binary program is placed directly in core at the time of assembly. "Core" is a 2048 element array in common used by the four basic programs.

INSTRUCTIONS continuedSYMBOLIC ADDRESSING

Symbols may be used for referring to machine instructions, data, constants, and certain other pseudo operations. A symbol represents the address for a computer word in memory. A symbol is defined when it is used as the label for a location in the program, the label of a data storage area or constant, the label of a value, or the label of a location external to the program. Through use of simple arithmetic operators, symbols may be combined with other symbols or numbers to form an expression which may identify a location other than that specifically defined, and symbols that are defined more than once are considered to be in error by the Assembler.

PROGRAM RELOCATION

In general, the expressions "relocatable" and "absolute" do not apply to the HPASMB simulator. Consequently, rules concerning relocatable and absolute can be ignored in programming. However, the user who wishes to punch a source tape to be run on an HP computer must not ignore these rules. If he wants his program to be relocatable, then he must follow the specifications for relocatable programs. If he wants his programs to be absolute, then he must follow all the specifications for absolute programs.

PROGRAM LOCATION COUNTERS

The Assembler maintains a counter, called the program location counter, that assigns consecutive memory addresses to source statements. The initial value of the program location counter is 2 or is established according to the use of the ORG pseudo operation at the start of the program.

ASSEMBLY OPTIONS

Only the L, T, R, and A options are available.

EXCEPTIONS

The following are statements of exceptions to the HP Assembler. Page numbers refer to HP Assembler (publication number HP 02116-9014).

CHARACTER SET

Characters other than those specified on pages 2-3 are not considered errors by HPASMB, but should not be used to preserve compatibility with the HP Assembler.

Spaces are field delimiters in HPASMB and may not be used within a field (pages 2-3 and 2-6).

STATEMENT LENGTH

A statement may contain up to 72 characters including blanks. However, if the user plans to assemble with the list option, source statement length should be limited to 53 characters because the octal representation of the instruction takes the first 19 characters of the line.

EVALUATION OF EXPRESSIONS (pages 2-10)

HPASMB gives an error message if the evaluation is not within the following boundaries:

Memory Reference 0 to 2048

LITERALS (pages 2-13)

The available identifiers are:

=D
=B
=L
=A

INSTRUCTION SET

HPASMB simulates a subset of the instructions the HP Assembler Language uses. The simulated instructions are extracted from Appendix B of the HP Assembler Manual (HP 02116-9014).

MEMORY REFERENCE

Jump and Increment-Skip

ISZ
JMP
JSB

Add, Load and Store

ADA
ADB
LDA
LDB
STA
STB

INSTRUCTIONS continued

Logical

AND
XOR
IOR
CPA
CPB

REGISTER REFERENCE

Shift-Rotate

CLE
ALS
BLS
ARS
BRS
RAL
RBL
RAR
RBR
ALR
BLR
ERA
ERB
ELA
ELB
ALF
BLF
SLA
SLB

No-operation

NOP

Alter-Skip

CLA
CLB
CMA
CMB
CCA
CCB
CLE
CME
CCE
SEZ
SSA
SSB
INA
INB
SZA
SZB
SLA
SLB
RSS

INPUT/OUTPUT, OVERFLOW, and HALT

Input/Output and Halt

There are three subprograms available to HPASMB:

.READ
.PRNT
.EXIT

These are for reading, printing, and stopping, respectively. These symbols are predefined by the HPASMB and should not be defined in the Assembler program.

To input data on the teletype the user must use the .READ subprogram. Its calling sequence is:

```
JSB   .READ
DEF   *+n+1 (Point of return from read. n is no. of arguments, 1 to 10 arguments are allowed.)
DEF   WD1 (Addresses of items to be read.)
.
.
DEF   WDn
```

INSTRUCTIONS continued

To print data on the teletype the user must use the .PRINT subprogram. Its calling sequence is:

```

JSB   .PRNT
DEF   *+n+1 (Point of return from PRNT. n is number arguments, maximum of 12.)
DEF   WDI
.
DEF   WDI (Addresses of items to be printed.)

```

Note: Only decimal numbers are read and printed with these routines. (See EXEC calls.)

To terminate a program, use the .EXIT subprogram as follows:

```

JSB   .EXIT

```

Overflow

```

CLO
STO
SOC
SOS

```

Extended Arithmetic Unit

```

MPY
DIV
DLD
DST
ASR
ASL
RRR
RRL
LSR
LSL

```

PSEUDO INSTRUCTIONS

Assembler Control

```

NAM
ORG
END

```

Address and Symbol Definition

```

DEF
ABS
EQU

```

Constant Definition

```

DEC
OCT
ASC

```

Storage Allocation

```

BSS

```

Assembly Listing Control

```

UNL
LST
SUP
UNS
SPC

```

Note: Instructions that do not appear in this listing are considered errors and the NOP instruction is substituted.

EXEC CALLS

All valid EXEC calls are accepted. EXEC calls which cannot be executed are checked for correct number of arguments but are otherwise ignored. In all I/O EXEC calls, data read or written is assumed to be ASCII characters. In the control word, M must be 1. See the DOS-M Manual for a description of the EXEC calls.

READ/WRITE

Disc transfers are not available. Logical units are 1 or 5 for READ and 1 or 6 for WRITE.

FILE READ/WRITE

Logical unit must be either 2 or 3.

Note: A file read to a sector that has not previously been written on will cause a fatal error. There are 128 words per sector. The file must be opened before the program is run. OPEN-file name, 10 will open a file of 10 sectors.

INSTRUCTIONS continued

Note: continued

Since only numbers are written on the files in FILE READ/WRITE and strings are written on program files, a program cannot read program files and the executive cannot read files created by the FILE READ/WRITE EXEC call.

A FILE WRITE to a program file will clobber the program.

I/O CONTROL

Only printer spacing and paper tape leader calls are executed. All others are ignored. Logical unit for printer spacing is either 1 or 6; for paper tape leader, either 1 or 4.

I/O STATUS

Only TLOG is returned. STATS is set to zero.

WORK AREA LIMITS

Ignored.

WORK AREA STATUS

Starting track is set to zero. Otherwise, ignored.

PROGRAM COMPLETION

Same as DOS-M.

PROGRAM SUSPEND

Ignored.

PROGRAM SEGMENT LOAD

Same as PROGRAM COMPLETION.

SEARCH FILE NAME

Same as listed except the A and B registers are set to zero.

TIME REQUEST

When executed, the time array is set up as follows:

ARRAY = 0
ARRAY+1 = 0
ARRAY+2 = TIM(0) minutes
ARRAY+3 = TIM(1) hours
ARRAY+4 = 0

CHANGE USER DISC

ignored.

MAIN PROGRAM LOAD

Same as PROGRAM COMPLETION

RUN

CRE-DEMO,1

CRE-ASMWRK,1

RUN

HPASMB

READ-ONLY FILES:

3

HP ASSEMBLER PACKAGE

```

@:JOB

@:STORE,S,DEMO,1
@
ASMB,R,L,T
    NAM DEMO
BEGIN DEMO
END DEC 10
START JSB .PRNT
    DEF **2
    DEF BEGIN
LDA BEGIN
CMA
ADA END
SZA,RSS
JSB,E\
JSB .EXIT
LDA BEGIN
INA
STA BEGIN
JMP START
END START

::
0017 LINES

@:LIST,S,1,DEMO
0001 ASMB,R,L,T
0002     NAM DEMO
0003 BEGIN DEMO
0004 END DEC 10
0005 START JSB .PRNT
0006     DEF **2
0007     DEF BEGIN
0008     LDA BEGIN
0009     CMA
0010     ADA END
0011     SZA,RSS
0012     JSB .EXIT
0013     LDA BEGIN
0014     INA
0015     STA BEGIN
0016     JMP START
0017     END START
****LIST END****

@:EDIT,DEMO,1
@
/R,3
@
BEGIN DEC 1
@
/E
EDITING COMPLETE

@:JFILE,DEMO

@:PROG,ASMB

SYMBOL TABLE

BEGIN 000002
END 000003
START 000004

```



```

0001          ASMB,R,L,T
0002 00002          NAM DEMO
0003 00002 000001 BEGIN DEC 1
0004 00003 000012 END   DEC 10
0005 00004 017776 START JSB .PRNT
0006 00005 000007          DEF **2
0007 00006 000002          DEF BEGIN
0008 00007 060002          LDA BEGIN
0009 00010 003000          CMA
0010 00011 040003          ADA END
0011 00012 002003          SZA,RSS
0012 00013 017775          JSB .EXIT
0013 00014 060002          LDA BEGIN
0014 00015 002004          INA
0015 00016 070002          STA BEGIN
0016 00017 024004          JMP START
0017 00004          END   START
** NO ERRORS*

```

```

@:PROG,LOADR
LOADR COMPLETE

```

@:R/IN

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

```

@EJ
BAD CONTROL STATE
RE-ENTER STATEMENT ON TTY

```

@:EJ

DONE

PZTUA
36758**TITLE:**

PILOT TUTORIAL

DESCRIPTION:

This is the first in a series of tutorial programs written in PILOT to teach the syntax and usage of PILOT.

This program deals with the TYPE and ANSWER statements and how to enter a PILOT program.

INSTRUCTIONS:

This program is stored in 3 files named P-TUA1, P-TUA2, and P-TUA3 for use on the HP 2000E System; and is stored on 1 file named PZTUA for use on the HP 2000 Series System.

See PILOTE (HP 36637) to use this program on the HP 2000E System.

See PILOTF (HP 36756) to use this program on the HP 2000F System.

1. Example (2000E version)

```
OPE-S,5
GET-PILOT
1 FILES P-TUA1, P-TUA2, P-TUA3, S
RUN
NUMBER PROGRAM FILES ? 3
```

2. Example (2000 series version)

```
CRE-S,5
GET-PILOTF
RUN
NAME OF PILOT PROGRAM? PZTUA
NAME OF SCRATCH FILE ? S
?RUN
```

ACKNOWLEDGEMENTS:

Lawrence E. Turner, Jr.
Pacific Union College

RUN

RUN
PILOT

NAME OF PILOT PROGRAM ?P-TUA
NAME OF SCRATCH FILE ?SCR

?RUN

PILOT

THIS IS THE FIRST IN A SERIES OF TUTORIAL PROGRAMS TO TEACH YOU ALL ABOUT 'PILOT'!!

FIRST, WHAT IS YOUR NAME ?PETE

OK, PETE, DOWN TO BUSINESS! HAVE YOU EVER USED THE PILOT LANGUAGE BEFORE ?A LITTLE
YOU HAVE COME TO THE RIGHT PLACE! WHAT ABOUT OTHER CAI LANGUAGES ?NO
WHAT DOES CAI MEAN ?COMPUTER ASSISTED INSTRUCTION
A VERY GOOD START PETE.

AS YOU PROGRESS THROUGH THIS MATERIAL DO NOT BE DISMAYED IF YOU DO NOT KNOW THE ANSWER OR DO NOT EVEN UNDERSTAND THE QUESTION, JUST RESPOND NATURALLY. THIS PROGRAM IS DESIGNED TO BE A LEARNING EXPERIENCE. YOU WILL NOT BE 'GRADED' AND THE COMPUTER WILL NOT HOLD IT AGAINST YOU FOR A WRONG ANSWER!

AN IMPORTANT ASPECT OF CAI IS TO ESTABLISH A DIALOG BETWEEN THE COMPUTER AND THE STUDENT. THIS FORCES THE STUDENT TO INTERACT AND ACTIVELY PARTICIPATE. THE PILOT LANGUAGE IS ESPECIALLY DESIGNED FOR THIS.

IN ORDER TO ESTABLISH A DIALOG WHAT MUST THE COMPUTER BE ABLE TO DO ?COMMUNICATE
THE COMPUTER MUST PRINT OUT INFORMATION AND ASK QUESTIONS OF THE STUDENT.

THIS IS ACCOMPLISHED IN PILOT BY A 'TYPE' STATEMENT DESIGNATED BY A 'T'. TYPICAL TYPE STATEMENTS WOULD APPEAR AS:

```
1000 T:HI THERE!  
1010 T:I DO LIKE YOU.  
1020 T:  
1030 T:THAT IS VERY GOOD FOR YOU TO KNOW!!
```

APART FROM THE 'T' THESE STATEMENTS HAVE TWO COMMON FEATURES. WHAT ARE THEY ?STATEMENT NUMBER AND COLON
ABSOLUTELY CORRECT! ALL PILOT STATEMENTS BEGIN WITH A LINE NUMBER (OR STATEMENT NUMBER), AND ALL PILOT STATEMENTS CONTAIN A COLON.

WHAT PURPOSE DOES THE LINE NUMBER SERVE??

?KEEP PROPER SEQUENCE
RIGHT ON, PETE!

WHAT IS THE SMALLEST STATEMENT NUMBER ALLOWED ?1

YES, THE SMALLEST ALLOWED STATEMENT NUMBER IS 1, AND THE LARGEST IS 9999.

WHAT WOULD STATEMENT 1000 ACTUALLY PRINT IF THE PROGRAM ABOVE WERE EXECUTED?? (REMEMBER, 1000 T:HI THERE!).
?HI THERE!

FINE! THE COLON SEPARATES THE STATEMENT INTO TWO PARTS. TO THE LEFT IS THE LINE NUMBER AND THE INSTRUCTION (IN THIS CASE 'T') AND TO THE RIGHT IS THE OBJECT.

WHAT IS THE PURPOSE OF THE INSTRUCTION??

?

??TO OPERATE THE PROGRAM

NOT QUITE, PETE! THE INSTRUCTION TELLS THE COMPUTER WHAT KIND OF STATEMENT IT IS. THIS DECIDES WHAT THE COMPUTER IS TO DO WITH THE OBJECT. IN THE CASE OF THE TYPE STATEMENT (T), THE OBJECT IS PRINTED ON THE TERMINAL.

NOW, BACK TO THE DIALOG QUESTION. THE COMPUTER CAN PRINT OUT INFORMATION AND ASK QUESTIONS. IT MUST ALSO ACCEPT A RESPONSE FROM THE STUDENT.

HOW DOES IT DO THIS ?FROM THE TYPED ANSWER
 VERY GOOD, PETE! A RESPONSE IS INDICATED BY AN ANSWER STATEMENT (DESIGNATED BY AN 'A'). THE COMPUTER TYPES OUT A QUESTION MARK (?) AND WAITS FOR SOME INPUT.

AN ANSWER STATEMENT CAN LOOK LIKE THIS:

```
2000 A:
2040 A:$FIRSTNAME12
2060 A:#X
```

WE WILL DISCUSS THE OBJECT OF THE ANSWER STATEMENT LATER ON. BUT FIRST LET'S COMBINE THE TWO PILOT STATEMENTS WE NOW KNOW. WHAT ARE THESE TWO TYPES ?T AND A
 BEAUTIFULL, PETE!

HERE IS A PROGRAM TO ASK A QUESTION:

```
100 T:DO YOU LIKE COMPUTERS
200 A:
```

IF THIS IS EXECUTED IT WILL LOOK LIKE:

```
DO YOU LIKE COMPUTERS
?YES
```

NOTICE THAT THE ANSWER STATEMENT AUTOMATICALLY PRODUCES A QUESTION MARK (?) AND WAITS FOR A RESPONSE.

HOW WOULD YOU CAUSE THE QUESTION MARK TO BE PRINTED RIGHT AFTER THE WORD 'COMPUTERS' ?WITH A SEMI-COLON;
 WELL, THAT'S NOT QUITE RIGHT. A PLUS SIGN (+) AS THE LAST CHARACTER OF A TYPE OBJECT WILL NOT ALLOW THE COMPUTER TO DO A NORMAL CARRIAGE RETURN-LINE FEED AT THE END, RATHER THE CARRIAGE WILL JUST SIT THERE UNTIL THE NEXT OUTPUT IS DONE (INCLUDING THE QUESTION MARK).

LET'S TRY IT ON OUR EXAMPLE ABOVE. THE PROGRAM NOW READS:

```
100 T:DO YOU LIKE COMPUTERS+
200 A:
```

NOW WHAT WILL BE PRINTED IF THE PROGRAM IS RUN??

?DO YOU LIKE COMPUTERS?
 THAT IS ABSOLUTELY CORRECT! THE PLUS SIGN IS NOT PRINTED, IT MERELY TELLS THE COMPUTER TO SIT THERE UNTIL THE NEXT POSSIBLE CHARACTER IS PRINTED.

LET'S EXECUTE THE ABOVE PROGRAM.

```
DO YOU LIKE COMPUTERS?YES
```

ANOTHER FEATURE OF TYPE AND ANSWER STATEMENTS IS THE ABILITY TO 'REMEMBER' A RESPONSE AND PRINT IT OUT LATER. AS AN EXAMPLE:
 YOUR NAME IS: PETE

WHAT PART OF THE ANSWER STATEMENT DO YOU THINK CAUSES THE COMPUTER TO 'REMEMBER' A RESPONSE ?\$

NO, THE OBJECT OF AN ANSWER STATEMENT (IF PRESENT) TELLS THE COMPUTER TO STORE THE RESPONSE. THUS AT A LATER TIME THIS MAY BE REFERENCED. CONSIDER SOME EXAMPLES:

```
1400 A:$NAME
1500 A:$RESPNSE37
1600 A:$P
1700 A:$3
1800 A:$A37BY16
```

WHAT DO THESE OBJECTS HAVE IN COMMON ?\$
 SO, SO, PETE. THE OBJECT BEGINS WITH A DOLLAR SIGN (\$) AND IS COMPOSED OF A CONTIGUOUS (NO BLANKS) STRING OF LETTERS AND DIGITS. THE MAXIMUM

LENGTH IS 50 CHARACTERS.

SUCH AN OBJECT IS TERMED A 'STRING VARIABLE' AND IT STORES THE ENTIRE RESPONSE TYPED IN BY THE STUDENT AND ASSOCIATES IT WITH THE NAME OF THE STRING VARIABLE.

WHICH OF THE FOLLOWING ARE ILLEGAL STRING VARIABLES:

- | | |
|------------------------|-------------|
| 1. SNAME | 5. \$JOHN C |
| 2. \$JOHNHENRYTHEFIRST | 6. \$19END |
| 3. \$3.79 | 7. \$ROCKY! |
| 4. \$C | 8. \$190 |

?5

WELL YOU MISSED AT LEAST ONE! THE ILLEGAL ONES ARE: 3, 5, AND 7 BECAUSE THEY CONTAIN A CHARACTER WHICH IS NOT A LETTER OR A DIGIT. THE OTHERS ARE PERFECTLY GOOD!

NOW THAT YOU HAVE A RESPONSE STORED, HOW CAN YOU CAUSE THE COMPUTER TO PRINT IT OUT ?WITH A T STATEMENT

OK, ONE MUST REFERENCE THE STRING VARIABLE IN A TYPE STATEMENT. TO DO THIS SIMPLY ENTER THE STRING VARIABLE WHERE YOU WANT THE REFERENCED RESPONSE TO APPEAR. AN EXAMPLE WILL ILLUSTRATE:

```
100 T:WHAT IS YOUR SEX +
120 A:$GENDER
130 T:YOU ARE A $GENDER MY FRIEND!
```

LET'S RUN THIS PROGRAM.

```
WHAT IS YOUR SEX ?MALE
YOU ARE A MALE MY FRIEND!
```

NOTICE THAT THE ENTIRE REFERENCE '\$GENDER' WAS REPLACED BY 'MALE'.

NOW, THE STRING VARIABLE BEGINS WITH A '\$', WHAT SIGNALS THE END OF THE STRING VARIABLE ?A SPACE

YES, IN THE EXAMPLE ABOVE A BLANK SIGNALS THE END OF THE STRING VARIABLE REFERENCE. THE BLANK IS PRINTED. THIS PERMITS HAVING TWO SIMILAR LOOKING STRING VARIABLES AS IN:

```
100 T:WHAT IS YOUR FIRST NAME +
110 A:$NAME
120 T:WHAT IS YOUR LAST NAME +
130 A:$NAMEA
140 T:FIRST: $NAME AND LAST: $NAMEA
```

THE FIRST REFERENCE WILL BE TO '\$NAME' AND THE SECOND TO '\$NAMEA'.

SOMETIMES IT IS DESIRED TO IMMEDIATELY FOLLOW THE RESPONSE WITH SOME CHARACTER OTHER THAN A BLANK. HOW COULD ONE CAUSE THE COMPUTER TO DO THIS ?I DON'T KNOW

AGAIN THE PLUS SIGN (+) TO THE RESCUE! A REFERENCE MAY ALSO BE TERMINATED WITH A '+', WHICH IS NOT PRINTED. CONSIDER:

```
5000 T:WHAT IS YOUR SEX +
5010 A:$SEXY
5020 T:ARE YOU REALLY A '$SEXY+'!!
```

IF YOU TYPE IN THE WORD 'NEUTER' AS A RESPONSE, WHAT WILL BE PRINTED BY STATEMENT 5020 ?ARE YOU REALLY A 'NEUTER'!!
QUITE RIGHT, PETE. TRY IT!

```
WHAT IS YOUR SEX ?NEUTER
ARE YOU REALLY A 'NEUTER'!!
```

THUS WE HAVE THREE POSSIBLE WAYS TO TERMINATE A STRING VARIABLE REFERENCE: 1. BLANK, 2. +, AND 3. END OF THE STATEMENT. ONLY ONE MORE POINT AND YOU WILL KNOW EVERYTHING THERE IS TO KNOW ABOUT STRING REFERENCES!

CONSIDER THIS PROGRAM:

```
1 T:HI '$NAME+', WHO ARE YOU +
2 A:
```

WHAT WOULD BE PRINTED ?HI '\$NAME', WHO ARE YOU?

WELL, SINCE THE REFERENCE \$NAME DOES NOT APPEAR AS AN OBJECT TO AN ANSWER STATEMENT, THE COMPUTER WILL JUST PRINT IT AS IS!

SO IT PRINTS: HI '\$NAME+', WHO ARE YOU ?
HOW ABOUT THIS:

```
1   T:HI '$NAME+', WHO ARE YOU +
2   A:$NAME
3   T:THANK YOU $NAME!
```

NOW WHAT WILL BE PRINTED BY LINE 1 ?

•
•
•
•

TITLE:

PILOT TUTORIAL

PZTUB
36775**DESCRIPTION:**

This is the second in a series of tutorial programs written in PILOT to teach the syntax and usage of PILOT.

This program deals with the TYPE and ANSWER statements and how to enter a PILOT program.

INSTRUCTIONS:

This program is stored in 3 files named P-TUB1, P-TUB2, and P-TUB3 for use on the HP 2000E System; and is stored on 1 file named P-TUB for use on the HP 2000F System.

See PILOTE (HP 36637) to use this program on the HP 2000E System.

See PILOTF (HP 36756) to use this program on the HP 2000 Series System.

1. Example (2000E version)
OPE-S,5
GET-PILOT
1 FILES P-TUB1, P-TUB2, P-TUB3, S
RUN
NUMBER PROGRAM FILES ? 3
2. Example (2000F version)
CRE-S,5
GET-PILOTF
RUN
NAME OF PILOT PROGRAM? PZTUB
NAME OF SCRATCH FILE ? S
?RUN

ACKNOWLEDGEMENTS:

Lawrence E. Turner, Jr.
Pacific Union College

RUN

NAME OF PILOT PROGRAM ?PZTUB
NAME OF SCRATCH FILE ?SCR4

?RUN

PILOT

WELCOME TO THE SECOND PROGRAM IN THE TUTORIAL SERIES TO TEACH YOU EVERYTHING YOU WANTED TO KNOW ABOUT PILOT (BUT WERE AFRAID ASK!).

BY NOW YOU ARE FAMILIAR WITH TWO DIFFERENT PILOT STATEMENTS. WHAT ARE THEY ?TYPE AND ANSWER OF COURSE, FROM THE FIRST PROGRAM YOU LEARNED ABOUT TYPE AND ANSWER STATEMENTS (THAT INCLUDES THE UNREFERENCED TYPE ALSO!).

WHAT THINGS DO ALL PILOT STATEMENTS HAVE IN COMMON??
?STATEMENT NUMBERS AND COLON

OK! ALL PILOT STATEMENTS HAVE: 1. A LINE NUMBER, 2. AN INSTRUCTION, AND 3. A COLON! THEY MAY ALSO HAVE AN OBJECT, BUT AT LEAST AS FAR AS THE TYPE AND ANSWER STATEMENTS, IT IS OPTIONAL.

WHAT DOES THE OBJECT OF AN ANSWER STATEMENT DO??
?STORES THE RESPONSE

RIGHT! THE OBJECT OF AN ANSWER STATEMENT STORES THE RESPONSE FOR FURTHER REFERENCE; THAT IS, IT MAY BE PRINTED OUT LATER.

WHAT SPECIAL CHARACTER SIGNIFIES CONCATENATION ?+
CORRECT! THE PLUS SIGN (+) AT THE END OF A TYPE OBJECT CAUSES THE CARRIAGE TO JUST SIT AT THAT POINT UNTIL THE NEXT CHARACTER IS PRINTED. IT ALSO SIGNIFIES THE END OF A STRING VARIABLE OR A NUMERIC VARIABLE REFERENCE.

•
•
•

CONTRIBUTED PROGRAM **BASIC**PZTUC
36877**TITLE:**

PILOT TUTORIAL

DESCRIPTION:

This is the third in the PILOT tutorial series written in PILOT to teach the syntax and usage of PILOT.

This program deals with labels, JUMP and conditions.

INSTRUCTIONS:

This program is stored in 3 files named P-TUC1, P-TUC2, and P-TUC3 for use on the HP 2000E Systems: and is stored on 1 file named PZTUC for use on the HP 2000 Series System.

See PILOTE (HP 36637) to use this program on the HP 2000E System.

See PILOTF (HP 36756) to use this program on the HP 2000 Series System.

1. Example (2000E Version)

```
OPE-S,5
GET-PILOT
1 FILES P-TUC1, P-TUC2, P-TUC3, S
RUN
NUMBER PROGRAM FILES ? 3
```

2. Example (2000 Series Version)

```
CRE-S,5
GET-PILOTF
RUN
NAME OF PILOT PROGRAM? PZTUC
NAME OF SCRATCH FILE ? S
?RUN
```

ACKNOWLEDGEMENTS:

Lawrence E. Turner, Jr.
Pacific Union College

RUN

CRE-S,5
GET-PILOTF
RUN
PILOTF

NAME OF PILOT PROGRAM ?PZTUC
NAME OF SCRATCH FILE ?S

?RUN

PILOT

IT IS GOOD TO SEE YOU AGAIN. THIS IS THE THIRD PROGRAM IN THE PILOT TUTORIAL SERIES. I HOPE THAT YOU HAVE PROGRESSED TO THIS POINT BECAUSE YOU ARE GENUINELY INTERESTED IN THE PILOT LANGUAGE. IN THE FIRST TWO PROGRAMS WE DISCUSSED FOUR DIFFERENT KINDS OF STATEMENTS AND SEVERAL OTHER CONCEPTS. WITH THESE ONE CAN WRITE SOME RATHER GOOD CAI PROGRAMS. BUT, THERE ARE ALL SORTS OF GOOD THINGS YET TO LEARN THAT HELP MAKE THE PROGRAMS EASIER TO WRITE AND MORE EFFECTIVE TO USE.

HAVE YOU HAD A CHANCE TO PRACTICE WRITING YOUR OWN PILOT PROGRAMS ?NO PRACTICE IS IMPORTANT. PILOT IS SUCH AN EASY LANGUAGE TO LEARN THAT THERE IS A TENDENCY TO THINK THAT YOU UNDERSTAND ALL THERE IS TO KNOW AND THAT PRACTICE IS UNNECESSARY. THIS IS NOT TRUE! IT IS VERY IMPORTANT TO TRY THESE IDEAS AND CONCEPTS OUT ON YOUR OWN.

LET US TRY A LITTLE REVIEW QUIZ TO SEE HOW MUCH YOU REMEMBER.

1. WHAT PILOT STATEMENT PRODUCES OUTPUT ?TYP
2. WHAT PILOT STATEMENT EXAMINES AND CHECKS A RESPONSE ?MATCH
3. WHAT PILOT STATEMENT REQUESTS A RESPONSE ?INPUT
4. WHAT PART OF A PILOT STATEMENT DESIGNATES THE ORDER OF THE PILOT STATEMENTS ?STATEMENT NUMBER
5. WHAT DOES A 'REMARK' STATEMENT DO ?NOTHING
6. WHAT SEPARATES THE OBJECT FROM THE INSTRUCTION PART ?A COLON
7. IF A MATCH STATEMENT FAILS, THEN WHICH SUBSEQUENT STATEMENTS ARE SKIPPED ?CONDITIONAL
8. WHAT CHARACTER DESIGNATES A STRING VARIABLE ?\$
9. WHAT CHARACTER SIGNIFIES CONCATENATION ?+
10. HOW DO YOU DELETE A GIVEN STATEMENT ?TYPE THE STATEMENT NUMBER,RETURN
11. WHAT PILOT COMMAND GIVES THE NUMBER OF STATEMENTS IN YOUR PILOT PROGRAM ?SIZE

NOT BAD, YOU DID MISS TWO HOWEVER.

THE CORRECT ANSWERS ARE:

3. AN 'ANSWER' STATEMENT PRODUCES A QUESTION MARK (?) AND THE COMPUTER WAITS FOR A RESPONSE TO BE TYPED IN.
7. IF THE 'MATCH' STATEMENT FAILS, THEN THOSE STATEMENTS WITH A 'Y' CONDITION ARE SKIPPED. IF IT IS SUCCESSFUL, THEN THOSE WITH A 'N' CONDITION ARE SKIPPED.

THE CONCEPTS YOU MISSED WERE PRIMARILY COVERED IN BOTH THE FIRST TUTORIAL PROGRAM, P-TUA, AND THE SECOND TUTORIAL PROGRAM, P-TUB.

WELL, LET'S FORGE AHEAD AND LEARN SOME NEW GOODIES! I WOULD LIKE TO KNOW YOUR NAME SO I CAN PRAISE YOU PERSONALLY. OK, WHAT IS YOUR JOHN HENRY ?JOHN HENRY

YOU HAVE LEARNED IN THE FIRST PROGRAMS IN THIS SERIES THAT THE LINE NUMBERS DETERMINE THE ORDER IN WHICH THE STATEMENTS ARE EXECUTED. THE COMPUTER EXECUTES EACH STATEMENT IN SEQUENCE. THERE IS A WAY TO PREVENT CERTAIN STATEMENTS FROM BEING EXECUTED. OK, JOHN HENRY, WHAT IS THIS WAY ?J+CONDITIONAL JUMPS
PRECISELY!

HOWEVER, THE ORDER OF THE EXECUTION IS NOT ALTERED. TO DO THIS TAKES ANOTHER KIND OF PILOT STATEMENT AND A NEW PART FOR THE INSTRUCTION PORTION. THE STATEMENT IS A 'JUMP' STATEMENT. WHAT DO YOU THINK IS THE ONE CHARACTER INSTRUCTION FOR THIS ?J
 RIGHT ON! THE 'JUMP' INSTRUCTION IS DESIGNATED BY 'J' AND IT CAUSES THE EXECUTION TO GO TO ANOTHER STATEMENT. WHAT PART OF THE 'JUMP' DESIGNATES THE NEW STATEMENT ?NUMBER ON LEFT
 YOU ARE SO RIGHT JOHN HENRY! THE OBJECT OF THE 'JUMP' STATEMENT TELLS THE COMPUTER WHERE TO GO. CONSIDER:

```
1039 JI:*NEXTQUEST
2340 JI:*OVER32
3110 JYI:*RIGHTONE
4520 JB:*GIMEANUMBER
8500 JI:*127
```

THE OBJECT OF A 'JUMP' STATEMENT IS TERMED A 'LABEL' AND EXECUTION IS TRANSFERRED TO THE STATEMENT WITH THAT LABEL. WHERE IN THE STATEMENT DO YOU SUPPOSE THE LABEL GOES ?IN THE BEGINNING
 EXACTLY JOHN HENRY! IT GOES AT THE BEGINNING OF THE STATEMENT, BETWEEN THE LINE NUMBER AND THE INSTRUCTION, AND IT IS SEPARATED FROM THE INSTRUCTION BY AT LEAST ONE BLANK.

WHAT IS THE FIRST CHARACTER OF A LABEL ?*
 YOU ARE VERY OBSERVANT! THE LEADING CHARACTER MUST BE AN ASTERISK (*). NOTE ALSO THAT THE REST OF THE LABEL IS COMPOSED OF A CONTIGUOUS SET OF DIGITS AND LETTERS. WHAT OTHER PILOT ANIMAL IS SO COMPOSED??
 ?DON'T KNOW

FOR PETE'S SAKE, IT IS A STRING VARIABLE. HOWEVER, THERE'S NO RESTRICTION TO THE LENGTH OF A LABEL. LET'S LOOK AT A SAMPLE PROGRAM!

```
2000 *GETAGE T:WHAT IS YOUR AGE +
2010 A:#X
2020 TB:DON'T BE AFRAID, GIVE ME A NUMBER!
2030 JB:*GETAGE
2040 T:#X IS A NICE AGE!
```

THE ORDER OF EXECUTION IS:

A NUMBER IS NOT TYPED IN	A NUMBER IS TYPED IN
2000	2000
2010	2010
2020	2040
2030	
2000	
2010	

TRY IT!

```
WHAT IS YOUR AGE ?32
32 IS A NICE AGE!
```

LET'S TRY ANOTHER EXAMPLE:

```
3100 R: SECTION TO GET SEX
3110 *ASKSX T:WHAT IS YOUR SEX +
3120 A:
3130 M:FEMALE,GIRL,LADY,GAL,FEMIN,NOT MALE,WOMAN,WOMEN
3140 Y:A CUTE ONE!
3150 JY:*NEXT
3160 M:MALE,MAN,BOY,GUY,MEN,MASCUL
3170 Y:A HANDSOME ONE!
3180 N:I DON'T RECOGNIZE THAT!
3190 JN:*ASKSX
3200 *NEXT R:
```

HERE IT IS NECESSARY TO BRANCH OVER THE SECOND MATCH SINCE IN ESSENCE THERE ARE THREE POSSIBLE RESPONSES AND THE 'YN' CAN ONLY SEPARATE TWO OF THEM. DO YOU UNDERSTAND THE STRUCTURE OF THIS PROGRAM ?YES
 EXCELLENT!

A PILOT STATEMENT CAN BE DIAGRAMED AS:

<LINE NUMBER> [LABEL] <INSTRUCTION>[CONDITION]:<OBJECT>

WHERE <> INDICATES A REQUIRED ELEMENT, AND [] INDICATES AN OPTIONAL ELEMENT. THE OBJECT MAY BE OMITTED ONLY FOR SOME KINDS OF STATEMENTS. THIS IS THE MOST GENERAL FORM OF A PILOT STATEMENT!

TITLE:

PILOT 73 AUTHOR LANGUAGE FOR HP 2000E

DESCRIPTION:

The PILOTE package contains 2 programs NAMED PILOT and PILOTE.

PILOTE is an author language for Computer Assisted Instruction (CAI). It is an implementation of PILOT 73 for a Hewlett-Packard 2000E Time-shared BASIC system. PILOT 73 is a hybridization of several author languages used in the San Francisco Bay area. Early in 1973 a group organized by Stanford Research Institute met and agreed upon a standardization called PILOT 73. These antecedents of PILOT have been used extensively for writing dialog type CAI programs.

There are several advantages of such an author language. First, the syntax is relatively simple so that within a short time most anyone can master the language. Even more importantly, the construction of the PILOT language is such as to facilitate "dialog" type programming with a minimum of effort. One is able to write effective programs quickly.

To be useful, any author language must be written as an interactive language. PILOTE is implemented in BASIC for HP 2000E time-shared system. This permits it to be used simultaneously with BASIC on this system.

INSTRUCTIONS:

P-DEMO is included here as a demonstration of the features of the PILOT language.

'PILOTE' is the syntax and entry portion of the system. The PILOT language program is stored on up to 3 files as source statements. Line numbers allow for editing (insertion, replacement, and deletion) of the PILOT language statements.

'PILOT' is the program that executes the PILOT language program.

continued on following page.

**SPECIAL
CONSIDERATIONS:**

See PILOTF (HP 36756) for the version of PILOT 73 modified for the HP 2000 Series.

See P-TUA (HP 36758) and P-TUB (HP 36775A) which are tutorial programs written in PILOT to teach the syntax and usage of PILOT.

See P-HYP (HP 36759) a PILOT language program concerning the scientific method and its relation to hypothesis and observation.

Complete user instructions including classroom implementation of this program is available: HP 5951-5660 PILOT Users Manual.

For ordering information of this manual, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Lawrence E. Turner, Jr.
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INSTRUCTIONS continued

A PILOT program consists primarily of statements and questions typed by the computer. The student's responses may be analyzed and appropriate action is then taken by the computer dependent on exactly what the student has typed. Thus a dialog between the computer the student may be established.

The syntax of PILOTE is relatively easy to master.

```

10 R: THIS IS A PILOT PROGRAM
20 R:
30 T:HELLO! I AM YOUR FRIENDLY COMPUTER
40 T: WHAT IS YOUR NAME +
50 A: $NAME
60 T:WELL $NAME HOW DO YOU USUALLY USE A COMPUTER??
70 A:
80 T:
90 T:THAT SOUNDS PRETTY GOOD!!
100 E:
    
```

This sample program contains four out of the thirteen possible statement types in PILOT. The first statement is a REMARK statement which is not executed, statement 30 is a TYPE statement. Everything to the right of the colon is printed on the terminal. The plus (+) as a last character in line 40 prevents the carriage return-line feed that would normally occur at the end of the line. Thus statement 50, an ANSWER statement prints a question mark (?) at the second position after the last "E" in statement 40. After printing the question mark the computer waits for the user to type in something from the terminal followed by a carriage return (ret). Whatever is typed-in is stored in the string variable NAME and is printed out in statement 60, where \$NAME is replaced by whatever the student typed-in for the response to statement 50. The last statement is an END statement which terminates the program.

A main virtue of a computer is the ability to analyze a student's response and to make decisions on the basis of what the student has typed. In PILOT this is accomplished by the MATCH statement and the use of a condition.

```

10 T:WHAT IS YOUR SEX +
20 A:
30 M:FEMALE,GIRL,WOMAN,LADY
40 TY:I HOPE YOU ARE NOT A MEMBER OF WOMEN'S LIB!
50 TN:I HOPE YOU ARE NOT A CHAUVINIST PIG!
    
```

In this case the MATCH statement (number 30) has four possible alternatives separated by a comma (,).

Some very powerful extensions are contained in the other PILOT statements.

The more important of these are: the JUMP statement allows one to branch to any labeled statement, again depending on a condition, the DEMAND statement (.D) provides for accumulating the results of more than one MATCH statement to check for several different responses in a single answer. With the COMPUTE statement the programmer can define variables which have numeric values associated with them. These variables may be given values, manipulated, and ultimately used in conditions or even printed on the terminal.

Complete User Instructions for PILOT are contained in the PILOT Users Manual (HP 5951-5660).

HOW TO ENTER A PILOT PROGRAM

The PILOT interpretive system consists of two BASIC programs. The first is entitled 'PILOTE' and is used to enter the PILOT program and provides editing and syntax checking. The second is entitled 'PILOT' and is used to execute the PILOT program.

The PILOT program is stored on one to three disk files, but three program files must be declared during the syntax phase. The execution of 'PILOTE' may be halted at each input with the command STOP or with a 'ctrl C'. The 'break' should be used only during a LIST.

The three program files, in which the PILOT program is stored, are designated by the user. They should contain at least two records each. In practice the entire PILOT program may fit into one or two files. The PILOT program is stored three, four, five, or six statements per record. Thus a maximum length of 864 PILOT statements is allowed.

These files need not be the same size. A fourth scratch file of at least two records must be opened before entering a PILOT program. It may be longer but only the first two records are used in editing the three program files. A files statement must be declared in line 1 of 'PILOT' before executing.

EXAMPLE:

```

OPEN-FILE1,30
OPEN-FILE2,30
OPEN-FILE3,20
OPEN-SCRACH,2

GET-PILOTE
1 FILES FILE1,FILE2,FILE3,SCRACH

```

Since a total of 80 records have been opened the PILOTE program must be less than 480 statements. The fourth file, 'SCRACH' must be at least 2 records.

Tape dumped by the LIS command may be read back if the terminal has an automatic reader control. Place the tape in the reader and turn it to start after a question mark has been printed by PILOTE for a new statement. It will proceed to read in the tape. At the end of the tape an extra ? will have been read in, typing a carriage return will clear this.

<u>PILOT COMMAND</u>	<u>PURPOSE</u>
LIST	The LIST command is used to list all or only a portion of the PILOT program on the terminal.
NUMBER	The NUMBER command is used to renumber the line numbers of an existing PILOT program.
PURge	The PURge command completely erases the PILOT program; that is, the program files are filled with eof's.
SIZE	The SIZE command gives the number of statements, the number of records, and the number of the last statement.
STOp	The STOp command is used to achieve an orderly exit from the program 'PILOTS'. The files are left in such a way as to allow future modification or execution.

In all cases only the first three letters of the command are required.

HOW TO RUN A PILOT PROGRAM

The BASIC program to execute a PILOTE program is entitled 'PILOT'. It requires, in addition to the PILOT program files, a scratch file as long as necessary. These are to be entered in statement 1.

In the following example, a PILOT program has been stored on the files: FILE1 and FILE2.

```

OPEN-SCR,48
GET-PILOT
1 FILES FILE1,FILE2,SCR
RUN
PILOT

NUMBER PROGRAM FILES?2
.
.
.

```

The first part of the execution of 'PILOT' sets up reference tables, checks for unreferenced JUMP statement and USE statements, and sets up a response table. The reference table consists of statement numbers and label names for all the labeled PILOT statements. The response table consists of string variables and a place to store a response for all ANSWER statements with a string variable as an object. Both these tables are stored on the scratch file.

The response table will take one-half of a record for each ANSWER statement with a string variable object. Thus in writing a PILOT program it is best to keep labels short and the number of ANSWER statement with string variable objects to a minimum. As a rough example; out of a PILOT program of 600 statements, one may have perhaps 80 labeled statements. If these are relatively short, say less than 20 characters, then the reference table would take about 10 records leaving room for 76 stored responses in the next 38 records. In many cases it is not necessary to actually store the student's response in order to analyze it. These numbers are based on the assumption that the scratch file is the maximum length allowed of 48 records.

After the initial "set up" phase, the program 'PILOT' proceeds to interpret the PILOT language program. When the PILOT program is finished, control returns to 'PILOT' and the user is asked if he wishes to repeat the execution of the PILOT program. If the response is 'YES' (or just 'Y'), the PILOT program is re-executed, if not, control is returned to the BASIC system.

RUN

1 FILES P-DEMO.SCR
RUN
PILOT

NUMBER PROGRAM FILES ?1

PILOT

HELLO! I AM YOUR FRIENDLY HP 2100A.

WHAT IS YOUR NAME ?GEORGE

THAT IS A NICE NAME GEORGE. I RATHER LIKE IT!!

IF YOU DON'T THINK IT TOO PERSONAL . . .
WHAT IS YOUR SEX ?MALE

THAT WAS WHAT I WAS AFRAID OF!
I WOULD ALSO LIKE YOUR AGE PLEASE ?2

I DON'T BELIEVE YOU!!!
I WOULD ALSO LIKE YOUR AGE PLEASE ?15

I HAVE A FEW QUESTIONS FOR YOU.
ARE YOU READY?NOPE
NOW WHAT'S THE MATTER???
ARE YOU READY?YES

WHO IS THE PRESIDENT OF THE U.S. ?SAM ERVIN
YOU MUST BE A DEMOCRAT, OR ARE YOU JUST DEAD??

WHO IS THE PRESIDENT OF THE U.S. ?NIXON
MY, YOU ARE UP TO DATE!!

FOR A HANDSOME GUY OF 15 YEARS, YOU TOOK ONLY 2 TRIES!!

CAN YOU NAME AT LEAST THREE COMPUTER MANUFACTURERS??
?NO
WELL, TRY ANYWAY!
?HP,IBM,XEROX

RIGHT ON, GEORGE! I CAN TELL YOU'RE AN EXPERT!

YOU DID SO WELL ON THAT LAST QUESTION, LET ME TRY A MORE THOUGHT
PROVOKING ONE!

I AM THINKING OF A NUMBER BETWEEN 0 AND 100. CAN YOU GUESS IT???

1 ?50

TOO SMALL!

2 ?75

TOO SMALL!

3 ?88

TOO SMALL!

4 ?95

TOO LARGE!

5 ?92

TOO SMALL!

6 ?93

TOO SMALL!

7 ?94

THAT IS VERY GOOD GEORGE, YOU DID IT IN SEVEN TRIES OR LESS!
WOULD YOU LIKE TO TRY IT AGAIN ?NO

I HAVE ONE LAST QUESTION FOR YOU GEORGE! WHAT DOES CAI MEAN??
?I DON'T KNOW
YOU BLEW IT! CAI STANDS FOR COMPUTER ASSISTED INSTRUCTION. THAT'S
WHAT WE'RE DOING RIGHT NOW!!

WELL, GEORGE, OUT OF THE 3 QUESTIONS I ASKED (NOT COUNTING THE
NUMBER GUESSING ONE), YOU GOT 1 CORRECT ON THE FIRST TRY. YOU GOT
AT LEAST ONE CORRECT.
END

PROGRAMMING AND COMPUTER SCIENCE (EDUCATION) (810)

CONTRIBUTED PROGRAM **BASIC**

PILOTF
36756

TITLE:

PILOT 73 AUTHOR LANGUAGE FOR HP 2000F

DESCRIPTION:

PILOTF is an author language for Computer Assisted Instruction (CAI). It is an implementation of PILOT 73 for a Hewlett Packard 2000F Time-Shared BASIC system. PILOT 73 is a hybridization of several author languages used in the San Francisco Bay Area. Early in 1973 a group organized by Stanford Research Institute met and agreed upon a standardization called PILOT 73. These antecedents of PILOT have been used extensively for writing dialog type CAI programs.

There are several advantages of such an author language. First, the syntax is relatively simple so that within a short time most anyone can master the language. Even more importantly, the construction of the PILOT language is such as to facilitate "dialog" type programming with a minimum of effort. One is able to write effective programs quickly.

To be useful, any author language must be written as an interactive language. PILOTF is implemented in BASIC for HP 2000 Series system. This permits it to be used simultaneously with BASIC on this system.

INSTRUCTIONS:

PZDEMO is included here as a demonstration of the features of the PILOT language.

continued on following page



**SPECIAL
CONSIDERATIONS:**

Statements are stored up to 13 per record (256 words). The only limit to the size of the PILOTF program is 9999 statements (1 to 9999 is the allowed range of line numbers).

See PILOTE (HP 36637) for the HP 2000E version of PILOT 73.

See PZTUA (HP 36758) and PZTUB (HP 36775) which are tutorial programs written in PILOTF to teach the syntax and usage of PILOTF.

See PZHYP (HP36759) a PILOT language program concerning the scientific method and its relation to hypothesis and observation.

Complete user instructions including classroom implementation of this program is available: HP 5951-5660 PILOT Users Manual.

For ordering information of this manual, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Lawrence E. Turner, Jr.
Pacific Union College

INSTRUCTIONS continued

A PILOT program consists primarily of statements and questions typed by the computer. The student's responses may be analyzed and appropriate action is then taken by the computer dependent on exactly what the student has typed. Thus a dialog between the computer and the student may be established.

The syntax of PILOTF is relatively easy to master.

```

10 R:  THIS IS A PILOT PROGRAM
20 R:
30 T:HELLO!  I AM YOUR FRIENDLY COMPUTER
40 T:  WHAT IS YOUR NAME +
50 A:  $NAME
60 T:WELL $NAME HOW DO YOU USUALLY USE A COMPUTER??
70 A:
80 T:
90 T:THAT SOUNDS PRETTY GOOD!!
100 E:

```

This sample program contains four out of the thirteen possible statement types in PILOT. The first statement is a REMARK statement which is not executed, statement 30 is a TYPE statement. (Everything to the right of the colon is printed on the terminal.) The plus (+) as a last character in line 40 prevents the carriage return-line feed that would normally occur at the end of the line. Thus statement 50, an ANSWER statement prints a question mark (?) at the second position after the last "E" in statement 40. After printing the question mark the computer waits for the user to type in something from the terminal followed by a carriage return (ret). Whatever is typed-in is stored in the string variable NAME and is printed out in statement 60, where \$NAME is replaced by whatever the student typed-in for the response to statement 50. The last statement is an END statement which terminates the program.

A main virtue of a computer is the ability to analyze a student's response and to make decisions on the basis of what the student has typed. In PILOT this is accomplished by the MATCH statement and the use of a condition.

```

10 T:WHAT IS YOUR SEX +
20 A:
30 M:FEMALE,GIRL,WOMAN,LADY
40 TY:I HOPE YOU ARE NOT A MEMBER OF WOMEN'S LIB!
50 TN:I HOPE YOU ARE NOT A CHAUVINIST PIG!

```

In this case the MATCH statement (number 30) has four possible alternatives separated by a comma (,).

Some very powerful extensions are contained in the other PILOT statements.

The more important of these are: the JUMP statement allows one to branch to any labeled statement, again depending on a condition, the DEMAND statement (.D) provides for accumulating the results of more than one MATCH statement to check for several different responses in a single answer. With the COMPUTE statement the programmer can define variables which have numeric values associated with them. These variables may be given values, manipulated, and ultimately used in conditions or even printed on the terminal.

Complete User Instructions for PILOT are contained in the PILOT Users Manual (HP 5951-5660).

HOW TO ENTER A PROGRAM

At each question either a PILOT command or a PILOT statement is required. Error messages indicate an incorrect input. The execution of PILOTF may be halted at each input with the command STOP or with a 'ctrl C'. The 'break' should be used only during a LIST.

The program file, in which the PILOT program is stored, is designated by the user. It should contain at least two records, and may be as long as one wishes. The PILOT program is stored up to 13 statements per record.

A scratch file of at least two records must be opened before entering a PILOT program. It may be longer but only the first two records are used in editing the program files. The user is asked the name of the program file during execution of PILOTF.

Example:

```

CRE-FILE1,80
CRE-SCRACH,2
GET-PILOTF
RUN

```

Tape dumped by the LIS command may be read back if the terminal has an automatic reader control. Place the tape in the reader and turn it to start after a question mark has been printed by PILOTF for a new statement. It will proceed to read in the tape. At the end of the tape an extra ? will have been read in, typing a carriage return will clear this.

INSTRUCTIONS continued

PILOT COMMAND	PURPOSE
LIST	The LIST command is used to list all or only a portion of the PILOT program on the terminal.
NUMber	The NUMber command is used to renumber the line numbers of an existing PILOT program.
PURge	The PURge command completely erases the PILOT program; that is, the program files are filled with EOF's.
RUN	The RUN command causes the execution of the PILOT program previously declared. All exits in the execution phase returns control to the syntax phase.
SIZE	The SIZE command gives the number of statements, the number of records, and the number of the last statement.
STOp	The STOp command is used to achieve an orderly exit from the program PILOTS. The files are left in such a way as to allow future modification or execution.

In all cases only the first three letters of the command are required.

HOW TO RUN A PILOT PROGRAM

In the following example, a PILOT program has been stored on the files, FILE1

```

CRE-SCR 48
GET-PILOTF
RUN
PILOTF

```

```

NAME OF PILOT PROGRAM? FILE1
NAME OF SCRATCH FILE? SCR
?RUN

```

The first part of the execution of PILOT sets up reference tables, checks for unreferenced JUMP statement and USE statements, and sets up a response table. The reference table consists of statement numbers and label names for all the labeled PILOT statements. The response table consists of string variables and a place to store a response for all ANSWER statements with a string variable as an object. Both these tables are stored on the scratch file.

The response table will take one-half of a record for each ANSWER statement with a string variable object. Thus in writing a PILOT program it is best to keep labels short and the number of ANSWER statement with string variable objects to a minimum. As a rough example; out of a PILOT program of 600 statements, one may have perhaps 80 labeled statements. If these are relatively short, say less than 20 characters, then the reference table would take about 10 records leaving room for 76 stored responses in the next 38 records. In many cases it is not necessary to actually store the student's response in order to analyze it. These numbers are based on the assumption that the scratch file is 48 records.

After the initial "set up" phase, the program PILOT proceeds to interpret the PILOT language program. When the PILOT program is finished, control returns to PILOT and the user is asked if he wishes to repeat the execution of the PILOT program. If the response is "YES" (or just "Y"), the PILOT program is re-executed, if not, control is returned to the BASIC system.

RUN

```

NAME OF PILOT PROGRAM ?PZDEMO
NAME OF SCRATCH FILE ?SCR

```

?RUN

PILOT

HELLO! I AM YOUR FRIENDLY HP 2100A.

WHAT IS YOUR NAME ?PETE

THAT IS A NICE NAME PETE. I RATHER LIKE IT!!

IF YOU DON'T THINK IT TOO PERSONAL . . .
WHAT IS YOUR SEX ?MAE-LE

THAT WAS WHAT I WAS AFRAID OF!
I WOULD ALSO LIKE YOUR AGE PLEASE ?1

I DON'T BELIEVE YOU!!!
I WOULD ALSO LIKE YOUR AGE PLEASE ?14

I HAVE A FEW QUESTIONS FOR YOU.
ARE YOU READY?OK

WHO IS THE PRESIDENT OF THE U.S. ?NIXON
MY, YOU ARE UP TO DATE!!

FOR A HANDSOME GUY OF 14 YEARS, YOU TOOK ONLY 1 TRY!!

CAN YOU NAME AT LEAST THREE COMPUTER MANUFACTURERS??
?NO
WELL, TRY ANYWAY!
?HP, IBM, XEROX

RIGHT ON, PETE! I CAN TELL YOU'RE AN EXPERT!

YOU DID SO WELL ON THAT LAST QUESTION, LET ME TRY A MORE THOUGHT
PROVOKING ONE!

I AM THINKING OF A NUMBER BETWEEN 0 AND 100. CAN YOU GUESS IT???

1 ?88

TOO SMALL!

2 ?93

TOO ARGE!

3 ?91

THAT IS VERY GOOD PETE, YOU DID IT IN SEVEN TRIES OR LESS!
WOULD YOU LIKE TO TRY IT AGAIN ?NO

I HAVE ONE LAST QUESTION FOR YOU PETE! WHAT DOES CAI MEAN??
?COMPUTER ASSISTED INSTRUCTION
EXCELLENT PETE! CAI STANDS FOR COMPUTER ASSISTED INSTRUCTION. THAT'S
WHAT WE'RE DOING RIGHT NOW!!

WELL, PETE, OUT OF THE 3 QUESTIONS I ASKED (NOT COUNTING THE
NUMBER GUESSING ONE), YOU GOT 3 CORRECT ON THE FIRST TRY. THAT IS
JUST ABOUT PERFECT!
END

TRY AGAIN ?NO

?STOP

DONE

CONTRIBUTED PROGRAM **BASIC**SNOBOL
36849**TITLE:**

SNOBOL 3 COMPILER FOR HP 2000 SERIES SYSTEM

DESCRIPTION:

The SNOBOL program is a 2000C/F implementation of the SNOBOL-3 compiler as described in Saul Rosen's well-known book "Programming Systems and Languages", published by McGraw-Hill (1967), pages 419-454. The book "SNOBOL-3 Primer", written by Allen Forte, published by MIT Press (1967), can also be used as a source of information about this SNOBOL. The differences between the SNOBOL-3 described in Rosen and SNOBOL/2000 are detailed in this documentation. Besides these differences, SNOBOL/2000 has no function handling capability, either built-in or user-defined.

The SNOBOL/2000 system consists of three BASIC programs:

1. SNOBOL = Compiles a SNOBOL-3 program into executable code.
2. SNOBEX = Executes the code produced by SNOBOL.
3. SNOBER = Prints errors produced during the execution of SNOBOL and SNOBEX.

NOTE: SNOBLD is included as an optional feature to allow the user to create the source file and data.

To use SNOBOL/2000, the user creates his source file and data, opens the scratch STRING file (to at least 10 sectors), and GETS and RUNS SNOBOL. The program will request the file name of the source program and will proceed to compile and (if compilation is successful) execute the user's SNOBOL program. If any errors are encountered, a message is printed and the program aborts. During compilation, the user is given the option of having his source program listed.

To run a program in SNOBOL3 language:

1. Type CRE-STRING, 10
2. Type CRE- _____, ____ (in the blanks are the name and sector number of your file.)
3. Type GET-SNOBLD
4. Starting with line 100, input your data in strings (for example):

Continued on next page.

The primary distinctive feature about SNOBOL is its strong-handling orientation. It is designed to manipulate strings of any size. In order to provide this capability in SNOBOL/2000 (with its 72 character string limitation), the compiler uses a scratch file called STRING. All strings used in a SNOBOL/2000 program are stored in this file. While this provides for strings of any length, execution is slow due to the extensive file accessing required. However, the speed is satisfactory for small classroom-type problems. No garbage collection routine has been implemented, so the STRING file may have to be expanded if a large program or a program with extensive iteration is executed.

ACKNOWLEDGEMENTS:

W. E. Fasnacht
West Chester State College

INSTRUCTIONS: Continued.

```
100 DATA "SUM='0'"
110 DATA "SYSPOT=SUM"
.
.
.
RUN (Follow program instructions)
```

5. Type GET-SNOBOL
RUN (Follow program instructions)
6. To rerun program, go back to step 5.
7. If you wish to build a new file, start with step 2 again.

Differences between the Rosen description of SNOBOL-3 and the HP 2000C/F implementation. Page references are to the description in Rosen.

P. 419

HP SNOBOL has a more extensive character set (since it is implemented on a teletype). The additional characters are !#%&; ?@

P. 421

HP SNOBOL does not allow labels to be made up of any special characters other than periods. Thus, only valid SNOBOL names may be used as labels. Since HP SNOBOL does not allow continuation statements, a period may be used as labels. Since HP SNOBOL does not allow continuation statements, a period may be used as the first character of a label.

P. 423

SYSPOT is a variable length string of 1 to 70 characters. SYSPPT is not implemented since it has no meaning in a teletype environment. Any attempt to assign a string larger than 70 characters to SYSPOT will result in a fatal execution error.

P. 424

In arithmetic expressions, parenthesizing is not necessary when three or more operands are involved. Precedence is from left to right with all arithmetic operators having the same precedence. However, in accordance with a note discovered in Jean Sammet's "Programming Languages: History and Fundamentals" book, arithmetic operators take precedence over concatenation. Parentheses may be used freely to override the normal precedence.

P. 424

The ' symbol is used in place of the ** to indicate exponentiation.

P. 428

Reference to SYSPIT will read a variable length record (1 to 70 characters) from the file specified by the user at the beginning of the SNOBOL run. This is the same file that contains the user's program. No blanks are appended to the string as it is input.

NOTE: In the sample RUNs shown, files named DICT, READER, PE10, TEXT and TOM* were built to show test cases only and are not a part of this package. Users should create their SNOBOL-3 source file and data, using SNOBLD or a similar program.

RUN

CRE-STRING, 10
 GET-SNOBOL
 RUN
 SNOBOL

INPUT FILE-NAME?DICT
 WANT A PROGRAM LISTING?YES

```

* LANGUAGE TRANSLATION PROGRAM TO TEST THE SNOBOL SYSTEM
1 DICT SYSPIT *FRENCH* '=' *ENGLISH* ' ' /F(TRANSLATE)
2 $FRENCH = ENGLISH /(DICT)
*** WHEN END OF DATA IS REACHED, PROGRAM BRANCHES TO END
3 TRANSLATE SYSPIT *TEXT* ' ' /F(END)
4  ENGTXT =
5  TEXT = TEXT ' '
6  NEXTW TEXT *W* ' ' = /F(PRINT)
7  '' $W /S(ERROR)
8  SET ENGTXT = ENGTXT $W ' ' /(NEXTW)
9  PRINT SYSPOT = ENGTXT /(TRANSLATE)
10 ERROR SYSPOT = 'THE WORD ' W ' IS NOT IN DICT'
11 $W = W /(SET)
12 END DICT
  
```

SUCCESSFUL COMPILATION

THE BOY LAUGHS
 SHE LAUGHS
 THE WORD SOLEIL IS NOT IN DICT
 THE SOLEIL LAUGHS

EXECUTION COMPLETE

```

WANT A DUMP?YES
ENGLISH = 'LAUGHS'
ENGTXT = 'THE SOLEIL LAUGHS '
ELLE = 'SHE'
FRENCH = '','','',''
GARCON = 'BOY'
LE = 'THE'
QUOTE = ''
RIT = 'LAUGHS'
SYSPIT = ' '
SYSPOT = 'THE SOLEIL LAUGHS '
SOLEIL = 'SOLEIL'
TEXT = ' '
  
```

DONE

GET-SNOBOL
 RUN
 SNOBOL

INPUT FILE-NAME?REV-ADER
 WANT A PROGRAM LISTING?YES


```

1 DEFINE('READER(NAM)'),'R1') /(<BGN)
2 R1 NAM *CH/1* /F(R2)
3 SYSPOT = NAM
4 R2 SYSPIT *LN/'72'*
5 LN 'ENDDTA' /S(RETURN)
6 LN '***' ** =
7 READER = READER LN /(<R2)
  *
8 BGN SYSPOT = READER('TEST OF READER')
9 END

```

SUCCESSFUL COMPILATION

FUNCTION NOT DEFINED

****ERROR - 2 AT STATEMENT 1
SYSTEM ERROR - STACK EXHAUSTED PREMATURELY

DONE

GET-SNOBOL
RUN
SNOBOL

INPUT FILE-NAME?PE10
WANT A PROGRAM LISTING?YES

```

1 M = '4'
2 I = '0'
3 LO Q = M - '1'
4 LI I = .LT(I,Q) I + '1' /F(END)
5 J = '0'
6 INC = '0'
7 L2 INC = INC + '1'
8 J = .LT(J,M) I + INC /F(LO)
9 SYSPOT = 'COMPARISON OF STR' I ' AND STR' J /(<L2)
10 END

```

SUCCESSFUL COMPILATION

FUNCTION NOT DEFINED

****ERROR - 2 AT STATEMENT 4
SYSTEM ERROR - STACK EXHAUSTED PREMATURELY

DONE

GET-SNOBOL
RUN
SNOBOL

INPUT FILE-NAME?TEXT
WANT A PROGRAM LISTING?YES

```

  * TEXT COUNTS THE NUMBER OF L'S IN LOLLYPOP
1 LINEA1 TEXT = 'LOLLYPOP'
2 SUM = '0'
3 SEARCH TEXT 'L' = QUOTE /F(REPLACE)
4 SUM = SUM + '1' /(<SEARCH)
5 REPLACE TEXT QUOTE = 'L' /S(REPLACE)
6 SYSPOT = 'L OCCURED ' SUM ' TIMES'
7 END

```

SUCCESSFUL COMPILATION

L OCCURED 3 TIMES

EXECUTION COMPLETE

WANT A DUMP?YES
 QUOTE = '''
 SYSPOT = 'L OCCURED 3 TIMES'
 SUM = '3'
 TEXT = 'LOLLYPOP'

DONE

GET-SNOBOL
 RUN
 SNOBOL

INPUT FILE-NAME?TOM*
 WANT A PROGRAM LISTING?YES

```

***BEGIN
1  COUNT = '0'
2  NEXT SYSPIT *A/'2'* *B/'3'* *C*
3  COUNT = '5' /S(END)
4  COUNT = COUNT + '1'
5  PRINT SYSPOT = A' 'B' 'C' /(NEXT)
6  END

```

SUCCESSFUL COMPILATION

NA POL EAN
 AL EXA NDER
 RO BER T E. LEE
 AT TIL A THE HUN
 PE TER THE GREAT

EXECUTION COMPLETE

WANT A DUMP?YES
 A = 'PE'
 B = 'TER'
 COUNT = '5'
 C = ' THE GREAT'
 QUOTE = '''
 SYSPIT = 'PETER THE GREAT'
 SYSPOT = 'PE TER THE GREAT'

DONE

PROGRAMMING AND COMPUTER SCIENCE (EDUCATION) (810)

CONTRIBUTED PROGRAM **BASIC**

TITLE:

MATH CALCULATOR PACKAGE

STOP
36208

DESCRIPTION:

STOP is a hypothetical STored Program digital computer having a very simple machine language. The STOP program in the TIES Time-Share library simulates STOP, allowing users to write programs in a simple machine language.

The op codes are:

- Ø1 LOAD - Clears the contents of the accumulator and brings to it the number stored in the location specified by the storage address.
- Ø2 ADD - Adds to the accumulator the number stored in the specified location.
- Ø3 SUBTRACT - Subtracts from the accumulator the number stored in the specified location.
- Ø4 MULTIPLY - Multiplies the number in the accumulator by the number in the specified location.
- Ø5 DIVIDE - Divides the number in the accumulator by the number in the specified location, keeping only the quotient in the accumulator.
- Ø6 STORE - Stores the accumulator contents in the specified location.
- Ø7 PRINT (cr) - Prints the number contained in the specified location and returns the carriage. It will not print a number directly from the accumulator.
- Ø8 BRANCH ON NEGATIVE - If the accumulator is negative, sends control to the specified location and continues execution with the instruction found there.
- Ø9 HALT - Stops execution of a program. The address portion of a halt instruction is ignored by the system. Use any 3 digits.
- 1Ø JUMP - Sends control unconditionally to the specified address and continues execution with the instruction found there.
- 11 PRINT - Prints the number contained in the specified location; does not return the carriage. It will not print a number directly from the accumulator.
- 12 DIVIDE - Divides the number in the accumulator by the number in the specified location, keeping only the remainder in the accumulator.
- 15 BRANCH ON ZERO - If the accumulator is zero, sends control to the specified location and continues execution with the instruction found there.
- 17 PRINT FROM ACCUMULATOR - Prints the number contained in the accumulator. Operand should be ØØØ since no address is referred to.

INSTRUCTIONS:

See Attached

SPECIAL
CONSIDERATIONS:

Statement 20 dimensions Array A at 500 to accomodate the HP 2000E. The array may be re-dimensioned to 1000 to allow HP 2000 Series users to write longer STOP programs.

ACKNOWLEDGEMENTS:

TIES
St. Paul, Minnesota

INSTRUCTIONS:

To enter a program in the STOP language:

- After the system prints "BEGIN TYPING IN YOUR PROGRAM AND DATA STATEMENTS.", enter each statement as in the following example:
 001,01200 (carriage return)
 The first three digits are the address where the instruction or datum (01200) will be stored.
- After your program and data are entered, type an E indicating the end of your entries.
- The system will print "TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP." Typing a 1 at this point allows you to re-enter any statements you wish to correct or to add new statements. You need to terminate your editing by typing an E. (See below for options 2 and 3)
- When you type a 0 to run, you will be asked to enter the starting address of the program. Touching the RETURN button after entering the address will cause the program to be executed.

Other Options

LIST: This will give a list of addresses and their contents. You must be prepared to type on request the beginning and ending addresses of the list you wish printed.

STEP: This will allow you to execute your program one step at a time. You will first enter the starting address as in the RUN option. As each step is executed, the teletype will print the address of the instruction executed and the contents of the accumulator after execution. Typing a 3 and carriage return will cause the system to execute the next instruction in the same manner. Typing a 0 and carriage return will cause the rest of the program to be executed from that point on. Typing a 1 will send control back to the original four-option statement.

SPECIAL CONSIDERATIONS:

An introduction to STOP and its language is found in Computers - Theory and Uses, written by Vincent S. Darnowski and published by the National Science Teachers Association, NEA, 1201 Sixteenth Street N.W., Washington, D.C. 20036. The cost is \$24.00 for 30 copies. The book was written as a text for introducing junior high school students to computers and their implications. Students studying this text can enhance their understanding of computers by writing and running machine language programs from any TIES Time-Sharing terminal.

Storage addresses must be integers greater than 0 and less than 1000. Instructions and data words must be integers between -99999 and 99999 inclusive.

Program or data statements can be corrected by retyping the statement. This can be done at any time during the entering of your program, or at other times when a system message gives you the option. New statements can be added at those same times.

STOP will execute instructions in sequence by address, starting with whatever address you specify and ending when a HALT command is reached. Hence, you must not leave any addresses undefined in the range of your program.

Since a datum and an instruction are each represented by a 5 digit integer, they appear the same to the computer. Therefore, programs and data must be stored in separate areas predetermined by you when you assign storage locations.

RUN

RUN
STOP

TYPE AN 'E' TO INDICATE YOU HAVE FINISHED INPUTTING.

BEGIN TYPING IN YOUR S T O P PROGRAM.

?001,11100
?002,11100
?003,07100
?004,11100
?005,09000
?100,02345

?E

TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP.

?2

INPUT THE STARTING AND ENDING ADDRESSES FOR THE LISTING.

?001,005

001,11100
002,11100
003,07100
004,11100
005,09000

TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP.

?0

INPUT THE STARTING ADDRESS.

?001

2345 2345 02345
2345 HALT

TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP.

?

DONE

RUN

STOP

TYPE AN 'E' TO INDICATE YOU HAVE FINISHED INPUTTING.

BEGIN TYPING IN YOUR S T O P PROGRAM.

?001,01401
?002,02402
?003,17000
?004,09000
?401,00003
?402,08632

?

??E

TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP.

?0

INPUT THE STARTING ADDRESS.

?001

08635
HALT

TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP.

?

??

DONE

PROGRAMMING AND COMPUTER SCIENCE (EDUCATION) (810)

CONTRIBUTED PROGRAM **BASIC**

STPAL
36765

TITLE:

STOP MACHINE AND ASSEMBLY LANGUAGE SIMULATOR

DESCRIPTION:

STPAL consists of 4 programs named STPAL, STPAL1, STPAL2, and STPAL3.

STOP is a hypothetical, electronic, stored-program, sequential, digital computer designed specifically to aid in teaching computer concepts. (It is not difficult to simulate STOP on many existing computer.) The STPAL system consists of a machine language translator and an assembly language translator. The two languages are SML (extended STOP simulated Machine Language) and SAL (STOP simulated Assembly Language).

The STOP system has had two predecessors, the most influential being a similar system developed at Illinois Institute of Technology with Computers - Theory and Uses by Vincent S. Darnowski as an initial impetus in this project. The second more recent influence is An Instructional Manual for CARDIAC by Hagelberger and Fingerman distributed and published by the Bell System for use in the classroom. CARDIAC consists of a cardboard "computer" with a small set of operations. The STOP system and CARDIAC are easily made compatible with HP Time-Sharing BASIC.

INSTRUCTIONS:

The STOP system begins by requesting "PROGRAM FILE NAME ?". The operator responds with the name of the file to be used to store the program or the file containing the program, if a previously written program is to be re-RUN. If the file is not available, STPAL will tell the operator how to open it and halt. It is necessary to type RUN after opening the file and re-enter the file name. The system will then print "TYPE YES IF THIS IS AN ASSEMBLY PROGRAM?". The operator responds with YES or NO. If NO is the response, STPAL types "ENTER MACHINE LANGUAGE STATEMENTS". The operator begins to enter statements according to the SML rules. After the operator enters a statement with a 000 address, execution of the machine language program begins.

After a HALT is encountered, the STPAL system asks "DO YOU WISH TO CORRECT THE MACHINE LANGUAGE PROGRAM?". The operator answers YES or NO. If no corrections are to be made, STPAL returns to the PROGRAM FILE NAME? request. The operator enters a new file name to run another program or //STOP to terminate.

continued on following page

ACKNOWLEDGEMENTS:

Norman Thompson
TIES

INSTRUCTIONS continued

The machine language version can be corrected by typing in the address and the instruction to go at that address. To end corrections, the operator types a 000 address, and the program begins executing as before.

If an assembly language program is indicated, STPAL types:

```
BEGINNING ASSEMBLY
TYPE 0 FOR NEW PROGRAM, 1 FOR REASSEMBLE OLD PROGRAM?
```

If an old program, the program statements will be read from the file requested earlier, then compiled and executed. If a new program, STPAL will request assembly statements, write them to the file, then, after an END statement is encountered, compile and execute the program. After execution of either an old or new assembly program, the system will type:

```
DO YOU WISH TO CORRECT THE MACHINE LANGUAGE PROGRAM?
```

and the operator should proceed as above.

I. SML - A Machine Language

1. Instruction WORD FORMAT

Each SML instruction is 5 decimal digits long. The first two (high order) digits form the operation code while the low order three digits form the operand. The operation code (op-code) specifies the operation to be performed. (See Section III.) The operand varies in function from operation to operation. The various uses are: a. Location of data; b. Location of next instruction to be executed; c. The data itself; d. Additional information necessary in the instruction execution.

2. Statement Format

SML recognizes two basic types of statements, program statements and comment statements. The comment statement must have an asterisk in column 1. Then the rest of the line will be taken as a comment for documentation purposes. Program statements have the following format:

Cols. 1-3	Address of the computer word to be stored.
Col. 4	Blank
Col. 5	Either blank or a +, -, #, or *.
Col. 6-10	Computer Word
Col. 11-72	Any comment

Blank is the only non-numeric character allowed in Cols. 1-3 and 6-10 inclusive and will be assumed to be zero. A + or - in Col. 5 assumes the computer word is a data word with the associated sign. An * in Col. 5 indicates indirect addressing. A # in Col. 5 indicates that operand (Col. 8-10) is the data itself. This is generally referred to as a literal operand.

3. Instruction Execution

SML instructions are executed in numerical order by location. A branch instruction (or transfer instruction) may alter the normal order of execution. The last statement written must have location 000 and contain in the operand portion (Cols. 8-10) the location of the first instruction to be executed.

II. SAL - An Assembly Language

SAL recognizes three basic types of statements: program statements, pseudo-operations, and comment statements.

1. Program Statement

Program statements are translated into equivalent SML statements and stored. They have the following format:

Col. 1	Any control character but generally A ^C . (Super script "C" indicates a control character which is done by pressing CTRL and the character simultaneously.)
Col. 2-3	Label field
Cols. 5-7	Operation field
Col. 8	An * or part of operand field
Cols. 9-10	Operand
Cols. 11-72	Any comment

If Col. 1 has an * (asterisk) the entire line is taken as a comment statement. The label field may contain a unique symbolic label of either 1 or 2 alpha-numeric characters. The first character must be alphabetic (A-Z) but the second character may be alphabetic, numeric or blank. The label may not be SQ or TR since these are reserved words used in the linkage to the square root and trig subroutines respectively. The operation field must contain a valid SAL mnemonic operation code. (See Section III.) The operand may contain a symbolic label as defined above. Also the operand may contain a literal 1, 2 or 3 digit right justified number. If this is so, the value used by the instruction is not the content of the location specified but the number itself. (For example, ADD100 would add the number 100 to the content of the accumulator, not the content of location 100.)

INSTRUCTIONS continued

Indirect addressing is indicated by an asterisk in Column 8. When indirect addressing is specified, the operand portion (Col. 9-10 of the assembled SML instruction) is replaced by the operand portion of the location indicated. If indirect addressing is specified by the new effective instruction, another indirect addressing cycle is taken. Indirect addressing may only be specified 10 levels deep.

It should be noted that the four fields of a SAL statement correspond to the four fields of SML statement even to essentially the same columns.

2. Pseudo-operations

Pseudo-operations, unlike normal operations in program statements, are not assembled into SML instructions, but are used to communicate with the assembler. In general, they have the same format as program statements.

a. ORG

The pseudo-operation ORG (origin) sets the location counter at the value of the operand. The operand must be right justified 1-3 digit non negative number in Columns 8-10.

b. END

The pseudo-operation END signals the end of the assembly program execution. An unconditional branch to the location specified by the operand is generated in location 000. The specified location will be the first statement to be executed by the assembled SML program.

c. DS

The pseudo-operation DS (define storage) is used to reserve the number of storage locations specified by the operand. The format of the operand is the same as that for the ORG pseudo-operation.

d. Define constant + and -.

Either the pseudo-operation + or the pseudo-operation - may be used to reserve one location of storage using the signed word content as the defined constant. The sign must appear in Column 5 and the word must be a 5 digit number right justified in Columns 6-10. The define constant may be used for constants in integer range -99,999 to 99,999.

III. The valid SML operation codes and their SAL equivalents are listed below.

OP-CODE	MNEMONIC	FUNCTIONS
00	REA	Allows one number to be read into the location specified by the operand.
01	LOA	Load the accumulator with the word specified by the operand.
02	ADD	Add to the accumulator the word specified by the operand.
03	SUB	Subtract from the accumulator the word specified by the operand.
04	MUL	Multiply the content of the accumulator by the word specified by the operand.
05	DVQ	Divide the content of the accumulator by the word specified by the operand and store the <u>quotient</u> in the accumulator.
06	STO	Store the content of accumulator in the location specified by the operand. (The content of the accumulator is not altered.)
07	PRT	Print the content of the location specified by the operand. ¹
08	BON	Branch to the location specified by the operand if the content of the accumulator is negative.
09	HLT	Halt execution. Control returns to a system command. ² (Operand is ignored.)
10	UCB	Branch to the location specified by the operand.
11	PSC	Print the word specified by the operand and suppress the carriage return. ¹
12	DVR	Divide the content of the accumulator by the word specified by the operand and store the <u>remainder</u> in the accumulator.
13	NOP	No operation executed. (Operand is ignored)
14	ZAC	Zero the accumulator. (Operand is ignored)
15	BOZ	Branch to the location specified by the operand if the content of the accumulator is zero.
16	BOP	Branch to the location specified by the operand if the content of the accumulator is positive.
17	PAD	Print the content of the accumulator inserting a decimal point the number of places from right specified by the operand. ^{1,3}
18	BSA	Store the address of the (current) instruction plus one in the location specified by the operand and branch to the address specified by the operand plus one. ⁴ (Appendix III)
19	RTC	Return the carriage. (Skips a line)
20	SCR	Suppress the carriage. ¹ (Operand ignored)
21	SNR	Shift the content of the accumulator right the number of decimal places specified by the operand.
22	SNL	Shift the content of the accumulator left the number of decimal places specified by the operand.
23	RAL	Allows up to 10 numbers to be read into the 10 consecutive locations beginning with the location specified by the operand. ⁴

INSTRUCTION continued

OP-CODE	MNEMONIC	FUNCTIONS
24	PCL	Print the number of locations specified by the accumulator beginning with the location specified by the operand. ⁵

Notes:

1. The print operations simulate a typewriter with an automatic carriage return (unless the carriage return is suppressed). PRT and PAD must be followed by SCR if so desired while PSC will suppress the automatic carriage return.
2. The system will always respond "TYPE YES IF THIS IS AN ASSEMBLY PROGRAM". If the answer is NO the system will expect a SML program, if YES a SAL program.
3. The PAD (17) operation is used to print a number with a decimal point. For example, to print the value of $PI(\pi)$ the content of the accumulator must be 31416 and then the operation PADO4 would be written and 3.1416 would be printed.
4. The RAL (23) operation allows up to 70 characters to be read from an input line. The format must be Col. 1 sign, Col. 2-6 numeric, and Col. 7 comma and so on across the line until the number of items desired is included.
5. The PCL (24) operation allows memory to be dumped from 001 by loading the accumulator with the number locations desired and executing PCL00.

IV. Subroutines

1. A subroutine is a sub-ordinate part of a computer program written to do some routine or operation. The linkage to a subroutine requires that the location of the subroutine be known; the location of the return address be known; and the location of the fields operated upon be known. In SAL the BSA (18) instruction is used to link to subroutines whether the subroutine is a library (See 2 and 3 below) or programmer created subroutine.
2. Linkage to the library subroutine for the square root is:

```
Col. 2345678910
      BSA SQ
      NU DS 001
      RT DS 001
```

NU must be loaded with the number whose square root is to be found. The square root subroutine will place in RT the root of the absolute value of NU (truncated to two decimal places but multiplied by a factor of 100).

3. Linkage to trigonometric subroutine is as follows:

```
Col. 2345678910
      BSA TR
      AA DS 001
      BB DS 001
```

BB must contain a parameter that indicates the values to be found while AA is the value to be operated upon.

Parameter	Unit of Input	Function	Stored
1	Degrees	SIN	BB
2	Degrees	COS	BB
3	Radians	SIN	BB
4	Radians	COS	BB
5	Degrees	SIN	AA
		COS	BB
6	Radians	SIN	AA
7	Degrees	ARCTAN	BB
8	Radians	ARCTAN	BB

If BB is less than or equal to 6, AA is an angle in degrees or radians. If AA is in degrees, it must be in the range +180.00 and two decimal places are assumed. If AA is in radians, it must be in the range +3.1416 and 4 decimal places are assumed. For these values of BB all results are truncated to 4 decimal places and multiplied by 10,000. Note that BB is always replaced by an answer and for options 5 and 6 both AA and BB are replaced by answers. If BB is 7 or 8, AA must be a number in the range +99.999 and 3 decimal places are assumed. If the output is in degrees, the results are truncated to two decimal places and multiplied by 100. If the output is in radians, the results are truncated to 4 decimal places and multiplied by 10,000.

RUN

RUN
STPAL

PROGRAM FILE NAME?ROBIN
TYPE CRE-ROBIN,2 (RETURN), THEN TYPE RUN

DONE
RUN
STPAL

PROGRAM FILE NAME?PROGFL

TYPE YES IF THIS IS AN ASSEMBLY PROGRAM

?NO\

NO

ENTER MACHINE LANGUAGE STATEMENTS

?001 \

001 #01001

?002 06020

?003 07020

?004 01020

?005 02020

?006 06020

?007 #03513

?008 08003

?009 09000

?000 10001

BEGINNING EXECUTION

1

2

4

8

16

32

64

128

256

512

HALT ENCOUNTERED. EXECUTION COMPLETE.

NUMBER OF STATEMENTS EXECUTED 63

DO YOU WISH TO CORRECT THE MACHINE LANGUAGE PROGRAM?NO

PROGRAM FILE NAME?FILE1

TYPE YES IF THIS IS AN ASSEMBLY PROGRAM

?YES

BEGINNING ASSEMBLY

TYPE 0 FOR NEW PROGRAM, 1 FOR RE-ASSEMBLE OLD PROGRAM.?1

LOC OPADD LAB OP OPER

001 R DS 001

002 H DS 001

003 DS 008

011 +00314 PI +00314

012 23001 GO RAL R

013 01001 LOA R

014 15022 BOZ EX

015 04001 MUL R

016 04002 MUL H

017 04011 MUL PI

018 11001 PSC R

019 11002 PSC H

020 17002 PAD 02

INSTRUCTIONS continued

COMMANDS:

ERASE - ER

PROMPTS
None

DESCRIPTION

This command causes the quintuples to be erased. Upon completion of the operation, the computer responds with "QUINTUPLES ERASED".

ERRORS

None

NEWTAPE - NT

PROMPTS
None

DESCRIPTION

This command causes the tape to be erased. Upon completion of the operations, the computer responds with "TAPE ERASED".

ERRORS

None

TAPE - TA

PROMPTS

"1ST CHARACTER POSITION" -- User is to input a number to indicate where the new information is to begin.

"TMT?" -- (stands for Turing Machine Tape)
User is to input information to be stored on the tape.

DESCRIPTION

This command allows one to enter meaningful information on the tape. When typing-in information, the user may use as many lines as are necessary. The input is terminated by the character "/". If the user types J characters, then J positions of the tape will be overlaid beginning with the position indicated as "1ST CHARACTER POSITION".

ERRORS

Due to the nature of the implementation, the tape has a finite length. If the user specifies a "1ST CHARACTER POSITION" outside the boundary of the tape, the computer will reprompt. If at any time the user inputs more characters than the tape can contain, the computer types "OUT OF STORAGE -- GOOF". Any time an invalid character is encountered "GOOF" is printed. (Valid characters are 0-9, A-Z.) In the case of any error the characters up to the goof are stored on the tape and control is returned to the main program.

QUINTUPLES - QU

PROMPTS

"TMQ?" -- (stands for Turing Machine Quintuple)
The user is to input a valid quintuple or the character "/".

DESCRIPTION

This command allows one to enter quintuples (program steps) into the system and to modify existing quintuples. Quintuples may be entered free-field but must contain exactly 3 or 7 non-blank characters. Character meanings are as follows with allowed values:

1,2	PRESENT STATE	(00-99)
3	PRESENT SYMBOL	(0-9,A-Z,\$)
4,5	NEW STATE	(00-99)
6	NEW SYMBOL	(0-9,A-Z,\$)
7	TAPE DIRECTION	(L,C,R)

There must be only one quintuple present for each unique pattern of the first three characters. (These three characters are used much like the statement numbers in BASIC.) Typing-in any quintuple will delete any previous quintuple with the same first three characters and enter the new one. Typing only the first three characters will delete the corresponding quintuple if it exists.

In this system, the "halt" command is anything which has the new state equal to the old state and has a tape direction of "center".

Instead of the normal alphanumeric symbols, the "\$" may be used as a "present symbol" or a "new symbol". Its meaning is indicated by the following table:

present symbol -- "whatever is on the tape"
new symbol -- "whatever the present symbol was"

INSTRUCTIONS continued

When executing the program, the system tries to satisfy all the specific cases first. The \$ notation is tried only as a last resort.

ERRORS

Goofs are caused by the following conditions: quintuples not 3 or 7 characters long, any parameter out of range, program space full. The last error also causes the computer to type "OUT OF STORAGE".

LIST TAPE - LT

PROMPTS

"1ST CHARACTER POSITION" -- User must respond with a number indicating where listing is to begin.

"LAST CHARACTER POSITION" -- User must respond with a number indicating where listing is to end.

DESCRIPTION

This command allows the user to look at the contents of the tape. Indicated portion of the tape is printed.

ERRORS

Any number specified which is outside the range of the tape will be ignored and the computer will reprompt.

LIST - LQ

PROMPTS

None

DESCRIPTION

This command allows the user to look at the quintuples (program steps). The quintuples are sorted, then printed.

ERRORS

None

PUNCH - PU

PROMPTS

None

DESCRIPTION

This command is the same as the LIST command except that a leader and trailer are punched. A "/" is also punched as the last quintuple to facilitate future read-in.

It is the responsibility of the user to turn the punch on and off at the appropriate times.

ERRORS

None

RUN - RU

PROMPTS

"INITIAL STATE" -- User must type the state number with which he wishes to start.

"INITIAL TAPE POSITION" -- User must type the tape position where processing is to begin.

DESCRIPTION

This command causes the computer to execute the quintuples with a given tape. The quintuples are executed and a trace is supplied by the computer. Each quintuple is printed with a copy of the tape as it appears after the quintuple has acted. The current tape position is also indicated. The whole tape is not printed; just the indicated character and 10 characters of context on either side.

ERRORS

Control is returned to the main program if a null program or tape is specified. The computer reprompts when invalid numbers are given for "INITIAL STATE" or "INITIAL TAPE POSITION". (Valid range for tape position is from 10 to 10 from the end of the tape.) A goof is generated when a real state-tape configuration finds no counterpart in the list of quintuples or when a tape runs out.

NORUN - NR

PROMPTS

"INITIAL STATE" -- User must type the state number with which he wishes to start.

"INITIAL TAPE POSITION" -- User must type the tape position where processing is to begin.

DESCRIPTION

This command causes the computer to execute the quintuples with a given tape. The quintuples are executed but no trace is given.

INSTRUCTIONS continued

ERRORS

Control is returned to the main program if a null program or tape is specified. The computer reprompts when invalid numbers are given for "INITIAL STATE" or "INITIAL TAPE POSITION". (Valid range for tape position is from 10 to 10 from the end of the tape.) A goof is generated when a real state-tape configuration finds no counterpart in the list of quintuples or when a tape runs out.

MODIFICATIONS:

The maximum number of quintuples and the maximum length of the tape may also be changed. Two procedures for doing the indicated modifications follow:

1. CHANGE NUMBER OF QUINTUPLES

Change the common statement in each program. Array Q is where the quintuples are stored. There must be 3 entries for each quintuple. (Thus the standard option allows for 100 quintuples.)

In the mainline, change the variable Q to be the new maximum number allowed.

File TQUIN will have to be changed. It takes approximately 1 record for each 20 quintuples allowed.

2. CHANGE LENGTH OF TAPE

Change variable T in the mainline to be one less than the new maximum tape length.

Files TTAPE and TWORM will have to be changed. It takes 1 record for each 64 characters allowed.

RUN

RUN
TM

TMC?ERASE
QUINTUPLES ERASED

TMC?NEWTAPE
TAPE ERASED

TMC?QUINTUPLES
TMQ?01A02AL
TMQ?01\$01\$R
TMQ?020031L
TMQ?021020L
TMQ?02A041L
TMQ?03A04AL
TMQ?03\$03\$L
TMQ?04\$04\$C
TMQ?/

TMC?LIST
01 A 02 A L
01 \$ 01 \$ R
02 0 03 ! L
02 1 02 0 L
02 A 04 1 L
03 A 04 A L
03 \$ 03 \$ L
04 \$ 04 \$ C

TMC?TAPE
1ST CHARACTER POSITION?18
TMT?AA1011AA/

TMC?LISTTAPE
1ST CHARACTER POSITION?10
LAST CHARACTER POSITION?50
.....AA1011AA.....

TMC?RUN
INITIAL STATE?1
INITIAL TAPE POSITION?20

QUINTUPLES--- TAPE-----

```

*** START ***
01 $ 01 $ R .....AA 1 011AA..... 20
01 $ 01 $ R .....AA1 0 11AA..... 21
01 $ 01 $ R .....AA10 1 1AA..... 22
01 $ 01 $ R .....AA101 1 AA..... 23
01 $ 01 $ R ....AA1011 A A..... 24
01 A 02 A L .....AA101 1 AA..... 23
02 1 02 0 L .....AA10 1 0AA..... 22
02 1 02 0 L .....AA1 0 00AA..... 21
02 0 03 1 L .....AA 1 100AA..... 20
03 $ 03 $ L .....A A 1100AA..... 19
03 A 04 A L .....A A 1100AA..... 18
04 $ 04 $ C .....A A 1100AA..... 18

```

TMC?
DONE

GET-TM
RUN
TM

TMC?ER
QUINTUPLES ERASED

TMC?NT
TAPE ERASED

TMC?00Y00XR } MISTAKE - SHOULD HAVE TYPED 'QU'
GOOF

```

TMC?QU
TMQ?00Y00XR
TMQ?00101XR
TMQ?00$00$R
TMQ?01B02BL
TMQ?01X011R
TMQ?01Y011R
TMQ?01$01$R
TMQ?02A03AR
TMQ?02$02$L
TMQ?03X04YR
TMQ?03$03$R
TMQ?041051R
TMQ?04B08BL
TMQ?04$04$R
TMQ?05106XL
TMQ?05X07XR
TMQ?05B09BL
TMQ?05$05$R
TMQ?06Y03YR
TMQ?06$05$L
TMQ?07106XL
TMQ?07B08BL
TMQ?07$07$R
TMQ?08A08AR
TMQ?08$08$L
TMQ?09Y10YL
TMQ?09$09$L
TMQ?10A11PC
TMQ?10Y11NC
TMQ?10$10$L
TMQ?11$11$C
TMQ?/

```

INPUT QUINTUPLES

TMC?LQ

```

00 I 01 X R
00 Y 00 X R
00 S 00 S R
01 B 02 B L
01 X 01 I R
01 Y 01 I R
01 S 01 S R
02 A 03 A R
02 S 02 S L
03 X 04 Y R
03 S 03 S R
04 I 05 I R
04 B 08 B L
04 S 04 S R
05 I 06 X L
05 B 09 B L
05 X 07 X R
05 S 05 S R
06 Y 03 Y R
06 S 06 S L
07 I 06 X L
07 B 08 B L
07 S 07 S R
08 A 08 A R
08 S 08 S L
09 Y 10 Y L
09 S 09 S L
10 A 11 P C
10 Y 11 N C
10 S 10 S L
11 S 11 S C

```

NOTE HOW LISTING IS SORTED

TMC?TA

1ST CHARACTER POSITION?20
TMT?A11111B/

TMC?FR

INITIAL STATE?0
INITIAL TAPE POSITION?20

STOP

~~~~~ > 5 MINUTES  
(OBVIOUSLY ONE OR MORE QUINTUPLES  
ARE WRONG)

RUN

TM\*RUN

START AGAIN

TMC?LT

1ST CHARACTER POSITION?15  
LAST CHARACTER POSITION?30  
.....A11111B.....

TMC?QU

TMQ?08A00AR  
TMQ?/

CHANGE WRONG QUINTUPLE

TMC?LQ

```

00 I 01 X R
00 Y 00 X R
00 S 00 S R
01 B 02 B L
01 X 01 I R
01 Y 01 I R
01 S 01 S R
02 A 03 A R
02 S 02 S L
03 X 04 Y R
03 S 03 S R
04 I 05 I R
04 B 08 B L
04 S 04 S R
05 I 06 X L
05 B 09 B L
05 X 07 X R
05 S 05 S R

```

06 Y 03 Y R  
 06 S 06 S L  
 07 I 06 X L  
 07 B 08 B L  
 07 S 07 S R  
 08 A 00 A R  
 08 S 08 S L  
 09 Y 10 Y L  
 09 S 09 S L  
 10 A 11 P C  
 10 Y 11 N C  
 10 S 10 S L  
 11 S 11 S C

← NOTE NEW ENTRY

TMC?FR  
 INITIAL STATE?0  
 INITIAL TAPE POSITION?20 *≈ 30 SECONDS*

.....PYXXXIB.....  
*5 IS PRIME*

TMC?NT  
 TAPE ERASED

TMC?TA  
 1ST CHARACTER POSITION?30  
 TMT?A1111B  
 TMT?/

TMC?FR  
 INITIAL STATE?0  
 INITIAL TAPE POSITION?30 *≈ 5 SECONDS*

.....AN1YIB.....  
*4 IS NON-PRIME*

TMC?  
 DONE



**TITLE:**

TUTOR SERIES BASIC LANGUAGE PROGRAM COURSE

**DESCRIPTION:**

This series of 25 individual programs (named TUT01, TUT02 . . . TUT25) provides conversational instructions to a student new to computer programming in the Time-Shared BASIC Language.

**INSTRUCTIONS:**

"GET" the first program, TUT01. Further instructions are included within that program.

Because of the extensive length of the 25 programs, only representative "RUNS" are printed and no listings.

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES

Student Background Required: No programming experience is required. However, some knowledge of algebra is needed.

REFERENCES: The student should have available the HP reference manuals to Time-Shared BASIC.

**ACKNOWLEDGEMENTS:**

RUN

RUN  
TUT01

WELCOME TO THE HEWLETT-PACKARD T/S SYSTEM. WE WILL TRY TO TEACH YOU ENOUGH ABOUT THE SYSTEM IN THIS SITTING FOR YOU TO BE ABLE TO WRITE YOUR OWN COMPUTER PROGRAMS

BEFORE WE CAN WRITE A PROGRAM WE NEED TO REVIEW THE SYMBOLS AVAILABLE

- (1) +
- (2) -
- (3) /
- (4) \*
- (5) ( )
- (6) ,

AFTER THE ? BELOW TYPE THE NUMBER OF YOUR ANSWER

WHICH OF THE SYMBOLS IS USED FOR ADDITION?1

GOOD

WHICH SYMBOL IS USED FOR SUBTRACTION?2

RIGHT

WHICH SYMBOL IS USED FOR DIVISION?3

GOOD FOR YOU. NOW, THE NEXT ONE IS TRICKY.

WHICH SYMBOL IS USED FOR MULTIPLICATION?4

VERY GOOD, IF 'X' WERE USED FOR MULTIPLY, IT COULD BE CONFUSED WITH THE VARIABLE 'X'. LETS PRACTICE A LITTLE:

HOW MUCH IS 2\*3?6

SURE

HOW MUCH IS 3\*4+7?14

SORRY, LOOK AGAIN

HOW MUCH IS 3\*4+7?19

RIGHT YOU ARE

HOW MUCH IS 3\*(1+5)/2?9

GOOD

THAT LEAVES , WHICH IS OUR WAY TO INDICATE SQUARES,CUBES ETC., SUCH AS X^2 FOR 'X SQUARED' OR X\*X, Y^3 FOR 'Y CUBED' OR Y\*Y\*Y ETC.

YOU CAN EVEN DEFINE YOUR OWN,BUT THESE WILL BE COVERED IN ANOTHER LESSON. WE'LL USE SQR(SQUARE ROOT) IN OUR COMING EXAMPLE TO GIVE YOU THE IDEA. LET'S ASSUME YOU WANT TO COMPOSE A PROGRAM TO COMPUTE RADIUS VECTORS (THE SQUARE ROOT OF THE SUM OF THE SQUARES OF THE THREE COMPONENTS). THIS PROBLEM WILL BE A SEQUENCE OF STATEMENTS TO TELL THE COMPUTER WHAT TO DO.

DO YOU THINK THE STATEMENTS SHOULD BE NUMBERED:

- (1) CONSECUTIVELY (1,2,3 ETC.)
- (2) INCREMENTALLY (10,20,30 ETC.)
- (3) ANY SEQUENCE FOR IT DOESN'T MATTER

(TYPE NO. OF ANSWER)

?2

RIGHT

LEAVING SPACE BETWEEN NUMBERS PERMITS INSERTIONS LATER. FOR OUR SAMPLE PROGRAM, LETS FIRST CALL FOR OUR KNOWN VARIABLES. WE SIMPLY TYPE:

```
10 INPUT X,Y,Z
```

```
10 IS SIMPLY THE FIRST STATEMENT NUMBER. X, Y, AND Z ARE OUR 'DATA'. NEXT, WE WRITE OUR EQUATION BY TYPING:  
20 LET R=SQR(X^2+Y^2+Z^2)
```

```
HERE 20 IS THE NEXT STATEMENT NUMBER, 'LET' TELLS THE COMPUTER THAT AN EQUATION IS COMING, AND 'R' IS OUR UNKNOWN VARIABLE. NOTE:UNKNOWN MUST BE ON THE LEFT OF THE '=' AND KNOWN ARE ON THE RIGHT. SQR IS THE SQUARE ROOT FUNCTION MENTIONED EARLIER. THE REST IS TELETYPE ALGEBRA. FROM THIS POINT ON 'R' CAN BE TREATED AS A KNOWN IN OTHER EQUATIONS. IN THIS EXAMPLE WE'LL TELL THE COMPUTER TO PRINT THE VALUE OF 'R' BY TYPING THE STATEMENT
```

```
30 PRINT R
```

WHICH WILL CAUSE THE COMPUTER TO DO JUST THAT. NOW WE ADD AN 'END' STATEMENT AND THIS IS OUR COMPLETE PROGRAM

```

10 INPUT X,Y,Z
20 LET R=SQR(X2+Y2+Z2)
30 PRINT R
40 END

```

WHEN 'RUN' IS TYPED, THE PROGRAM WILL CALL FOR THE VALUES OF X,Y,Z WITH A QUESTION MARK.

(TRY IT. TYPE ANY THREE NUMBERS SEPARATED BY COMMAS.)

?2,5,6

8.06226 (THIS IS YOUR RADIUS VECTOR)  
 WELL, THE HARD PART IS OVER AND NOW THE FUN BEGINS. BY THE WAY, YOU HAVE ANSWERED 8 CORRECTLY OUT OF 9 QUESTIONS. IN ORDER TO CONTINUE WHAT WE HAVE BEGUN, IT WILL BE NECESSARY TO REQUEST ANOTHER PROGRAM FROM ME. TO DO THIS, TYPE 'GET-\$TUT02'. WHEN I RESPOND WITH A LINE FEED TYPE 'RUN' AND I'LL MEET YOU THERE.  
 LAST ONE THERE IS A HUMAN!! GOOD LUCK.

DONE

```

RUN
TUT04

```

HELLO AGAIN. LET'S HAVE A QUICK REVIEW. USE THIS CODE:

```

1=PRINT; 2=INPUT; 3=LET; 4=GO TO; 5=END

```

WHICH OF THE ABOVE IS USED FOR ARITHMETIC OPERATIONS?3

VERY GOOD. WHICH ONE ALWAYS PRODUCES A QUESTION MARK?2

EXCELLENT! YOU SEEM TO KNOW THEM. NOW LET US LOOK AT SOME ADDITIONAL KINDS OF STATEMENTS AND SEE HOW TO USE THEM. FIRST WE'LL LOOK AT 'READ' AND 'DATA', WHICH MUST BOTH BE USED IF EITHER ONE IS USED.

WHICH ANSWER WOULD YOU PICK FOR THE FOLLOWING QUESTION?  
 (USE 1=LET, 2=INPUT, 3=GO TO, OR 4=PRINT)

'READ' IS SOMETHING LIKE WHICH ONE?2

THAT'S CORRECT. IN BOTH CASES INFORMATION IS BEING PUT INTO THE COMPUTER. THE DIFFERENCE (NOTE THIS) IS WHEN IT IS TO BE ENTERED. FOR THE 'INPUT' INSTRUCTION, THE COMPUTER RECEIVES INFORMATION WHILE THE PROGRAM IS BEING EXECUTED; THE TELETYPE STOPS AND WAITS FOR THE ENTRY. ON THE OTHER HAND, THE 'READ' STATEMENT REQUIRES THAT THE INFORMATION (DATA) BE ALREADY AVAILABLE IN THE COMPUTER'S MEMORY. NOW DO YOU SEE WHERE THE 'DATA' STATEMENT COMES IN?

WHEN THE COMPUTER IS INSTRUCTED TO 'READ', IT IMMEDIATELY LOOKS FOR THE 'DATA' STATEMENT. THE WORD 'READ' MUST BE FOLLOWED BY THE NAME OR NAMES OF WHAT THE COMPUTER IS TO READ. THE ACTUAL NUMERICAL VALUES WILL BE FOUND AFTER THE WORD 'DATA' SO, OF COURSE, YOU MUST SEE THAT THEY ARE THERE.

NOW LET'S RETURN TO OUR RADIUS VECTOR PROBLEM. INSTEAD OF USING STATEMENTS 9 AND 10, LET'S SAY:

```

11 READ X, Y, Z
12 DATA 3, 4, 12

```

STUDY THE ABOVE TWO STATEMENTS CAREFULLY. NOTICE WHERE THE COMMAS ARE (COMMAS ARE VERY IMPORTANT IN COMPUTER DIRECTIONS. YOU MUST NEVER LEAVE ONE OUT OR PUT ONE IN WHERE IT DOES NOT BELONG). WHAT DO YOU THINK THE VALUE OF 'X' IS?3

A PERFECT CHOICE. AND WHAT IS Z?12

RIGHT AGAIN. YOU NOW HAVE MASTERED THE FUNDAMENTALS OF THESE TWO TYPES OF STATEMENTS.

LET US CONSIDER ONE MORE THING ABOUT 'DATA' - YOU ARE ALLOWED TO HAVE MORE THAN ONE DATA 'SET' WITH THE DATA STATEMENT.

FOR INSTANCE, IF WE WANTED TO DETERMINE TWO RADIUS VECTORS INSTEAD OF ONE, WE COULD REPLACE STATEMENT 12 WITH:

```
12 DATA 3, 4, 12, 8, 15, 11
```

THIS STATEMENT CONTAINS TWO X'S, TWO Y'S, AND TWO Z'S. EACH OF THESE HAS BEEN INCLUDED IN STATEMENT 12 ABOVE. WHICH DO YOU THINK IS THE SECOND Y: THE '8', THE '15', OR THE '11'?15

THAT IS CORRECT. ALSO, THE SECOND X IS 8 AND THE SECOND Z IS 11. SO FAR SO GOOD.

HOWEVER, THE COMPUTER WON'T AUTOMATICALLY READ BOTH SETS UNLESS IT IS SOMEHOW DIRECTED TO USE THE READ STATEMENT TWICE. USE 1=PRINT, 2=GO TO, 3=LET, AND 4=INPUT, AND DECIDE WHICH OF THESE COULD MAKE IT READ MORE THAN ONE SET OF DATA. WHICH?2

YOU'RE DOING FINE. THIS ENDS THE 'TUT04' PART OF YOUR LESSON. NOW CALL THE PROGRAM 'TUT05' (USE THE SAME METHOD YOU USED TO CALL 'TUT04') AND CONTINUE YOUR STUDY. GOOD LUCK.

DONE

```
RUN
TUT15
```

EGAD - YOU AGAIN? WHAT PERSEVERANCE.

IN THE PAST SESSIONS WE HAVE DEALT PRIMARILY WITH STATEMENTS AND INSTRUCTIONS WHICH DETERMINE THE LOGIC OF A PROGRAM. A SYSTEM COMMAND, AS DISTINCT FROM A PROGRAM INSTRUCTION, REQUESTS A CHANGE IN YOUR CURRENT STATUS WITH THE COMPUTER. FOR EXAMPLE, THE SYSTEM COMMAND 'RUN' DIRECTS THE COMPUTER TO EXECUTE A PROGRAM. IN NO WAY CAN IT AFFECT THE LOGICAL STRUCTURE OF THE PROGRAM.

TO SEE IF THIS DISTINCTION IS REASONABLY CLEAR, TRY YOUR HAND AT THE FOLLOWING. TYPE A ZERO IF YOU THINK A SYSTEM COMMAND IS INVOLVED, AND A ONE FOR A PROGRAM INSTRUCTION.

BATTING AVERAGE

|                 |     |      |
|-----------------|-----|------|
| GOSUB ?1        | HIT | 1000 |
| DEF ?1          | HIT | 1000 |
| BYE ?0          | HIT | 1000 |
| IF...THEN... ?1 | HIT | 1000 |
| HELLO ?1        | OUT | 800  |
| SCR ?0          | HIT | 833  |
| LET ?1          | HIT | 857  |
| INPUT ?1        | HIT | 875  |
| LIST ?0         | HIT | 889  |

THE DODGERS COULD HAVE USED YOU LAST SEPTEMBER.

--NOTE-- A PROGRAM INSTRUCTION MUST BE PRECEDED BY A STATEMENT NUMBER -- A SYSTEM COMMAND IS NEVER PRECEDED BY ONE.

LET'S SEE HOW SOME OF THESE SYSTEM COMMANDS CAN BE USED. ASSUME THE FOLLOWING IS PART OF A PROGRAM BEING DEVELOPED:

```

.
.
410 GOSUB 800
420 LET T=T+T1
430 LET T=T+T1
440 LET D=V*T
.
800 LET Q=C1*V+2
810 LET R=K*D
820 END

```



UPON EXAMINATION, YOU MAY NOTE THAT STATEMENT 430 IS REDUNDANT. YOU COULD DELETE THIS BY MERELY TYPING IN THE STATEMENT NUMBER. THEN DEPRESSING THE CARRIAGE RETURN. THE COMPUTER INTERPETS THIS AS AN ERASURE OF THE PREVIOUSLY WRITTEN STATEMENT 430.

THERE IS ALSO A STATEMENT MISSING FROM THE SAMPLE PROGRAM ABOVE. WITHOUT WHICH THE PROGRAM WOULD NOT RUN. JUST FOR EXERCISE. TYPE IN THE 2 STATEMENT NUMBERS (SEPARATED BY A COMMA) WHERE THE MISSING STATEMENT SHOULD HAVE BEEN.?810,820

VERY GOOD. A 'RETURN' STATEMENT WAS OMITTED FROM THE SUBROUTINE, WHICH SHOULD BE INSERTED BETWEEN STATEMENT NUMBERS 810 AND 820. YOU COULD CORRECT THIS BY TYPING IN:

```
815 RETURN
```

DO YOU SEE THE ADVANTAGE OF NUMBERING YOUR STATEMENTS INCREMENTALLY? IT'S EASIER TO INSERT STATEMENTS AT A LATER TIME WITHOUT NEEDLESS RETYPING OF NEIGHBORING STATEMENTS.

IF YOU WERE CORRECTING A PROGRAM, YOU WOULD SOON REALIZE THAT YOU HAVE A HOPELESS RECORD OF YOUR WORK, AND WOULD LIKE A FRESH UPDATED LISTING.

THE SYSTEM COMMAND 'LIST' WILL SUPPLY THIS FOR YOU, STARTING FROM THE VERY FIRST STATEMENT OF YOUR PROGRAM. SHOULD YOU WANT A LISTING STARTING FROM A SPECIFIED STATEMENT NUMBER. FOR EXAMPLE 1280, YOU SHOULD TYPE

```
LIST-1280
```

WHEN YOU ARE READY, CALL 'TUT16'. SEE YOU SOON.

DONE





ACZ1  
36152

**TITLE:**

COMPUTER AIDED PRACTICE IN EE AC ANALYSIS

**DESCRIPTION:**

ACZ1 offers computer aided practice in the analysis of single frequency sine waves, complex power, power factor, etc.

**INSTRUCTIONS:**

Instructions are included within the program.

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Any AC analysis course such as Electrical Science

**ACKNOWLEDGEMENTS:**

Dr. Clifford M. Siegel  
University of Virginia

RUN

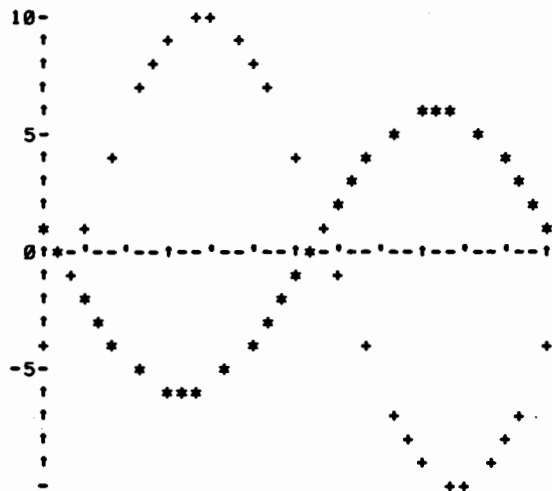
RUN

ACZ1

COMPUTER AIDED PRACTICE IN ANALYSIS OF SINGLE-FREQUENCY  
SINE WAVES, COMPLEX POWER, POWER FACTOR, ETC;  
PREPARED BY C.M. SIEGEL, NOV.24, 1970 (REV. 12/3/70).

LET CURRENT AND P.D. APPEAR AS FOLLOWS:

P.D. = + + + + + + + +  
CURRENT = \* \* \* \* \* \* \* \*



EXPECTED ANSWERS WILL BE GIVEN IN ( ).

ALL ANGLES ARE MULTIPLES OF + OR - 5 DEGREES;  
SHOULD BE EXPRESSED IN THE RANGE,  $-180 < \text{ANGLE} \leq 180$ .

1. WHAT ARE THE POLAR COMPONENTS OF THE  
P.D. REGARDED AS A SINE FUNCTION?  
MAGNITUDE ?10  
CLOSE ENOUGH, ( 10 )

PHASE (DEGREES) ?-20  
TOO FAR WRONG;  
-----TRY AGAIN.?-15  
TOO FAR WRONG;  
(-25 )

2. CURRENT REGARDED AS A SINE FUNCTION?  
MAGNITUDE ?6  
CLOSE ENOUGH, ( 6 )

PHASE (DEGREES) ?170  
CLOSE ENOUGH, ( 170 )

3. P.D. REGARDED AS A COSINE FUNCTION?  
PHASE (DEGREES) ?-115  
CLOSE ENOUGH, (-115 )

4. CURRENT REGARDED AS A COSINE FUNCTION?  
PHASE (DEGREES) ?8  
TOO FAR WRONG;  
-----TRY AGAIN.?80  
CLOSE ENOUGH, ( 80 )

5. WHAT ARE THE POLAR COMPONENTS OF THE IMPEDANCE (V/I)?  
MAGNITUDE ?1.67  
CLOSE ENOUGH, ( 1.66667 )

PHASE (DEGREES) ?165  
CLOSE ENOUGH, ( 165 )

AND ITS RECTANGULAR COMPONENTS,  
R = ?.432 ,  
TOO FAR WRONG;  
-----TRY AGAIN.?-1.62  
CLOSE ENOUGH, (-1.61 )  
AND X = ?.432  
CLOSE ENOUGH, ( .430904 )

6. WHAT ARE THE POLAR COMPONENTS OF THE ADMITTANCE (I/V)?  
MAGNITUDE ?.6  
CLOSE ENOUGH, ( .6 )

PHASE (DEGREES) ?-165  
CLOSE ENOUGH, (-165 )

AND ITS RECTANGULAR COMPONENTS,  
G = ?-.58  
CLOSE ENOUGH, (-.5796 )

AND B = ?-.155  
CLOSE ENOUGH, (-.155125 )

AND WHAT ARE THE  
7. POWER FACTOR?.99  
YOU ARE NOT FAR OFF;  
-----TRY AGAIN.?97  
CLOSE ENOUGH, ( .966 )

8. VOLT-AMPERES?60  
TOO FAR WRONG;  
-----TRY AGAIN.?30  
CLOSE ENOUGH, ( 30 )

9. AVERAGE POWER?29  
TOO FAR WRONG;  
-----TRY AGAIN.?-29  
CLOSE ENOUGH, (-28.98 )

10. REACTIVE VOLT-AMPERES (ACCORDING TO V\*CONJ I)?7.8  
CLOSE ENOUGH, ( 7.75627 )

11. AVERAGE P.D.?0  
CLOSE ENOUGH, ( 0 )

12. AVERAGE CURRENT?0  
CLOSE ENOUGH, ( 0 )

13. RMS P.D.?7.07  
CLOSE ENOUGH, ( 7.07 )

14. RMS CURRENT?4.25  
CLOSE ENOUGH, ( 4.242 )

15. MAXIMUM INSTANTANEOUS POWER?-55  
TOO FAR WRONG;  
-----TRY AGAIN.?-50  
TOO FAR WRONG;  
( 1.02 )

16. MINIMUM INSTANTANEOUS POWER?-55  
TOO FAR WRONG;  
-----TRY AGAIN.?-58  
CLOSE ENOUGH, (-58.98 )

RELATIVE TO THE P.D., WHAT ARE THE  
17. IN-PHASE RMS CURRENT?-5.8  
TOO FAR WRONG;  
-----TRY AGAIN.?-4.1  
CLOSE ENOUGH, (-4.09777 )

18. THE REACTIVE (I.E. QUADRATURE) RMS CURRENT?1.1  
TOO FAR WRONG;  
-----TRY AGAIN.?-1.1  
CLOSE ENOUGH, (-1.09674 )

RELATIVE TO THE CURRENT, WHAT ARE THE  
19. IN-PHASE RMS P.D.?-6.85  
CLOSE ENOUGH, (-6.82962 )

20. REACTIVE (I.E. QUADRATURE) RMS P.D.?-1.83  
TOO FAR WRONG;  
-----TRY AGAIN.?1.83  
CLOSE ENOUGH, ( 1.82789 )

DONE



ENGINEERING (EDUCATION) (820)  
CONTRIBUTED PROGRAM **BASIC**

COMPLX  
36153

**TITLE:** CAI IN ALGEBRA OF COMPLEX NUMBERS

**DESCRIPTION:** COMPLX offers computer aided practice in the algebra of complex numbers. Several different types of problems are offered.

**INSTRUCTIONS:** Instructions and definitions of the types of problems available are included within the program.

**SPECIAL CONSIDERATIONS:** FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Any course in AC circuit analysis  
Student Background Required: Some knowledge of the algebra of complex numbers

**ACKNOWLEDGEMENTS:** Dr. Clifford M. Siegel  
University of Virginia

RUN

RUN  
COMPLX

FOR INSTRUCTIONS TYPE 1, OTHERWISE 0.

?1

COMPUTER AIDED PRACTICE IN ALGEBRA OF COMPLEX NUMBERS  
AS USED IN A.C. CIRCUITS; PREPARED BY C.M.SIEGEL  
AND E. DIXON, JUNE 30, 1970. (REV. 12/20/70)

SELECT THE KIND OF PROBLEM FROM THIS LIST.

1. INTRODUCTION- SLIDE RULE INSTRUCTION, RECTANGULAR TO POLAR CONVERSION.
2. CONVERT RECTANGULAR TO POLAR
3. FIND RECIPROCAL
4. CONVERT POLAR TO RECTANGULAR FORM
5. FIND R,X,G,B
6. FIND COMPLEX POWER
99. FINISHED

EXPECTED ANSWERS WILL BE SHOWN IN [ ].

WHICH KIND?

?1

FOR Z = 85 , 35

WHAT IS ITS POLAR FORM?

FIND IT VIA THE FOLLOWING STEPS.

FIND THE SHORT-SIDE VALUE ON THE SLIDE RULE D-SCALE.

PUT THE HAIR LINE THERE. WHAT IS THAT NUMBER?

?35

O.K.

MOVE THE SLIDE(NOT THE HAIR LINE) SO THAT THE  
RIGHT\* OR LEFT\*END OF THE S,T AND ST SCALES LIES OVER  
THE LONG SIDE VALUE ON THE D-SCALE. (\* THE WRONG  
CHOICE OF END WILL NOT LEAVE THE S,T AND ST SCALES  
BENEATH THE HAIR LINE.)

WHAT IS THAT NUMBER?

?85

O.K.

OBTAIN THE ANGLE FROM THE READING ON THE T(OR ST) SCALE  
BENEATH THE HAIR LINE.

WHAT IS THE ANGLE(DEGREES)?

(SHOW REGARD FOR THE PROPER QUADRANT; CHOSE ANGLE  
BETWEEN -180 AND +180)

?24.4

YOU ARE NOT WITHIN 1.11 OR MORE DEGREES

TRY THE ANGLE AGAIN.

?22.4

CORRECT IN 2 TRY(S)

[ 22.3801 ]

MOVE THE SLIDE UNTIL THAT SAME READING (ON THE T SCALE)  
APPEARS ON THE S-SCALE# BENEATH THE HAIR LINE  
(# IF RATIO, SHORT-SIDE/LONG-SIDE, IS < .1 USE THE ST  
SCALE; NO SLIDE MOVEMENT NEEDED.)ONE END OF THE S,T OR ST SCALES SHOULD NOW LIE  
OVER THE HYPOTENUSE-VALUE ON THE D-SCALE

THE MAGNITUDE EQUALS?

?92

CORRECT IN 1 TRY(S)

[ 91.9239 ]

WHICH KIND?

?2

FOR Z = 313 - J 11

WHAT IS ITS POLAR FORM?

WHAT IS THE ANGLE(DEGREES)?

(SHOW REGARD FOR THE PROPER QUADRANT; CHOSE ANGLE  
BETWEEN -180 AND +180)

?-19.4

YOU ARE NOT WITHIN .1 OR MORE DEGREES

TRY THE ANGLE AGAIN.  
?-2  
CORRECT IN 2 TRY(S)  
[-2.01276 ]  
THE MAGNITUDE EQUALS?  
?313  
CORRECT IN 1 TRY(S)  
[ 313.193 ]

WHICH KIND?  
?99

DONE





**TITLE:**

CAI IN VOLTAGE AND CURRENT DIVIDERS

**DESCRIPTION:**

DVDRS offers computer aided practice in the analysis of voltage (potential difference) and current dividers.

**INSTRUCTIONS:**

Instructions are included within the program.

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Introductory Engineering courses

Student Background Required: Some knowledge of voltage and current dividers.

**ACKNOWLEDGEMENTS:**

Dr. Clifford M. Siegel and Edward T. Dixon  
University of Virginia

RUN

RUN  
DVDRS

WHAT IS THE TIME OF DAY (HR:MIN)?  
?10:42

A PROGRAM FOR COMPUTER AIDED PRACTICE IN ANALYSIS  
OF P.D. AND CURRENT DIVIDERS, PREPARED BY  
C.M. SIEGEL AND E. DIXON, JULY 2, 1970 (REV. 11/22/70)

WHEN ASKED FOR KIND, YOU SHOULD TYPE  
1. FOR RESISTIVE NETWORKS  
2. FOR R,L,C NETWORKS  
0 TO QUIT

KIND ?1

FOR 2 RESISTANCES IN PARALLEL WITH VALUES AS FOLLOWS:  
R 1 = 7830  
R 2 = 180

WHAT FRACTION OF THE APPLIED CURRENT PASSES THROUGH R 1 ?0224  
O.K. IN 1 TRY(S);  
THE EXPECTED ANSWER WAS 2.24719E-02

WHAT IS THE RESISTANCE OF THE COMBINATION?  
?180  
YOU ARE WITHIN 5 PER CENT; TRY AGAIN ?179.5  
YOU ARE WITHIN 5 PER CENT; TRY AGAIN ?179  
YOU ARE WITHIN 5 PER CENT; TRY AGAIN ?175  
O.K. IN 4 TRY(S);  
THE EXPECTED ANSWER WAS 175.955

KIND ?2

FOR 2 ADMITTANCES IN PARALLEL WITH VALUES AS FOLLOWS:  
(G1,B1)= 1172 , -5600 MICROMHOS  
(G2,B2)= 1286 , 4440 MICROMHOS  
WHAT FRACTION (MAG) OF THE APPLIED CURRENT PASSES THROUGH Y 2  
?1.71  
O.K. IN 1 TRY(S);  
THE EXPECTED ANSWER WAS 1.70071

WHAT IS THE ASSOCIATED ANGLE ?99.2  
O.K. IN 1 TRY(S);  
THE EXPECTED ANSWER WAS 99.1109

KIND ?0

DONE

ENGINEERING (EDUCATION) (820)  
CONTRIBUTED PROGRAM **BASIC**

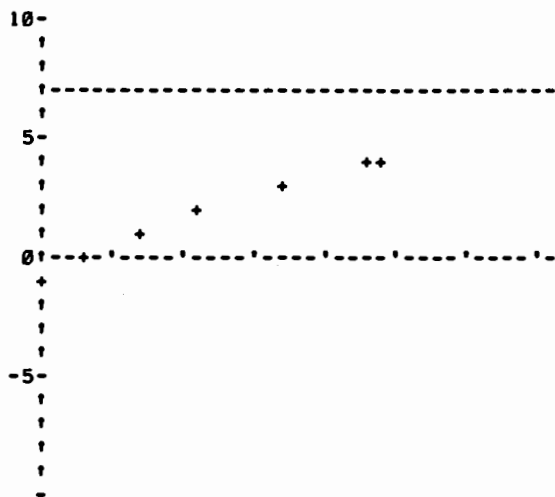
EXPNTL  
36148

|                                |                                                                                                                                                              |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b>                  | CAI IN SIMPLE EXPONENTIAL FUNCTIONS OF TIME                                                                                                                  |
| <b>DESCRIPTION:</b>            | EXPNTL offers computer aided instruction and practice in the identification of various characteristics of exponential functions of time.                     |
| <b>INSTRUCTIONS:</b>           | Instructions are contained within the program.                                                                                                               |
| <b>SPECIAL CONSIDERATIONS:</b> | FOR INSTRUCTIONAL PURPOSES<br>Suitable Courses: Any Mathematical or Engineering course<br>Student Background Required: Some knowledae of elementary calculus |
| <b>ACKNOWLEDGEMENTS:</b>       | Dr. Clifford M. Siegel<br>University of Virginia                                                                                                             |

RUN

RUN  
EXPNTL

COMPUTER AIDED PRACTICE IN IDENTIFICATION OF SIMPLE  
EXPONENTIAL FUNCTIONS OF TIME;  
PREPARED BY C.M. SIEGEL, DEC. 4, 1970 (REV. 1/3/71).



THE HOR. LINE IS THE FINAL VALUE ASYMPTOTE.

TEAR THIS OFF FOR MEASURING.

GIVEN THE FUNCTION,  $B + A * \exp(-T/T.C.)$ ,  
PLOTTED AS ABOVE,  
WHAT ARE THE VALUES

1. OF B?7  
CLOSE ENOUGH, ( 7 )

2. OF A? -8  
CLOSE ENOUGH, (-8 )

3. OF T.C.? 15  
TOO FAR WRONG;  
-----TRY AGAIN.?20  
YOU ARE NOT FAR OFF;  
( 24 )

DRAW A TANGENT TO THE CURVE AT T=0;  
4. AT WHAT VALUE OF T DOES THAT TANGENT INTERSECT  
THE FINAL VALUE ASYMPTOTE?24  
CLOSE ENOUGH, ( 24 )

5. WITH THIS MUCH OF THE ASYMPTOTE AS BASE, FORM  
A RECTANGLE WITH HEIGHT EXTENDING (UP OR DOWN)  
TO THE INITIAL HEIGHT OF THE GIVEN CURVE.  
WHAT IS ITS AREA?192  
CLOSE ENOUGH, ( 192 )

6. WHAT IS THE AREA ENCLOSED BY THE VERTICAL AXIS,  
THE ASYMPTOTE AND CURVE FOR ALL POSITIVE T?192  
CLOSE ENOUGH, ( 192 )

7. AS A FRACTION OF A, HOW FAR IS THE CURVE FROM ITS  
ASYMPTOTE WHEN T HAS THE VALUE GIVEN BY THE ANSWER  
TO 4, ABOVE?.5  
TOO FAR WRONG;  
-----TRY AGAIN.?4  
TOO FAR WRONG;  
( .368 )

DRAW A TANGENT TO THE CURVE AT T DIFFERENT FROM ZERO.  
8. HOW MUCH MUST T INCREASE BEYOND THIS FOR THIS  
TANGENT TO REACH THE ASYMPTOTE?10  
TOO FAR WRONG;  
-----TRY AGAIN.?12  
TOO FAR WRONG;  
( 24 )

DONE

INDMTR  
36154

**TITLE:**

ANALYSIS OF A BALANCED POLYPHASE INDUCTION MOTOR

**DESCRIPTION:**

INDMTR aids in the analysis of a balanced polyphase induction motor. Machine parameters or no load test data must be supplied and the program will calculate the current, efficiency, torque, losses, electrical power in and the mechanical power out as a function of speed.

**INSTRUCTIONS:**

Instructions are included within the program.

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Any course in machinery

Student Background Required: Some knowledge of polyphase induction motors.

**ACKNOWLEDGEMENTS:**

Dr. Clifford M. Siegel  
University of Virginia

RUN

RUN  
INDMTR

INDMTR: BALANCED POLYPHASE INDUCTION MOTOR ANALYSIS  
PREPARED BY C.M.SIEGEL, DEC. 31, 1969.

IF YOU WANT BRIEFING REMARKS, TYPE 1, OTHERWISE 0.

?1

GIVES CURRENT, EFFICIENCY, TORQUE, LOSSES, ELECTRICAL  
POWER IN, AND MECHANICAL POWER OUT AS FUNCTIONS OF SPEED  
WHEN MACHINE PARAMETERS OR NO-LOAD TEST DATA ARE GIVEN.

R1 AND R2 ARE STATOR AND ROTOR WINDING RESISTANCES.  
X1 AND X2 ARE STATOR AND ROTOR LEAKAGE REACTANCES.  
R3 AND X3 ARE MAGNETIZING LOSS RESISTANCE AND MUTUAL REACTANCE.

WHEN YOU SEE THE WORD, CONTINUE?, TYPE 1 FOR AFFIRMATIVE.  
TYPING 0 WILL LET YOU RESUBMIT DATA.

BASE SPEED (RPM) MEANS YOUR CHOICE OF 100% VALUE OF ROTOR SPEED.

START(%) AND STOP(%) ARE THE BEGINNING AND END OF THE

SPEED RANGE OF INTEREST (% OF BASE SPEED)

INCREMENT(%) IS THE SIZE OF INCREMENTS BETWEEN START AND STOP

FOR WHICH ANALYSIS IS WANTED (% OF BASE SPEED)

WHEN YOU ARE ASKED FOR:

BASE SPEED (RPM), START(%), STOP(%), INCREMENT(%)?--

ILLUSTRATION: PUTTING IN

1800, 80, 100, 2 GIVES MOTOR PERFORMANCE  
FOR THE RANGE 1440 TO 1800 RPM AT 36 RPM INCREMENTS.

ALL ELECTRICAL WATTS, VOLTS, AMPS, ETC ARE PER PHASE.  
ALL MECHANICAL HP AND TORQUE ARE TOTAL.

TYPE 1 IF YOU WANT TO PUT IN MACHINE PARAMETERS,

2 IF YOU WANT TO PUT IN TEST DATA, OR

99 IF YOU ARE FINISHED.

?1

R1, R2, R3, X1, X2, X3?

?25, .46, 132, .655, .655, 18.5

FOR F(CPS) CORRESPONDING TO X1,X2,X3, TYPE VALUES OF

F(CPS), NO. OF PHASES, NO. OF POLES.

?60,3,8

CONTINUE?

?1

OPERATING CONDITIONS:

VOLTS(LINE-TO-NEUTRAL; RMS), F (CPS)?

?254,60

BASE SPEED (RPM), START (%), STOP (%), INCREMENT (%)?

?900, -40, 160, 20

CONTINUE?

?1

| RPM  | TORQUE<br>WATTS IN | CURRENT<br>H.P. OUT | P.F.<br>WATTS LOSS | VARs IN<br>EFFICIENCY |
|------|--------------------|---------------------|--------------------|-----------------------|
| -360 | 233.345            | 180.571             | .403982            | 41955.9               |
|      | 18528.7            | -15.9943            | 22505.9            | -.214654              |
| -180 | 263.653            | 177.78              | .433289            | 40697.2               |
|      | 19565.7            | -9.0359             | 21812.6            | -.11484               |
| 0    | 301.586            | 173.682             | .471868            | 38895.                |
|      | 20816.5            | 0                   | 20816.5            | 0                     |
| 180  | 348.923            | 167.255             | .52443             | 36172.2               |
|      | 22279.3            | 11.9582             | 19305.7            | .13347                |
| 360  | 404.756            | 156.271             | .598665            | 31794.                |
|      | 23762.7            | 27.7435             | 16863.8            | .290324               |
| 540  | 452.172            | 135.358             | .705442            | 24368.                |
|      | 24253.7            | 46.4904             | 12693.1            | .476654               |
| 720  | 400.405            | 91.264              | .843909            | 12436.3               |
|      | 19562.7            | 54.8906             | 5913.24            | .697729               |
| 900  | 0                  | 13.3727             | .156488            | 3354.81               |
|      | 531.536            | 0                   | 531.536            | 0                     |
| 1080 | -544.738           | 103.093             | -.763228           | 16919.2               |
|      | -19985.5           | -112.015            | 7868.93            | .717498               |
| 1260 | -645.239           | 159.096             | -.509473           | 34772.5               |
|      | -20587.9           | -154.795            | 17904.4            | .534858               |
| 1440 | -552.822           | 180.666             | -.323302           | 43424.7               |
|      | -14836.1           | -151.57             | 22854.4            | .393629               |

CONTINUE?

?1

OPERATING CONDITIONS:

VOLTS(LINE-TO-NEUTRAL; RMS), F (CPS)?

?254,60

BASE SPEED (RPM), START (%), STOP (%), INCREMENT (%)?

?900, 99, 100, .25

CONTINUE?

?1

| RPM    | TORQUE<br>WATTS IN | CURRENT<br>H.P. OUT | P.F.<br>WATTS LOSS | VARS IN<br>EFFICIENCY |
|--------|--------------------|---------------------|--------------------|-----------------------|
| 891    | 30.2503<br>1827.57 | 15.0489<br>5.13184  | .478118<br>551.45  | 3357.22<br>.69826     |
| 893.25 | 22.7526<br>1504.93 | 14.4582<br>3.86962  | .409798<br>542.687 | 3349.85<br>.639395    |
| 895.5  | 15.2107<br>1181.34 | 13.9738<br>2.59346  | .332834<br>536.433 | 3346.97<br>.545912    |
| 897.75 | 7.6257<br>856.837  | 13.6083<br>1.30347  | .247892<br>532.708 | 3348.61<br>.378286    |
| 900    | 0<br>531.536       | 13.3727<br>0        | .156488<br>531.536 | 3354.81<br>0          |

CONTINUE?

?0

TYPE 1 IF YOU WANT TO PUT IN MACHINE PARAMETERS,

2 IF YOU WANT TO PUT IN TEST DATA, OR

99 IF YOU ARE FINISHED.

?2

BLOCKED-ROTOR QUANTITIES:

TORQUE(FT-LBS), WATTS IN, VOLTS IN, CURRENT IN?

?301.586, 20816.5, 254,,- 173.682

FREQ(CPS), NO. OF PHASES, NO. OF POLES?

?60, 3, 8

NO-LOAD QUANTITIES:

SLIP(RPM), WATTS IN, VOLTS IN, CURRENT IN?

?2.25, 856.837, 254, 13.6083

CONTINUE?

?1

RESULT OF SUCCESSIVE ITERATIONS FOLLOWS:

| R1<br>L1-M             | R2<br>M                | R3<br>L1               | X1 AND X2 | X3      |
|------------------------|------------------------|------------------------|-----------|---------|
| .240617<br>1.74809E-03 | .46332<br>5.14449E-02  | 132.035<br>.053193     | .659014   | 19.3943 |
| .249809<br>1.73659E-03 | .458743<br>.049382     | 131.481<br>5.11186E-02 | .65468    | 18.6166 |
| .249961<br>1.73744E-03 | .459788<br>4.91252E-02 | 131.932<br>5.08627E-02 | .655      | 18.5198 |
| .249992<br>1.73745E-03 | .459966<br>.049081     | 131.986<br>5.08184E-02 | .655003   | 18.5031 |
| .249997<br>1.73745E-03 | .459995<br>.049074     | 131.996<br>5.08115E-02 | .655005   | 18.5005 |

IF YOU WANT TO CONTINUE THE ITERATION, TYPE 2

IF YOU ARE READY FOR CALCULATION OF BEHAVIOR, TYPE 1

?1

OPERATING CONDITIONS:

VOLTS(LINE-TO-NEUTRAL; RMS), F (CPS)?

?254, 60

BASE SPEED (RPM), START (%), STOP (%), INCREMENT (%)?

?900, 80, 100, 5

CONTINUE?

?1

| RPM | TORQUE<br>WATTS IN | CURRENT<br>H.P. OUT | P.F.<br>WATTS LOSS | VARS IN<br>EFFICIENCY |
|-----|--------------------|---------------------|--------------------|-----------------------|
| 720 | 400.406<br>19562.8 | 91.2646<br>54.8907  | .843906<br>5913.27 | 12436.5<br>.697728    |
| 765 | 343.695<br>16443.4 | 74.0015<br>50.061   | .874818<br>3994.91 | 9105.93<br>.757051    |
| 810 | 258.621<br>12185.9 | 53.7291<br>39.8854  | .892922<br>2267.7  | 6144.13<br>.813908    |
| 855 | 142.781<br>6789.65 | 31.1161<br>23.2435  | .859069<br>1009.77 | 4045.49<br>.851278    |



|     |        |         |         |         |
|-----|--------|---------|---------|---------|
| 900 | 0      | 13.3724 | .156495 | 3354.73 |
|     | 531.55 | 0       | 531.55  | 0       |

CONTINUE?

?99

TYPE 1 IF YOU WANT TO PUT IN MACHINE PARAMETERS,

2 IF YOU WANT TO PUT IN TEST DATA, OR

99 IF YOU ARE FINISHED.

?99

DONE

JACOBI  
36167

**TITLE:**

EIGENVALUES AND EIGENVECTORS OF A REAL SYMMETRIC MATRIX

**DESCRIPTION:**

Using the Jacobi rotation method, this program calculates eigenvalues and eigenvectors of a real symmetric matrix.

**INSTRUCTIONS:**

Instructions are included within the program.

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Quantum Mechanics

**ACKNOWLEDGEMENTS:**

Dr. Avery Catlin  
University of Virginia

RUN

RUN  
JACOBI

TYPE 1 IF YOU WANT INSTRUCTIONS, OTHERWISE 0?1  
THIS PROGRAM USES THE JACOBI ATION METHOD TO CALCULATE  
THE EIGENVALUES AND EIGENVECTORS OF A REAL SYMMETRIC  
MATRIX. TYPE RUN AND WHEN ASKED, SUPPLY THE FOLLOWING  
INFORMATION:

1. REQUIRED ACCURACY OF THE EIGENVALUES.  
(NORMALLY 1E-6 FOR THE H-P COMPUTER)
2. THE ORDER OF THE MATRIX.  
(A SINGLE NUMBER SINCE THE MATRIX MUST BE SQUARE)
3. THE MATRIX ELEMENTS BY ROW.  
(START AT ROW 1, COLUMN 1 AND SEPARATE THE ELEMENTS  
BY COMMAS. WHEN YOU REACH THE END OF A TYPED LINE,  
PUSH THE RETURN KEY. THE COMPUTER WILL ADVANCE THE  
PAPER AND PRINT ?? IF MORE DATA IS NEEDED.)

NOW TYPE RUN AGAIN.

DONE  
RUN  
JACOBI

TYPE 1 IF YOU WANT INSTRUCTIONS, OTHERWISE 0?0

WHAT IS REQUIRED RELATIVE ACCURACY OF EIGENVALUES?1E-6

WHAT IS ORDER OF MATRIX?3

WHAT ARE THE MATRIX ELEMENTS?1,2,3,2,2,2,3,2  
??5

FINAL THRESHOLD V5= 4.08248E-07

EIGENVALUES

-.945668  
1.0748  
7.87086

EIGENVECTORS

.870996  
-.379706  
-.311752

.163801  
.822692  
-.544377

.463179  
.423085  
.778758

DONE

**TITLE:**

PLOTS SINGLE VARIABLE IN POLAR FORM

**DESCRIPTION:**

Plots a function of a single variable in polar form.

**INSTRUCTIONS:**

Instructions are included within the program.

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Engineering

Student Background Required: Knowledge of elementary trigonometry and the polar form for plotting functions.

**ACKNOWLEDGEMENTS:**

John H. Fikus  
University of Virginia

RUN

RUN  
POLAR

THIS PROGRAM PLOTS FUNCTIONS IN POLAR FORM.  
TO USE IT TYPE:

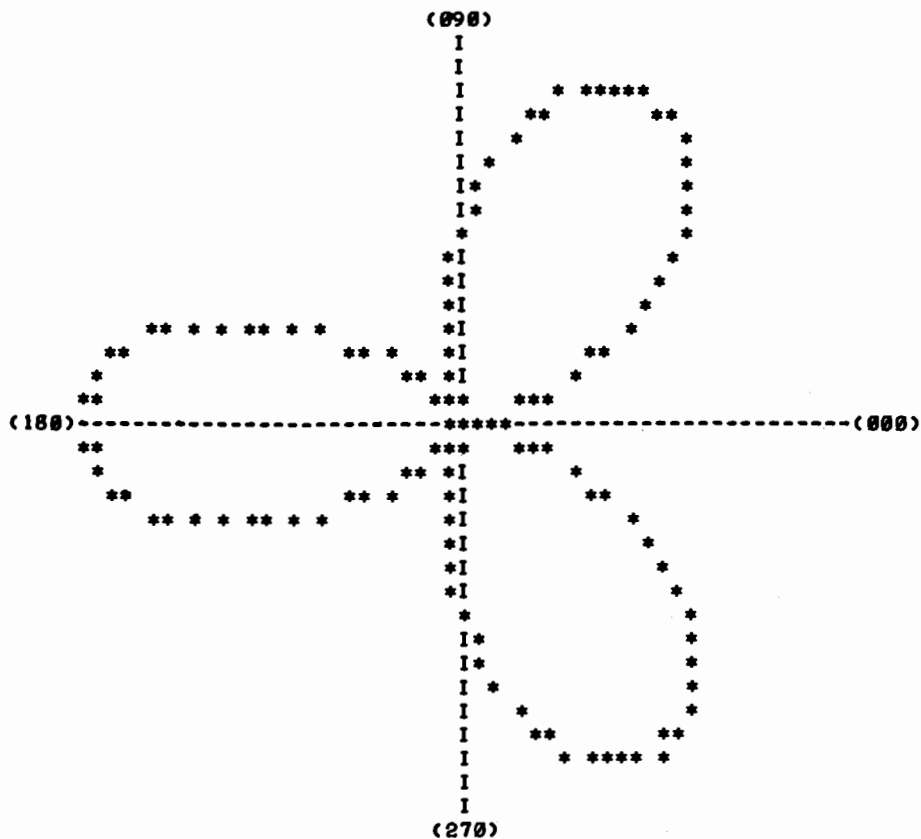
```
8900 DEF FNR(0)=<YOUR FUNCTION>
9900 DATA <INCR>,<RADIUS>,<NUMBER>
RUN
```

WHERE,<INCR> IS THE DESIRED INCREMENT IN DEGREES BETWEEN THE POINTS, <RADIUS> IS THE LARGEST VALUE OF THE RADIAL DISPLACEMENT FROM THE ORIGIN TO BE PLOTTED AND <NUMBER> IS THE NUMBER OF '360 DEGREE' PLOTTING SWEEPS DESIRED (FOR MOST PROBLEMS 1 IS SUFFICIENT).

A GOOD INITIAL CHOICE FOR <INCR> AND <NUMBER> ARE '10' AND '1' RESPECTIVELY. FOR <RADIUS> TRY TO CHOOSE A VALUE SUCH THAT MOST OF THE FUNCTION WILL FIT ON THE PLOTTING FIELD. IN OTHER WORDS IF  $FNR(\theta)=\sin(\theta)$  THEN LET <RADIUS>=1.

THE USER MAY NEED TO ADJUST THE VALUES OF <INCR> <RADIUS> OR <NUMBER> TO OBTAIN THE BEST REPRESENTATION OF THE FUNCTION.

```
DONE
8900 DEF FNR(0)=1-COS(3*0)
9900 DATA 2.5,2,1
RUN
POLAR
```



DONE

ENGINEERING (EDUCATION) (820)  
CONTRIBUTED PROGRAM **BASIC**

SOLVER  
36149

**TITLE:** SOLVES COMPLEX SIMULTANEOUS EQUATIONS

**DESCRIPTION:** SOLVER solves simultaneous equations having complex coefficients and complex driving functions, where the imaginary part of the root is frequency dependent. SOLVER also plots a graph for the last variable and steps the frequency in 1-2-4-8 decades.

**INSTRUCTIONS:** Instructions are included within the program.

**SPECIAL CONSIDERATIONS:** FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Electrical Science I and II  
Student Background Required: Engineering college level courses in circuit analysis. No programming knowledge required. Some knowledge of simultaneous equations with complex coefficients.

**ACKNOWLEDGEMENTS:** Edward T. Dixon  
University of Virginia

RUN

RUN  
SOLVER

DO YOU WANT INSTRUCTIONS?  
?YES

SOLVER SOLVES N SIMULANEOUS EQUATIONS HAVING COMPLEX  
COEFFICIENTS AND COMPLEX DRIVING SOURCES, WHERE THE  
IMAGINARY PART OF THE ROOT IS FREQUENCY DEPENDANT.  
SOLVER ALSO PLOTS A GRAPH FOR THE LAST VARABLE AND  
STEPS THE FREQUENCY IN 1-2-4-8 DECADES.  
THE FREQUENCY PART MAY CONTAIN A LINEAR PART AND  
A INVARSE PART. THE DATA IS FED AS FOLLOWS:

9900 DATA <FIRST COEFFICIENT OF FIRST EQUATION>  
9901 DATA <SECOND COEFFICIENT OF FIRST EQUATION>  
99-- ETC.  
99-- DATA <COEFFICIENTS OF DRIVING SOURCE>

FOR EXAMPLE TO SOLVE:

$$(3+(2W-1/4W)J)V1 + (-2+(0+1/W)J)V2 = 1+2J$$

$$(1+(3W)J)V1 + (1+(2/W)J)V2 = -2+0J$$

NOTE W STANDS FOR OMEGA  
THE DATA STATEMENTS WOULD BE:

9900 DATA 3,2,-4  
9901 DATA -2,0,1  
9902 DATA 1,3,0  
9903 DATA 1,0,.5  
9904 DATA 1,2,-2,0

THE DATA LINES SHOULD BE NUMBERED FROM 9900  
THROUGH 9997  
IF NO LINEAR OR INVARSE PARTS OF A COEFFICIENT EXIST  
THEN ENTER ZERO'S

DONE

9900 DATA 3,2,-4  
9901 DATA -2,0,1  
9902 DATA 1,3,0  
9903 DATA 1,0,.5  
9904 DATA 1,2,-2,0  
RUN  
SOLVER

WOULD YOU LIKE TO COMPUTE SOME SPECIFIC VALUES OF F?  
?NO

WHAT IS YOUR VALUE FOR F1 AND F2?  
?10,40

DO YOU ONLY WANT TO SEE THE GRAPH?  
?NO

| FREQ | VAR NO | REAL        | IMAG        | MAG         | ANGLE    |
|------|--------|-------------|-------------|-------------|----------|
| 10   | 1      | 4.05616E-03 | 6.12632E-03 | 7.34740E-03 | 56.492   |
|      | 2      | -.87292     | -.742909    | 1.14626     | -139.601 |
| 20   | 1      | 2.00899E-03 | 3.02370E-03 | 3.63026E-03 | 56.3993  |
|      | 2      | -.873983    | -.746486    | 1.14939     | -139.499 |
| 40   | 1      | 9.99637E-04 | 1.50197E-03 | 1.80421E-03 | 56.3542  |
|      | 2      | -.874497    | -.748251    | 1.15092     | -139.449 |

GRAPH FOLLOWS

```
FREQ          VARIABLE NO. 2
(TIMES 100)
-----
1.146          1.147          1.149          1.15
-----
.1 *
.2 *
.4 *
-----
DONE
```





ENGINEERING (EDUCATION) (820)  
CONTRIBUTED PROGRAM **BASIC**

UNITS  
36157

|                                |                                                                                                              |
|--------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b>                  | CAI IN INTERPRETATION OF EE UNITS                                                                            |
| <b>DESCRIPTION:</b>            | UNITS offers computer aided practice in choosing new units to avoid large positive or negative powers of 10. |
| <b>INSTRUCTIONS:</b>           | Instructions are included within the program.                                                                |
| <b>SPECIAL CONSIDERATIONS:</b> | FOR INSTRUCTIONAL PURPOSES<br>Suitable Courses: Electrical Engineering at any level.                         |
| <b>ACKNOWLEDGEMENTS:</b>       | Dr. Clifford M. Siegel and Edward D. Dixon<br>University of Virginia                                         |

RUN

RUN  
UNITS

A PROGRAM FOR COMPUTER AIDED PRACTICE IN CHOOSING  
NEW UNITS TO AVOID LARGE - OR + POWERS OF 10;  
PREPARED BY C.M. SIEGEL AND E. DIXON, JULY 1, 1970

IF AT ANY TIME YOU WANT A NEW SET OF C AND L  
UNITS, ANSWER QUESTIONS WITH ANY NEGATIVE NUMBER

(YOU NEED TO KNOW THAT THE SQUARE ROOT OF 10 IS 3.16)

TO SATISFY THE RELATIONS  $V=ZI$ ,  $I=YV$ ,  
 $X=\text{OMEGA TIMES } L$ ,  $B=\text{OMEGA TIMES } C$ ,  
 $\text{OMEGA} = 1/\text{SQR}(LC)$ , ETC.

IF WE USE  $1.00000\text{E}-07$  FARADS AS UNIT OF CAPACITANCE AND  
10 HENRIES AS UNIT OF INDUCTANCE, THEN

THE UNIT OF OMEGA WILL BE HOW MANY RAD/SEC ?  
?1E3  
CORRECT

THE UNIT OF TIME WILL BE HOW MANY SECONDS ?  
?1E-3  
CORRECT

THE UNIT OF IMPEDANCE WILL BE HOW MANY OHMS ?  
?1E3  
WRONG, TRY AGAIN  
?1E2  
WRONG, TRY AGAIN  
?1E4  
CORRECT

THE UNIT OF ADMITTANCE WILL BE HOW MANY MHOS ?  
?1E-4  
CORRECT

IF, FURTHERMORE, P.D. IS EXPRESSED IN VOLTS,  
THE UNIT OF CURRENT WILL BE HOW MANY AMPERES ?  
?1E-4  
CORRECT

THE UNIT OF POWER WILL BE HOW MANY WATTS ?  
?1E-4  
CORRECT

IF, HOWEVER, CURRENT IS EXPRESSED IN AMPERES,  
THE UNIT OF P.D. WILL BE HOW MANY VOLTS ?  
?1E4  
CORRECT

THE UNIT OF POWER WILL BE HOW MANY WATTS ?  
?1E4  
CORRECT  
IF YOU WANT A NEW PROBLEM, TYPE 1, OTHERWISE 0  
?0

DONE

**TITLE:**

CIRCULAR FLOW MODEL

**DESCRIPTION:**

Simulation of the circular flow of goods, services, and money, between business and the consumer in a free enterprise economy without government control.

OBJECTIVES:

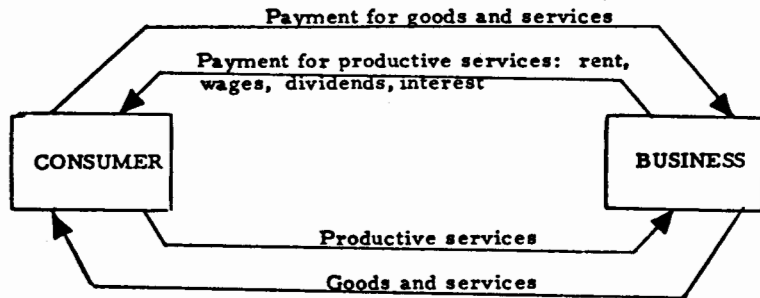
- A. To explore the effect of personal consumption upon business' demand for productive services from the individual, and upon personal income.
- B. To demonstrate that widespread uninvested savings can cause a general drop in income.
- C. To demonstrate how credit buying can raise personal income, in general.

**INSTRUCTIONS:**

PRELIMINARY PREPARATION:

A. Student

- 1. Terms to define:
  - a. propensity to consume
  - b. savings
  - c. credit
  - d. circular flow of goods, services, and money
- 2. Concepts for explanation or discussion:



CIRCULAR FLOW

Continued on following page.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

INSTRUCTIONS: continued

DISCUSSION:

A. Operational Suggestions

1. Student level - average to above average ability
2. Placement in curriculum - Unit: Economic growth and stability
3. Group size - may be used individually, with small groups, or as a teacher demonstration

B. Follow-up

Suggested classroom activities:

1. Use the circular flow chart to illustrate one or more of the program "run-offs".
2. Discuss the lack of aggregate demand as a cause for recession; and the rise in aggregate demand as a cause for growth or inflation.

RUN

RUN  
CIRFLW

THE FOLLOWING WILL SIMULATE THE EFFECT ON THE CIRCULAR FLOW OF GOODS, SERVICES AND MONEY WHEN ALL THE INDIVIDUALS IN THE ECONOMY SPEND ALL THEIR INCOME. IF THE AVERAGE INCOME IS \$2,500 AND EVERY INDIVIDUAL SPENDS 100 PERCENT OF IT, EACH INCOME WILL BE IN EQUILIBRIUM--THEY WILL EARN BACK FROM BUSINESS \$2500  
THE FOLLOWING WILL BE A COMPUTATION OF THE VALUES IN THE CIRCULAR FLOW

AVERAGE INCOME- 2500

PROPENSITY TO CONSUME IS  
100 PERCENT

INDIVIDUAL'S PAYMENTS FOR  
GOODS AND SERVICES- 2500

THE VALUE OF GOODS  
AND SERVICES- 2500

THE PERCENT OF PRODUCTIVE  
SERVICES BUSINESS WANTS  
IS 100 PERCENT.

THE RETURN INCOME  
TO INDIVIDUAL-2500.

THE ABOVE REPRESENTS THE AVERAGE OF ALL INDIVIDUAL INCOMES IN THE ECONOMY. SINCE ALL INDIVIDUALS CONSUMED 100 PERCENT OF THEIR INCOME, THEIR RETURN INCOME IS 100 PERCENT OF THEIR PREVIOUS INCOME. THIS HAPPENS BECAUSE BUSINESS NEEDS 100 PERCENT OF THE PREVIOUS PRODUCTIVE SERVICES TO MEET THE DEMAND.

THE RETURN INCOME TO THE INDIVIDUAL FROM BUSINESS DEPENDS TO A LARGE EXTENT ON HOW MUCH ALL INDIVIDUALS SPEND (THEIR PROPENSITY TO CONSUME). COMMON SENSE TELLS US THAT IF AN INDIVIDUAL SAVES PART OF HIS INCOME AND INVESTS IT IN A BANK, HE WILL RAISE HIS INCOME BY MEANS OF THE INTEREST ON HIS SAVINGS. BUT IF ALL OR MANY OF THE INDIVIDUAL CONSUMERS IN THE ECONOMY CUT THEIR CONSUMPTION, THEN THE OVERALL RETURN INCOME TO THOSE INDIVIDUALS WILL PROBABLY DROP. BY CHANGING THE PERCENTAGE OF YOUR PROPENSITY TO CONSUME YOU CAN CHANGE YOUR INCOME.

A PROPENSITY TO CONSUME OF 100 PERCENT WILL, IN THIS SIMULATION, GIVE YOU A RETURN INCOME EQUAL TO YOUR ORIGINAL INCOME. ANY VALUE MORE OR LESS THAN 100 PERCENT WILL CHANGE YOUR RETURN INCOME.

TYPE IN A VALUE FOR THE PROPENSITY TO CONSUME, A PERCENTAGE MORE OR LESS THAN 100 PERCENT. PUT IT IN IN DECIMAL FORM (E.G. .75=75 PERCENT)

WHAT IS THE VALUE?.75  
BECAUSE YOUR PROPENSITY TO CONSUME IS LESS THAN YOUR INCOME, YOU ARE SAVING MONEY. WE WILL ASSUME THAT YOU DIDN'T PUT IT IN A BANK BUT RATHER STUFFED IT UNDER YOUR MATTRESS, SO YOU WON'T RAISE YOUR INCOME WITH INTEREST

INDIVIDUAL'S PAYMENTS FOR  
GOODS AND SERVICES- 1875

VALUE OF GOODS AND SERVICES  
FROM BUSINESS- 1875

PERCENT OF PRODUCTIVE  
SERVICES IN DEMAND- .75

RETURN INCOME TO IN-  
DIVIDUAL- 1875

YOUR RETURN INCOME  
HAS DROPPED THE FOLLOWING  
PERCENTAGE POINTS FROM  
100 PERCENT- 25  
IF YOU WISH TO PUT IN ANOTHER PERCENTAGE VALUE  
FOR THE PROPENSITY TO CONSUME, TYPE 0  
IF YOU WISH TO STOP THE PROGRAM, TYPE 1  
?1

DONE

CONTRIBUTED PROGRAM **BASIC**

GMCRO1

36519

**TITLE:**

FISCAL POLICY GAME

**DESCRIPTION:**

GMCRO1 and GMCRO2 are economic simulation games which allow the student to manage fiscal policy.

GMCRO1 puts the student in the position of managing only fiscal policy for an economy represented by a model in the computer. Each "year" the student has the opportunity to change the level of government expenditures (G) and the level of tax receipts (T). The computer calculates the effects of the policy decisions and reports the following information: Potential NNP (Q), Actual NNP (Y), Consumption (C), Investment (I), Disposable Income (D), the Level of Government Expenditures (G), tax receipts (T) and "achievement score".

The game continues for twenty years. From time to time the computer asks questions which can be answered correctly only on an understanding of the basic model. The computer will occasionally inform the student of changes in economic or political conditions to which he has to react.

The goal throughout GMCRO1 is to keep actual NNP (Y) at or near potential NNP (Q); as in most economies, Q grows over time. The student is given a "score" by the computer on the basis of how well he does. The student may wish to consider other policy goals also, e.g., balancing the budget or altering the mix of C and G.

GMCRO2 differs from GMCRO1 in important respects. It is designed to emphasize the influence of the consumer on the economy as a whole and on the problems of the policy-maker.

Again, the student controls yearly changes in government expenditures and taxes. The effects of yearly policy moves are reported on a quarterly basis so that the economy's reactions can be seen more clearly; that is, after entering changes at the beginning of a year, the computer will print out four quarters of results (at yearly rates) before asking for another set of changes.

**INSTRUCTIONS:**

See Page 2

**ACKNOWLEDGEMENTS:**

Graduate School of Business  
Stanford University



INSTRUCTIONS:

These programs may require an hour or more to play carefully. If you think that you may possibly wish to play it in more than one sitting, or may wish to stop to think before continuing, you should create a file to store the data generated by your economy.

If you desire to stop the program during execution, you may do so by typing '9999' when the change in G is requested. Remember to type in the change in T also. You may then logoff and resume GMCRO1 in the year that you stop. Instructions for restarting will be given when you stop.

GMCRO1: your objectives in the next twenty years are to keep GNP (Y) as close as possible to potential output (Q) in constant dollars, and to determine from the economy's performance the values of certain multipliers and propensities.

You begin the first year with a score of 1000. Each year you lose the absolute value of the difference between Y and Q. You can control Government expenditures (G) and Taxes (T) for each year by typing in values for the changes in G and T as requested. If there is no change type a zero. You will be given all values including investment (I), consumption (C), and disposable income (D).

GMCRO2 deals with theories of aggregate consumption. The model generates quarterly observations, but you can change G and T only once a year. When you are requested to do so type in the values for changes in G and T. If there is no change type a zero. Note that the changes in G and T are to be entered on the same line separated by a comma.

Your objectives in the next 15 years are to keep Y as close to Q as possible and to determine from the economy's performance the parameters of the consumption function. You begin the first year with a score of 5000. Each quarter you lose the absolute value of the difference between Y and Q.

**RUN**

RUN  
GMCRO1

MCRO1 MAY REQUIRE AN HOUR OR MORE TO PLAY CAREFULLY.  
IF YOU THINK THAT YOU MAY POSSIBLY WISH TO PLAY IT  
IN MORE THAN ONE SITTING, OR MAY WISH TO STOP TO THINK  
BEFORE CONTINUING, YOU SHOULD CREATE A FILE TO STORE  
THE DATA GENERATED BY YOUR ECONOMY.

DO YOU WANT THE FLEXIBILITY TO STOP THE GAME AND RETURN  
LATER ?YES

WHEN THE PROGRAM STOPS, TYPE

200 FILES DATAI  
CRE-DATA1,1  
RUN-200

THE PROGRAM WILL NOW STOP TO ALLOW YOU TO TYPE IN THESE LINES.  
TYPE IN THE LINES AFTER THE COMPUTER PRINTS 'DONE'.

DONE  
200 FILES DATAI  
CRE-DATA1,1  
RUN-200  
GMCRO1

IF YOU DESIRE TO STOP THIS PROGRAM DURING EXECUTION, YOU MAY  
DO SO BY TYPING '9999' WHEN THE CHANGE IN G IS REQUESTED.  
REMEMBER TO TYPE IN THE CHANGE IN T ALSO. YOU MAY THEN  
LOGOFF AND RESUME MCRO1 IN THE YEAR THAT YOU STOP.  
INSTRUCTIONS FOR RESTARTING WILL BE GIVEN WHEN YOU STOP.

YOUR OBJECTIVES IN THE NEXT TWENTY YEARS ARE TO KEEP GNP (Y)  
AS CLOSE AS POSSIBLE TO POTENTIAL OUTPUT (Q) IN CONSTANT DOLLARS,  
AND TO DETERMINE FROM THE ECONOMY'S PERFORMANCE THE VALUES OF  
CERTAIN MULTIPLIERS AND PROPENSITIES.

YOU BEGIN THE FIRST YEAR WITH A SCORE OF 1000. EACH YEAR YOU  
LOSE THE ABSOLUTE VALUE OF THE DIFFERENCE BETWEEN Y AND Q.  
YOU CAN CONTROL GOVERNMENT EXPENDITURES (G) AND TAXES (T)  
FOR EACH YEAR BY TYPING IN VALUES FOR THE CHANGES IN G AND T  
AS REQUESTED. IF THERE IS NO CHANGE TYPE A ZERO. YOU WILL BE  
GIVEN ALL VALUES INCLUDING INVESTMENT (I), CONSUMPTION (C),  
AND DISPOSABLE INCOME (D).

WHEN REQUESTED TO DO SO, TYPE IN THE VALUES OF G AND T  
SEPARATED BY A COMMA.

TYPE YOUR NAME -?ANON  
ANON GNP ACCOUNTS YEAR 0  
Q= 610 Y= 600 C= 520 I= 55  
D= 550 G= 25 T= 50 SCORE= 1000

CHANGE IN G,T?2,0  
CHECK YOUR WORK. ANY CHANGES? (1=YES,0=NO) ???0

ANON GNP ACCOUNTS YEAR 1  
Q= 628.3 Y= 620 C= 538 I= 55  
D= 570 G= 27 T= 50 SCORE= 991.7

CHANGE IN G,T?  
DONE

RUN  
GMCRO2

MCRO2,MAY REQUIRE AN HOUR OR MORE TO PLAY CAREFULLY.  
IF YOU THINK THAT YOU MAY POSSIBLY WISH TO PLAY IT  
IN MORE THAN ONE SITTING, OR MAY WISH TO STOP TO THINK  
BEFORE CONTINUING, YOU SHOULD CREATE A FILE TO STORE  
THE DATA GENERATED BY YOUR ECONOMY.

DO YOU WANT THE FLEXIBILITY TO STOP THE GAME AND RETURN  
LATER ?YES

WHEN THE PROGRAM STOPS, TYPE

200 FILES DATA2  
CRE-DATA2,1  
RUN-200

THE PROGRAM WILL NOW STOP TO ALLOW YOU TO TYPE IN THESE LINES.  
TYPE IN THE LINES AFTER THE COMPUTER PRINTS 'DONE'.

DONE  
200 FILES DATA2  
CRE-DATA2,1  
RUN-200  
GMCRO2

IF YOU DESIRE TO STOP THIS PROGRAM DURING EXECUTION, YOU MAY  
DO SO BY TYPING '9999' WHEN THE CHANGE IN G IS REQUESTED.  
REMEMBER TO TYPE IN THE CHANGE IN T ALSO. YOU MAY THEN  
LOGOFF AND RESUME MCR02 IN THE YEAR THAT YOU STOP.  
INSTRUCTIONS FOR RESTARTING WILL BE GIVEN WHEN YOU STOP.

MCR02 DEALS WITH THEORIES OF AGGREGATE CONSUMPTION. THE  
MODEL GENERATES QUARTERLY OBSERVATIONS, BUT YOU CAN CHANGE  
G AND T ONLY ONCE A YEAR. WHEN YOU ARE REQUESTED TO DO SO  
TYPE IN THE VALUES FOR CHANGES IN G AND T. IF THERE IS  
NO CHANGE TYPE A ZERO. NOTE THAT THE CHANGES IN G AND T  
ARE TO BE ENTERED ON THE SAME LINE SEPARATED BY A COMMA.

YOUR OBJECTIVES IN THE NEXT 15 YEARS ARE TO KEEP Y AS CLOSE  
TO Q AS POSSIBLE AND TO DETERMINE FROM THE ECONOMY'S  
PERFORMANCE THE PARAMETERS OF THE CONSUMPTION FUNCTION. YOU  
BEGIN THE FIRST YEAR WITH A SCORE OF 5000. EACH QUARTER  
YOU LOSE THE ABSOLUTE VALUE OF THE DIFFERENCE BETWEEN Y AND Q.

TYPE YOUR NAME -?ANON

|        |              |           |             |
|--------|--------------|-----------|-------------|
| ANON   | GNP ACCOUNTS | QUARTER 0 |             |
| Q= 610 | Y= 600       | C= 520    | I= 55       |
| D= 550 | G= 25        | T= 50     | SCORE= 5000 |

CONSUMERS BEHAVIOR IS NOW REPRESENTED BY A FUNCTION OF THE  
FORM:  $C(T)=A+B*D(T)$  WHERE T=NUMBER OF THE QUARTER.  
ENTER CHANGES IN G,T -?3,0  
CHECK YOUR VALUES. CHANGES ? (1=YES, 0=NO) ??70

|          |              |           |               |
|----------|--------------|-----------|---------------|
| ANON     | GNP ACCOUNTS | QUARTER 1 |               |
| Q= 616.1 | Y= 630       | C= 547    | I= 55         |
| D= 580   | G= 28        | T= 50     | SCORE= 4986.1 |

|            |              |           |                |
|------------|--------------|-----------|----------------|
| ANON       | GNP ACCOUNTS | QUARTER 2 |                |
| Q= 622.261 | Y= 630       | C= 547    | I= 55          |
| D= 580     | G= 28        | T= 50     | SCORE= 4978.36 |

|            |              |           |                |
|------------|--------------|-----------|----------------|
| ANON       | GNP ACCOUNTS | QUARTER 3 |                |
| Q= 628.484 | Y= 630       | C= 547    | I= 55          |
| D= 580     | G= 28        | T= 50     | SCORE= 4976.84 |

|            |              |           |                |
|------------|--------------|-----------|----------------|
| ANON       | GNP ACCOUNTS | QUARTER 4 |                |
| Q= 634.768 | Y= 630       | C= 547    | I= 55          |
| D= 580     | G= 28        | T= 50     | SCORE= 4972.08 |

ENTER CHANGES IN G,T -?  
DONE

CONTRIBUTED PROGRAM **BASIC**GMCRO5  
36521**TITLE:**

ECONOMIC POLICY GAME

**DESCRIPTION:**

GMCRO5 and GMCRO6 simulate the complexities of a dynamic economy and the problems inherent in the use of fiscal and monetary policy to pursue the goals of economic stability and growth.

In GMCRO5 a student will control fiscal policy and monetary policy and will have an eight period history of a hypothetical economy which was generated by a fairly realistic model of the U.S. economy. For succeeding periods the economy will be influenced by past policy decisions. From the ninth period on, each student makes independent policy decisions, thus his economy will run a separate course.

The emphasis in this game is on combining a number of policy tools (government spending, the marginal tax rate, and the money supply) to reach specified national economic goals. The goals are defined by a "welfare function" which expresses mathematically the relative weight the policy maker gives to various economic indicators of well-being. Scoring well in this game requires giving thought to what the welfare function really means in terms of policy.

The computer reports each year's economic data after policy decisions have been decided upon and implemented. In particular, prices and unemployment are reported; their behavior is important to welfare. Since GNP components are stated in "real" (deflated) terms, actual output (Y) cannot exceed potential output (Q). If aggregate demand is excessively great, it is met not by added output, but by inventory decumulation -- and this information is reported.

A student who has played GMCRO5 will have faced many of the problems economists and government policy makers face. In GMCRO6 the student still faces the unemployment-inflation dilemma. However, he must also be aware that the policy tools used to control the domestic economy have significant effects on exports, imports, and international capital flows, i.e., the balance of payments. Should the student now encounter a severe balance of payments deficit he must either deflate his economy or suffer the international consequences specified at the beginning of GMCRO6.

In this model of the economy, exports are dependent upon the level of GNP and upon the inflation rate, imports depend upon disposable income. Capital inflows vary with the domestic interest rate. Again the student should study the economic history before beginning.

No goals are prescribed for the student in GMCRO6. Rather, as policy maker, he must attempt to achieve the economic goals which he considers important. The game continues for twenty "years". Various changes will occur in international relations during this period. They affect exports and imports and, consequently, policy decisions..

**INSTRUCTIONS:**

See Page 2

**ACKNOWLEDGEMENTS:**Graduate School of Business  
Stanford University

**INSTRUCTIONS:**

The game is played in three ten-period sessions each having a different welfare function which requires widely differing policies.

For the first ten periods the objective is to maximize a welfare function of the form  $W = (C)^{.6} (I)^{.2} (G)^{.2} - U - (PC)^3$ . Note that the inflation rate (PC) is weighted much more heavily than unemployment (U).

For the second ten periods the welfare function is  $W = (C)^{.4} (I)^{.2} (G)^{.4} - U^3 - PC$ . Now unemployment is weighted more heavily than inflation.

For the final ten periods the welfare function is  $W = Q - U^2 - (PC)^2$ . Both unemployment and inflation are weighted equally.

Clues for Good Policy Making

To achieve policy objectives students might find the following guidelines helpful.

1. Interpret the goal. What does it mean to maximize the given welfare function? What variables in the economy should the student be trying to affect by his policy decisions?
2. Formulate ideas about how the economy functions. What factors are likely to be important determinants of the variables that he wants to influence? How will changes in the policy variables influence these target variables?
3. Test ideas against available information contained in the accompanying table. Do these ideas explain most of the economy's behavior in past periods? Do the data suggest alternative explanations as to how the economy functions?

GMCRO5--ECONOMIC DATA FOR PREVIOUS YEARS

| Year | Q     | Y     | C     | I     | G     | TI  | T     | D     | E     | M     | R   | P     | PC   | U   | IN   |
|------|-------|-------|-------|-------|-------|-----|-------|-------|-------|-------|-----|-------|------|-----|------|
| -7   | 569.0 | 500.0 | 303.5 | 104.5 | 92.0  | .30 | 110.0 | 315.0 | 75.0  | 125.6 | 3.9 | 1.0   | 0.0  | 6.5 | 0.0  |
| -6   | 588.4 | 521.0 | 313.9 | 115.1 | 92.0  | .30 | 116.3 | 326.5 | 78.1  | 135.6 | 3.3 | .997  | -0.3 | 6.3 | 0.0  |
| -5   | 608.9 | 576.4 | 341.3 | 128.1 | 107.0 | .30 | 132.9 | 357.0 | 86.5  | 150.6 | 3.1 | .995  | -0.2 | 4.3 | 0.0  |
| -4   | 630.6 | 583.1 | 292.2 | 124.0 | 167.0 | .40 | 193.2 | 302.4 | 87.5  | 150.6 | 3.3 | 1.013 | 1.8  | 5.0 | 0.0  |
| -3   | 652.2 | 620.7 | 335.3 | 118.4 | 167.0 | .35 | 177.2 | 350.3 | 93.1  | 150.6 | 4.0 | 1.021 | 0.7  | 4.1 | 0.0  |
| -2   | 673.6 | 673.6 | 389.4 | 117.2 | 167.0 | .30 | 162.1 | 410.5 | 101.0 | 170.6 | 4.2 | 1.042 | 2.1  | 2.5 | 15.5 |
| -1   | 695.1 | 692.8 | 398.9 | 126.9 | 167.0 | .30 | 167.8 | 421.0 | 103.9 | 170.6 | 5.0 | 1.149 | 10.3 | 2.6 | 0.0  |
| 0    | 717.6 | 651.6 | 378.5 | 106.1 | 167.0 | .30 | 155.5 | 398.4 | 97.7  | 170.6 | 4.7 | 1.214 | 5.7  | 5.5 | 0.0  |

Definitions

- |                                                |                                               |
|------------------------------------------------|-----------------------------------------------|
| Q = Potential Net National Product             | E = Corporate Retained Earnings               |
| Y = Net National Product                       | M = Money Supply                              |
| C = Consumption Expenditures                   | R = Rate of Interest (percentage)             |
| I = Net Private Investment                     | P = Index of Price Level                      |
| G = Government Purchases of Goods and Services | PC = Yearly Rate of Price Change (percentage) |
| TI = Marginal Income Tax Rate                  | U = Unemployment Rate (percentage)            |
| T = Tax Receipts                               | IN = Inventory Disinvestment                  |
| D = Disposable Personal Income                 | W = Welfare for Current Year                  |
|                                                | W* = Sum of Welfare since Year Zero           |

INSTRUCTIONS: (continued)

## GMCRO6 - Economic Data for Previous Years

| Year | -7    | -6    | -5    | -4    | -3    | -2    | -1    | 0     |
|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Q    | 569.0 | 588.4 | 608.9 | 630.6 | 652.2 | 673.6 | 695.1 | 717.6 |
| Y    | 500.0 | 521.0 | 576.4 | 583.1 | 620.7 | 673.6 | 692.8 | 651.6 |
| C    | 303.5 | 313.9 | 341.3 | 292.2 | 335.3 | 389.4 | 398.9 | 378.5 |
| I    | 104.5 | 115.1 | 128.1 | 124.0 | 118.4 | 117.2 | 126.9 | 106.1 |
| G    | 92.0  | 92.0  | 107.0 | 167.0 | 167.0 | 167.0 | 167.0 | 167.0 |
| TI   | .30   | .30   | .30   | .40   | .35   | .30   | .30   | .30   |
| T    | 110.0 | 116.3 | 132.9 | 193.2 | 177.2 | 162.1 | 167.8 | 155.5 |
| D    | 315.0 | 326.5 | 357.0 | 302.4 | 350.3 | 410.5 | 421.0 | 398.4 |
| E    | 75.0  | 78.1  | 86.5  | 87.5  | 93.1  | 101.0 | 103.9 | 97.7  |
| M    | 125.6 | 135.6 | 150.6 | 150.6 | 150.6 | 170.6 | 170.6 | 170.6 |
| R    | 3.9   | 3.3   | 3.1   | 3.3   | 4.0   | 4.2   | 5.0   | 4.7   |
| P    | 1.0   | 9.997 | 0.995 | 1.013 | 1.021 | 1.042 | 1.149 | 1.214 |
| PC   | 0.0   | -0.3  | -0.2  | 1.8   | 0.7   | 2.1   | 10.3  | 5.7   |
| U    | 6.5   | 6.3   | 4.3   | 5.0   | 4.1   | 2.5   | 2.6   | 5.5   |
| IN   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 15.5  | 0.0   | 0.0   |
| EX   | 40.0  | 41.3  | 42.1  | 36.3  | 40.3  | 37.2  | 12.9  | 25.9  |
| IM   | 28.4  | 29.4  | 32.1  | 27.2  | 31.5  | 36.9  | 37.9  | 35.9  |
| K    | -1.2  | -2.9  | -3.6  | -2.9  | -1.0  | -0.6  | 0.0   | -0.1  |
| BoP  | 10.4  | 9.0   | 6.4   | 6.2   | 7.8   | -0.3  | -25.0 | -10.1 |
| BoP+ | 10.4  | 19.4  | 25.8  | 32.0  | 39.8  | 39.5  | 14.5  | 4.4   |

Definitions

Q = Potential Net National Product  
 Y = Net National Product  
 C = Consumption Expenditures  
 I = Net Private Investment  
 G = Government Purchases of Goods and Services  
 TI = Marginal Income Tax Rate  
 T = Tax Receipts  
 D = Disposable Personal Income  
 R = Rate of Interest (percentage)

P = Index of Price Level  
 PC = Yearly Rate of Price Change (percentage)  
 U = Unemployment Rate (percentage)  
 IN = Inventory Disinvestment  
 W = Welfare for Current Year  
 W+ = Sum of Welfare since Year Zero  
 EX = Exports  
 IM = Imports  
 K = Capital Inflows  
 BoP = Balance of Payments  
 BoP+ = Balance of Payments since Year 0

**RUN**

RUN  
GMCRO5

MCR05 MAY REQUIRE AN HOUR OR MORE TO PLAY CAREFULLY.  
IF YOU THINK THAT YOU MAY POSSIBLY WISH TO PLAY IT  
IN MORE THAN ONE SITTING, OR MAY WISH TO STOP TO THINK  
BEFORE CONTINUING, YOU SHOULD CREATE A FILE TO STORE  
THE DATA GENERATED BY YOUR ECONOMY.

DO YOU WANT THE FLEXIBILITY TO STOP THE GAME AND RETURN  
LATER ?YES

WHEN THE PROGRAM STOPS, TYPE

200 FILES DATAS  
CRE-DATA5,1  
RUN-200

THE PROGRAM WILL NOW STOP TO ALLOW YOU TO TYPE IN THESE LINES.  
TYPE IN THE LINES AFTER THE COMPUTER PRINTS 'DONE'.

DONE  
200 FILES DATAS  
CRE-DATA5,1  
RUN-200  
GMCRO5

IF YOU DESIRE TO STOP THIS PROGRAM DURING EXECUTION,  
YOU MAY DO SO BY TYPING '9999' WHEN THE CHANGE IN M IS  
REQUESTED. YOU MAY THEN LOGOFF AND RESUME MCR05 IN THE  
YEAR THAT YOU STOP. INSTRUCTIONS FOR RESUMING WILL BE  
GIVEN WHEN YOU STOP.

MCR05 DEALS WITH DESIGNING POLICY STRATEGIES TO MEET DIFFERENT  
ECONOMIC GOALS. YOU WILL BE GIVEN INFORMATION ON MAJOR ECONOMIC  
VARIABLES INCLUDING THE RATE OF UNEMPLOYMENT (U) AND THE RATE OF  
INFLATION (PC). YOU SHOULD HAVE STUDIED THE PAST PERFORMANCE OF  
THE ECONOMY PRIOR TO THE BEGINNING OF THE GAME. YOU WILL CONTROL  
THE MONEY SUPPLY (M), GOVERNMENT EXPENDITURES (G), AND THE  
MARGINAL TAX RATE (T1). WHEN YOU ARE REQUESTED TO DO SO TYPE IN  
THE CHANGES IN M,G, AND T1. IF THERE IS NO CHANGE A ZERO MUST  
BE TYPED.

YOUR OBJECTIVE IN MCR05 IS TO MAXIMIZE A FUNCTION  
WHICH IS DEFINED IN TERMS OF WELFARE (W).

THE NATIONS WELFARE FUNCTION FOR YEARS 1 THROUGH 10 IS

$$W = (C^{.6})(I^{.2})(G^{.2}) - U - PC^3$$

NOTICE THAT CONSUMPTION IS VALUED RATHER HIGHLY, AND INFLATION  
IS REGARDED MUCH MORE SERIOUSLY THAN UNEMPLOYMENT. YOU ARE TO  
MAXIMIZE THE SUM OF WELFARE (W+) OVER THE NEXT 10 YEARS.

TYPE YOUR NAME -?ANON

| ANON        | GNP ACCOUNTS |              | YEAR 0      |           |  |
|-------------|--------------|--------------|-------------|-----------|--|
| Q = 717.645 | Y = 651.611  | C = 378.547  | I = 106.063 | G = 167   |  |
| T1 = .3     | R = 155.483  | D = 398.386  | E = 97.7416 | M = 170.6 |  |
| P = 1.21428 | T = 4.69452  | PC = 5.67608 | U = 5.53652 | IN = 0    |  |
| W = 0       | W+ = 0       |              |             |           |  |

ENTER CHANGE IN M - ?0  
ENTER CHANGE IN G - ?0  
ENTER CHANGE IN T1 - ?0  
CHECK YOUR WORK. ANY CHANGES ? (1=YES,0=NO).?0

| ANON        | GNP ACCOUNTS |              | YEAR 1      |           |  |
|-------------|--------------|--------------|-------------|-----------|--|
| Q = 738.808 | Y = 651.083  | C = 378.286  | I = 105.797 | G = 167   |  |
| T1 = .3     | T = 155.325  | D = 398.096  | E = 97.6624 | M = 170.6 |  |
| P = 1.21653 | R = 4.57059  | PC = .185108 | U = 6.41838 | IN = 0    |  |
| W = 242.536 | W+ = 242.536 |              |             |           |  |

ENTER CHANGE IN M - ?9999  
 YOUR DATA HAS BEEN STORED IN A FILE DESIGNATED DATA5.  
 TO RESTART CALL MCR05 AND TYPE

2510 FILES DATA5  
 RUN-2500

DONE

RUN  
 GMCRO6

MCR06 MAY REQUIRE AN HOUR OR MORE TO PLAY CAREFULLY.  
 IF YOU THINK THAT YOU MAY POSSIBLY WISH TO PLAY IT  
 IN MORE THAN ONE SITTING, OR MAY WISH TO STOP TO THINK  
 BEFORE CONTINUING, YOU SHOULD CREATE A FILE TO STORE  
 THE DATA GENERATED BY YOUR ECONOMY.

DO YOU WANT THE FLEXIBILITY TO STOP THE GAME AND RETURN  
 LATER ?YES

WHEN THE PROGRAM STOPS, TYPE

200 FILES DATA6  
 CRE-DATA6,1  
 RUN-200

THE PROGRAM WILL NOW STOP TO ALLOW YOU TO TYPE IN THESE LINES.  
 TYPE IN THE LINES AFTER THE COMPUTER PRINTS 'DONE'.

DONE  
 200 FILES DATA6  
 CRE-DATA6,1  
 RUN-200  
 GMCRO6

IF YOU DESIRE TO STOP THIS PROGRAM DURING EXECUTION,  
 YOU MAY DO SO BY TYPING '9999' WHEN THE CHANGE IN M IS  
 REQUESTED. YOU MAY THEN LOGOFF AND RESUME MCR06 IN THE  
 YEAR THAT YOU STOP. INSTRUCTIONS FOR RESUMING WILL BE  
 GIVEN WHEN YOU STOP.

MCR06 DEALS WITH DESIGNING POLICY STRATEGIES TO MEET  
 YOUR ECONOMIC GOALS. YOU WILL BE GIVEN INFORMATION  
 ON MAJOR ECONOMIC VARIABLES INCLUDING CURRENT EXPORTS (EX),  
 IMPORTS (IM), AND SHORT TERM CAPITAL INFLOWS (K). THE  
 BALANCE OF PAYMENTS IN THE CURRENT YEAR (BOP) AND THE  
 TOTAL DOLLAR CLAIMS ON OTHER NATIONS FROM YEAR -7 (BOP+)  
 ARE ALSO REPORTED.

YOU MAY SET YOUR OWN OBJECTIVES IN MCR06. NOTE THAT YOU  
 MUST BE CONCERNED WITH THE BALANCE OF PAYMENTS AND FOREIGN  
 TRADE IN ADDITION TO UNEMPLOYMENT AND INFLATION. BE CAREFUL  
 TO MAKE YOUR OBJECTIVES REALISTIC, FOR SHOULD THE BALANCE  
 OF PAYMENTS FALL BELOW -20 IN ANY YEAR, ALL MEMBERS OF THE  
 IMF WILL REVALUE THEIR CURRENCIES UPWARDS.

YOU SHOULD HAVE STUDIED THE PAST PERFORMANCE OF THE ECONOMY  
 PRIOR TO THE BEGINNING OF THE GAME. YOU WILL CONTROL THE  
 MONEY SUPPLY (M), GOVERNMENT EXPENDITURES (G), AND THE  
 MARGINAL TAX RATE (T1). WHEN YOU ARE REQUESTED TO DO SO,  
 TYPE IN THE CHANGES IN M,G, AND T1. IF THERE IS NO CHANGE  
 A ZERO MUST BE TYPED.

TYPE YOUR NAME -?ANON

| ANON           | GNP ACCOUNTS | YEAR 0       |               |           |
|----------------|--------------|--------------|---------------|-----------|
| Q = 717.645    | Y = 651.611  | C = 378.547  | I = 106.063   | G = 167   |
| T1 = .3        | T = 155.483  | D = 398.386  | E = 97.7416   | M = 170.6 |
| P = 1.21428    | R = 4.69452  | PC = 5.67608 | U = 5.53652   | IN = 0    |
| EX = 25.932    | IM = 35.856  | K = .009     | BOP = -10.014 |           |
| BOP+ = 4.45499 |              |              |               |           |



ENTER CHANGE IN M - ?  
ENTER CHANGE IN G - ?  
ENTER CHANGE IN T1 - ?  
CHECK YOUR WORK. ANY CHANGES ? (1=YES,0=NO).?

| ANON           | GNP ACCOUNTS | YEAR 1       |               |           |
|----------------|--------------|--------------|---------------|-----------|
| Q = 738.888    | Y = 651.883  | C = 378.286  | I = 185.797   | G = 167   |
| T1 = .3        | T = 155.325  | D = 398.896  | E = 97.6624   | M = 178.6 |
| P = 1.21653    | R = 4.57859  | PC = .185188 | U = 6.41838   | IN = 8    |
| EX = 42.4663   | IM = 35.8286 | K = -.184391 | BOP = 6.45334 |           |
| BOP+ = 18.9883 |              |              |               |           |

ENTER CHANGE IN M - ?9999  
YOUR DATA HAS BEEN STORED IN A FILE DESIGNATED DATA6.  
TO RESTART CALL MCR06 AND TYPE  
2518 FILES DATA6  
RUN-2588

DONE

**TITLE:**

PROPAGATION OF ERROR

**DESCRIPTION:**

This program computes the resultant precision of a quantity computed from imprecise measured quantities.

**INSTRUCTIONS:**

Instructions are contained in the program.

The program will compute the propagation of error through a series of binary operations. These are the familiar arithmetic operators. The input consists of three possible categories:

1. Commands
  - REStore, clears all variables,
  - LISt, lists all non-empty variables and their values.

only the first three characters are needed.
2. Single letter
  - This allows entering a value and an absolute precision directly into the given variable.
3. Operation
  - The operation is of the form: VoV, where V is any alphabetic character, the accumulator #, or a single digit integer. The absolute precision of the integers is zero. The operator, o, is one of the following:
    - + add
    - subtract
    - \* multiply
    - / divide
    - ↑ exponentiation
    - = store

In all cases except '=' (store), the result is put into the accumulator, #. This may be used in subsequent operations. If the variable referenced does not have a previously defined value, the program automatically requests a value and absolute precision.

**SPECIAL  
CONSIDERATIONS:**

The formulas for the error propagation are based on a geometric sum as described in Introduction to the Theory of Error by Yardley Beers (Addison-Wesley Publishing Co., 1957). Thus the resultant precision is an estimate of the actual precision of the computed quantity assuming that the errors in the measured quantities are independent, rather than an upper limit.

Continued on following page.

**ACKNOWLEDGEMENTS:**

Lawrence E. Turner, Jr.  
Pacific Union College

SPECIAL CONSIDERATIONS: continued

## FOR INSTRUCTIONAL PURPOSES

Suitable Courses: General Physics Laboratory

Student Background Required: Discussion of precision and propagation of error.

In most laboratory situations the final result is computed from a set of measurements. It is important for the student to be able to estimate or determine the precision of each measurement. From this the precision of the result may be computed. It is also very important for the student to understand how the error in his initial data affects the result. To determine this, one performs a standard propagation of error analysis. However, this can be quite tedious, especially if the expression involves both sums and multiplies. One has to convert from relative to absolute precision and back.

Most students are so discouraged by the arithmetic in an analysis of error that they lose any benefit from the process. They rebel about doing the proper analysis. It was for this reason that the program was written. The computer is a good tool to do messy arithmetic.

In practice the students are introduced to the concept of error analysis and perform several calculations by hand. Thereafter, it is assumed that they have learned the concept, and the computer is allowed to help do the calculations.

**RUN**

RUN  
ALERA

## ALGEBRAIC ERROR ANALYSIS

INSTRUCTIONS, (YES OR NO)?YES

THIS PROGRAM COMPUTES THE RESULTANT PRECISION OF A QUANTITY.  
IT IS RESTRICTED TO A SERIES OF BINARY OPERATIONS OF THE FORM: VOV  
WHERE 'V' IS ANY ALPHABETIC CHARACTER, '#', -OR A SINGLE DIGIT INTEGER.  
THE ABSOLUTE PRECISION OF THE INTEGERS IS ZERO.

'O' IS ONE OF THE FOLLOWING OPERATORS

+ ADD  
- SUBTRACT  
\* MULTIPLY  
/ DIVIDE  
↑ EXPONENTIATE  
= STORE

IN ALL CASES EXCEPT '=', THE RESULT IS RETURNED IN '#',  
THIS MAY BE USED IN SUBSEQUENT OPERATIONS.

TYPING A SINGLE VARIABLE ALLOWS ENTERING ITS VALUE DIRECTLY  
OTHERWISE, THE PROGRAM WILL ASK FOR ALL VALUES NEEDED

THERE ARE TWO COMMANDS:

RESTORE, CLEARS ALL VARIABLES  
LIST, LISTS ALL NON-EMPTY VARIABLES

INITIALIZED

?P

ENTER: P, DP ?3.14159,0

?R↑2

ENTER: R, DR ?12,1

# = 144 D# = 24 D## = .166667

?P\*\*

# = 452.389 D# = 75.3982 D## = .166667

?A=#

STORED

?4\*\*

# = 1809.56 D# = 301.593 D## = .166667

?S=#

STORED

?LIS

A = 452.389 DA = 75.398  
P = 3.14159 DP = 0  
R = 12 DR = 1  
S = 1809.56 DS = 301.593  
# = 1809.56 D# = 301.593

?  
DONE

ATOM  
36705**TITLE:**

DERIVES THE ELECTRONIC CONFIGURATION OF ANY ELEMENT

**DESCRIPTION:**

This program dervies the electronic configuration of any element according to the atomic orbital theory.

**INSTRUCTIONS:**

Type in the atomic number of the element to be analyzed when required.

**ACKNOWLEDGEMENTS:**Babson College  
Babson Park, Massachusetts

RUN

RUN  
ATOM

THIS PROGRAM DERIVES THE ELECTRONIC CONFIGURATION OF ANY  
ELEMENT ACCORDING TO THE ATOMIC ORBITAL THEORY.

WHAT IS THE ATOMIC NUMBER OF YOUR ELEMENT?16

THE ELECTRONIC CONFIGURATION IS:  
1S 2 2S 2 2P 6 3S 2 3P 4

DO YOU WANT ME TO DO ANOTHER ELEMENT?YES

WHAT IS THE ATOMIC NUMBER OF YOUR ELEMENT?1

THE ELECTRONIC CONFIGURATION IS:  
1S 1

DO YOU WANT ME TO DO ANOTHER ELEMENT?YES

WHAT IS THE ATOMIC NUMBER OF YOUR ELEMENT?12

THE ELECTRONIC CONFIGURATION IS:  
1S 2 2S 2 2P 6 3S 2

DO YOU WANT ME TO DO ANOTHER ELEMENT?NO

DONE

**TITLE:**

CALCULATES ATOMIC WEIGHT

**DESCRIPTION:**

This program will calculate the atomic weight (atomic mass) of an element from the % abundance of each isotope of the element. The % abundance may be found in the chemistry handbook.

OBJECTIVES:

To show that the atomic weight is an average weight and not the weight of any particular atom.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - The student should have an introductory understanding of atomic weight, mass number, and isotopes.
- B. Materials - A chemistry handbook from which mass numbers and % abundances may be obtained is necessary.

DISCUSSION:

It is usually difficult to get the point across that the atomic weight is an average weight and not the weight of any particular atom. This point can be made rather easily if the calculations for atomic weight are examined. This program will enable the teacher, in a few minutes during his discussion, to do a large number of calculations. This is particularly impressive when the teacher uses % data that is significant to 5-6 figures, and thus produces an atomic weight as accurate as those given in most tables.

If the teacher is interested in discussing programming with his students, this program is a good one to use. It has the advantage of being short, but still containing a number of interesting programming techniques.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
ATWT

THIS PROGRAM WILL CALCULATE THE ATOMIC WEIGHT (ATOMIC MASS)  
FROM THE PERCENT ABUNDANCE OF EACH ISOTOPE. PERCENT  
ABUNDANCES MAY BE FOUND IN THE CHEMISTRY HANDBOOK.

HOW MANY ISOTOPES DOES THE ELEMENT HAVE ?7

INPUT THE MASS NUMBER AND THE PERCENT ABUNDANCE FOR  
EACH OF THE 7 ISOTOPES.

|               |             |
|---------------|-------------|
| ISOTOPE NO. 1 | ?196.15     |
| ISOTOPE NO. 2 | ?198.10     |
| ISOTOPE NO. 3 | ?199.16.9   |
| ISOTOPE NO. 4 | ?200.1-23.1 |
| ISOTOPE NO. 5 | ?201.13.2   |
| ISOTOPE NO. 6 | ?202.29.8   |
| ISOTOPE NO. 7 | ?204.6.8    |

ATOMIC WEIGHT (ATOMIC MASS) IS 200.525

ANOTHER RUN (1=YES, 0=NO) ?0

DONE

**TITLE:**

AVOGADRO'S NUMBER

**DESCRIPTION:**

A class presentation designed to calculate Avogadro's number, by using the molecular weight of a compound and dividing by the combined actual weight of the total numbers of neutrons and protons in a single molecule.

OBJECTIVES:

To show by calculation, the value of Avogadro's number, and to reinforce the concept of Avogadro's hypothesis.



**INSTRUCTIONS:**

PRELIMINARY PREPARATION:

- A. Student - The student must be familiar with atomic structure, atomic mass, nuclear particles, and isotopes.
- B. Materials - None

DISCUSSION:

A. Operational Suggestions

The presentation of this program can be utilized to occupy one forty-five minute teaching period, even though the actual running time is approximately 10 minutes.

B. Suggested Follow-up

The occurrence of built-in error, due to the use of average atomic weights, generally provokes discussion as to the reasons for the error.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn



RUN

RUN  
AVOGA

IF INSTRUCTIONS DESIRED, TYPE 1, IF NOT, TYPE 0?1

THIS PROGRAM WILL CALCULATE AVOGADRO'S NUMBER BY USING  
ANY PURE GASEOUS ELEMENT OR BINARY COMPOUND.

THIS VALUE WILL BE CALCULATED BY USING THE MASS IN GRAMS  
OF THE NEUTRON, WHICH IS : 1.67438E-24  
AND THE MASS OF THE PROTON, WHICH IS : 1.67206E-24

YOU MUST SUPPLY THE ATOMIC NUMBER AND THE ATOMIC WEIGHT OF  
INPUT EACH ELEMENT USED. CARRY DIGITS UP TO 6 PLACES IF YOU  
WISH. WHEN THE MACHINE ASKS (?) INPUT THE ATOMIC NUMBER  
AND THE ATOMIC WEIGHT OF THE FIRST ELEMENT, THEN THE  
ATOMIC NUMBER AND THE ATOMIC WEIGHT OF THE SECOND IN THE  
FORM A,B,C,D. IF USING SINGLE ELEMENTS, BE SURE TO  
PUT IN 0 FOR VALUES C AND D.

\*\*\*\*\*

NOW INPUT THE VALUES FOR YOUR COMPOUND  
?6,12.0012,8,15.9994  
INPUT THE NUMBER OF ATOMS FOR EACH ELEMENT.  
(CO2 WOULD BE 1,2) :?1,2

\*\*\* THE NUMBER OF PARTICLES PER MOLE OF THIS GAS IS 5.97650E+23

WOULD YOU LIKE TO TRY ANOTHER PROBLEM ?  
TYPE 1 IF YES, TYPE 0 IF NO ?1

\*\*\*\*\*

NOW INPUT THE VALUES FOR YOUR COMPOUND  
?8,15.994,0,0  
INPUT THE NUMBER OF ATOMS FOR EACH ELEMENT.  
(CO2 WOULD BE 1,2) :?2,0

\*\*\* THE NUMBER OF PARTICLES PER MOLE OF THIS GAS IS 5.97650E+23

WOULD YOU LIKE TO TRY ANOTHER PROBLEM ?  
TYPE 1 IF YES, TYPE 0 IF NO ?0

DONE

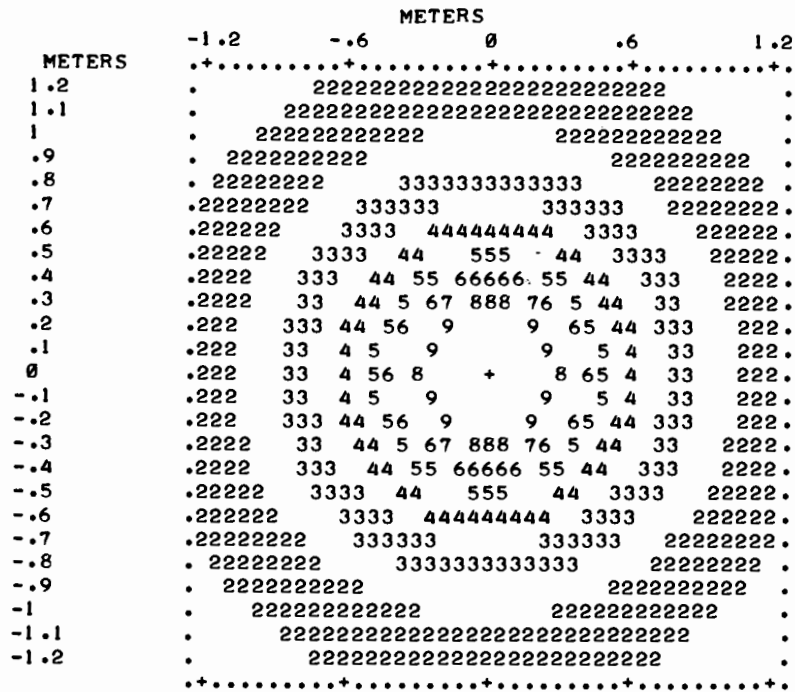
|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b>            | BFIELD: Magnetic Field Picture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>DESCRIPTION:</b>      | <p>Student may visualize the effects of current on the magnetic field produced about a single conductor. The student may also explore the fields produced by the current flow in two parallel wires. The current in the two wires may be chosen in the same direction or in opposite directions.</p> <p><u>OBJECTIVES:</u></p> <p>To acquaint student with the magnetic fields produced by current carrying conductors.</p>                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>INSTRUCTIONS:</b>     | <p><u>PRELIMINARY PREPARATION:</u></p> <p>A. Student - Prior preparation involving currents and fields.<br/>B. Materials - None</p> <p><u>DISCUSSION:</u></p> <p>Student may qualitatively explore the effects of currents on the production of magnetic fields by successively increasing or decreasing the current. The resulting magnetic field is printed out showing the relative magnitude of the field in relation to the position of the current.</p> <p>The student may also view the magnetic field due to two currents in the same or opposite direction.</p> <p>This program may also be used to introduce groups to the field concept. In addition, minor modification of the program will produce a series of plots which will demonstrate an expanding field resulting from an increasing current.</p> |
| <b>ACKNOWLEDGEMENTS:</b> | Huntington Project<br>Polytechnic Institute of Brooklyn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

RUN  
 RUN  
 BFIELD

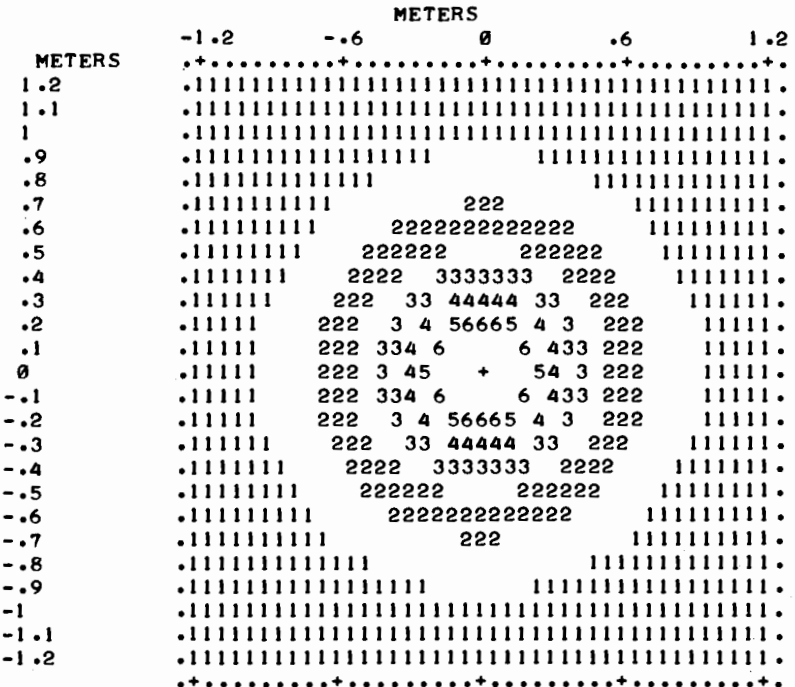
THIS PROGRAM WILL PERMIT YOU TO EXPLORE THE MAGNETIC FIELD ABOUT A CURRENT DIRECTED INTO THE PAGE AS A FUNCTION OF THE CURRENT MAGNITUDE.

WHAT WILL BE YOUR INITIAL CURRENT (SELECT POSITIVE VALUES BETWEEN 1 AND 8 AMPERES).  
 ENTER YOUR VALUE OF CURRENT?6

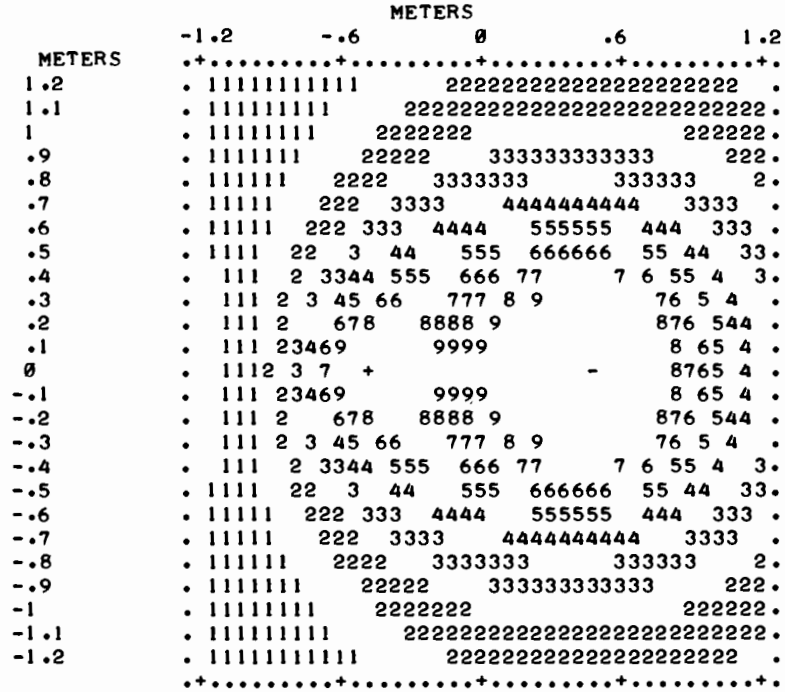
THE MAGNITUDE OF THE FIELD DECREASES FROM 9 TO 0.  
 9 IS THE HIGHEST POSSIBLE FIELD STRENGTH, AND 0 (WHICH MEANS A ZERO FIELD) THE LOWEST.



SELECT A DIFFERENT CURRENT.  
 ENTER YOUR VALUE OF CURRENT?3



WOULD YOU LIKE TO TRY TWO DIFFERENT CURRENTS AT THE SAME  
 TIME (YES=1; NO=0)?1  
 THE TWO CURRENTS WILL BE SEPARATED BY 1.0 METER. (NOTE: IF  
 THE CURRENTS ARE TO BE OPPOSITELY DIRECTED, STATE ONE OF THEM  
 AS A NEGATIVE VALUE).  
 ENTER THE TWO CURRENTS?4,-8



WANT TO TRY AGAIN (YES=1; NO=0)?0  
 WELL I GUESS YOU'RE ALL THROUGH. THANKS-- SEE Y'A

DONE



BOHR  
36313**TITLE:**

BOHR: Energy Level Diagram

**DESCRIPTION:**

The student may choose to have the Lyman, Balmer, or Paschen Series of the hydrogen emission spectrum displayed. He then must decide which energy level transitions are responsible for the lines of the spectrum that he has chosen. If he is successful, an energy-level diagram is presented and he must determine the energies of the photons emitted by the electron as it falls between randomly-selected energy levels.

OBJECTIVES:

To give an increased understanding of the Bohr atom and of how emission spectra are formed.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - The student should have been introduced to the Bohr atom, quantum theory, and ideally, have measured the wavelengths of the bright lines of the hydrogen spectrum.
- B. Materials - A piece of paper and a pencil.

DISCUSSION:

After the student selects the series he wishes to see, it is displayed and he tries to discover which quantum level jumps by the electron are responsible for the first two of three lines in the series. If he is successful three times, a statement as to how the lines of that series are formed is printed and he may then elect to try another series or move on to work with the energy-level diagram for hydrogen.

After a brief explanation concerning the energy of a photon emitted during the transition of the electron from a higher to a lower energy level, the student is given a chance to show what he has learned. Energy levels are randomly selected and he must calculate the energy of the emitted photon. If the student is not successful, he gets a further explanation. After six trials the program ends.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
BOHR

YOU MAY VIEW THE 1. LYMAN 2. BALMER OR 3. PASCHEN  
SERIES BY TYPING IN THE NUMBER OF THE SERIES YOU WANT  
DISPLAYED, OR TYPE 4 FOR AN ENERGY LEVEL DIAGRAM.

CHOOSE THE NUMBER OF THE PART YOU WOULD LIKE TO SEE.  
?2

|      |   |                                      |
|------|---|--------------------------------------|
| 7000 | A |                                      |
| 6900 | A |                                      |
| 6800 | A |                                      |
| 6700 | A |                                      |
| 6600 | A |                                      |
| 6500 | A | ----- 6564.7                         |
| 6400 | A |                                      |
| 6300 | A |                                      |
| 6200 | A |                                      |
| 6100 | A |                                      |
| 6000 | A |                                      |
| 5900 | A |                                      |
| 5800 | A |                                      |
| 5700 | A |                                      |
| 5600 | A |                                      |
| 5500 | A |                                      |
| 5400 | A |                                      |
| 5300 | A |                                      |
| 5200 | A |                                      |
| 5100 | A |                                      |
| 5000 | A |                                      |
| 4900 | A |                                      |
| 4800 | A | ----- 4862.75                        |
| 4700 | A |                                      |
| 4600 | A |                                      |
| 4500 | A |                                      |
| 4400 | A |                                      |
| 4300 | A | ----- 4341.74                        |
| 4200 | A |                                      |
| 4100 | A | ----- 4102.94                        |
| 4000 | A |                                      |
| 3900 | A | ----- 3971.24                        |
| 3800 | A | ----- 3890.2                         |
| 3700 | A |                                      |
| 3600 | A | ----- 3647.06      -----SERIES LIMIT |
| 3500 | A |                                      |
| 3400 | A |                                      |
| 3300 | A |                                      |
| 3200 | A |                                      |
| 3100 | A |                                      |
| 3000 | A |                                      |

ACCORDING TO THE BOHR THEORY EACH OF THESE LINES RESULTS  
FROM THE EMISSION OF A PHOTON DURING THE TRANSITION OF THE  
ORBITAL ELECTRON OF AN EXCITED HYDROGEN ATOM FROM A HIGHER  
ENERGY STATE (ORBIT) TO A LOWER ONE. IN A PARTICULAR SERIES  
THE TRANSITION (JUMP) IS ALWAYS INTO THE SAME LOWER LEVEL  
(ORBIT) FROM ANY HIGHER ONE.

LET'S SEE IF YOU CAN DETERMINE WHICH TWO ORBITS THE ELECTRON  
JUMPED BETWEEN TO GIVE THE LINES THAT HAVE BEEN DISPLAYED.

THE LOWEST ENERGY LEVEL (GROUND STATE) IS NUMBERED ONE.  
HIGHER ENERGY LEVELS HAVE HIGHER NUMBERS IN SEQUENCE.

FOR EXAMPLE: FROM 4 TO 1 ENTER AS 4,1?3,2

GOOD START. THAT GIVES A WAVELENGTH OF 6564.71  
THE NEXT LINE IS FORMED BY WHICH TRANSITION?4,2

BY GEORGE!! I THINK YOU'VE GOT IT!! THE WAVELENGTH IS 4862.75  
TRY ONE MORE - THE NEXT ONE. ENTER NOW.?5,2

ANY TRANSITION FROM A HIGHER ENERGY LEVEL INTO THE  
SECOND ENERGY LEVEL YIELDS A PHOTON OF THE BALMER SERIES.

IF YOU WOULD LIKE TO TRY ANOTHER SERIES TYPE IN THE NUMBER OF THAT SERIES. IF YOU WANT TO GO ON TO A NEW PART OF THE PROGRAM TYPE 4 WHICH??4

YOU WILL NOW GET AN ENERGY LEVEL DIAGRAM FOR HYDROGEN. IT SHOWS THE ENERGY OF THE ELECTRON IN THE VARIOUS ENERGY LEVELS. THE DIFFERENCE BETWEEN THE ENERGY OF THE ELECTRON IN A HIGHER LEVEL AND THAT IN A LOWER LEVEL IS THE ENERGY OF THE EMITTED PHOTON.  $E(\text{PHOTON}) = E(\text{HIGHER}) - E(\text{LOWER})$

## CONTINUUM

|    |                    |       |              |
|----|--------------------|-------|--------------|
| N= | .....INFINITY..... | E=    | 000000       |
| N= | 6                  | ----- | E= - .370001 |
| N= | 5                  | ----- | E= - .540001 |
| N= | 4                  | ----- | E= - .850001 |
| N= | 3                  | ----- | E= - 1.51    |
| N= | 2                  | ----- | E= - 3.4     |
| N= | 1                  | ----- | E= - 13.6    |

FIND THE ENERGIES OF THE PHOTONS GIVEN OFF FOR THE TRANSITIONS GIVEN BELOW.

FROM LEVEL 3 TO LEVEL 1 THE ENERGY OF THE PHOTON IS??-11.09

THE ENERGY OF LEVEL 3 IS-1.51111  
THE ENERGY OF LEVEL 1 IS-13.6

THEIR DIFFERENCE = PHOTON ENERGY = 12.0889

FROM LEVEL 4 TO LEVEL 1 THE ENERGY OF THE PHOTON IS??-12.75

GOOD. TRY ANOTHER

FROM LEVEL 3 TO LEVEL 1 THE ENERGY OF THE PHOTON IS??12.09

GOOD. TRY ANOTHER

FROM LEVEL 3 TO LEVEL 2 THE ENERGY OF THE PHOTON IS??1.89

GOOD. TRY ANOTHER

FROM LEVEL 4 TO LEVEL 1 THE ENERGY OF THE PHOTON IS??12.75

GOOD. TRY ANOTHER

FROM LEVEL 2 TO LEVEL 1 THE ENERGY OF THE PHOTON IS??10.2

THANK YOU, AND GOODBYE.

DONE





CONTRIBUTED PROGRAM **BASIC****TITLE:**

NUCLEAR PHYSICS GAME

BOLA  
36879**DESCRIPTION:**

BOLA is a physics game which uses a section chart of Nuclides as a playing field. Through bombardment of atomic nuclei, the players (1 or 2) attempt to move through the chart.

**INSTRUCTIONS:**

User instructions and classroom material are contained in a publication of the Hewlett Packard Curriculum Project entitled: BOLA, A Nuclear Physics Game (HP-5951-7177). For information contact:

Computer Curriculum Project  
Hewlett Packard Company  
11000 Wolfe Road  
Cupertino, CA

**ACKNOWLEDGEMENTS:**

Michael Chester

RUN

RUN  
BOLA

HOW MANY PLAYERS, 0, 1, OR 2

?0

IS THIS A TEST

?NO

LI 7

WHAT NUCLEAR REACTION

?2

B 10

B 10 IS ONE OF THE MAIN MOBILITY CENTERS OF THIS GAME. THERE ARE MANY PLACES YOU CAN GO FROM HERE. IN PART, THIS REFLECTS THE MANY REACTIONS THAT HAVE BEEN CARRIED OUT INVOLVING B 10 BOMBARDMENT. BE 9 AND N14 ARE SIMILAR STRATEGIC HUBS.

WHAT NUCLEAR REACTION

?5

B 9

SHORT-LIVED ISOTOPE.

BE 8

BE 8 LIVES JUST LONG ENOUGH (10 TO THE MINUS 16 SECONDS) TO FORM A REACTION BRIDGE TO C 12. THE REACTIONS, OCCURRING IN STELLAR INTERIORS, ARE:  $HE\ 4 + HE\ 4 = BE\ 8$ ; THEN,  $BE\ 8 + HE\ 4 = C\ 12$ . WITHOUT THIS BRIDGE THERE WOULD BE NO ELEMENTS HEAVIER THAN HELIUM IN THE UNIVERSE. BERYLLIUM 8 WAS THE FLICKERING GATE THAT LED TO SOLID PLANETS AND CARBON CHAINS AND LIFE IN THE UNIVERSE.

SHORT-LIVED ISOTOPE.

HE 4

HE 4 IS A VERY STABLE ISOTOPE, AND THEREFORE THE END POINT OF MANY NUCLEAR REACTIONS, AND THE END POINT OF THIS GAME.

END OF GAME

DO YOU WANT A FINAL DISPLAY

?NO

DONE

RUN  
BOLA

HOW MANY PLAYERS, 0, 1, OR 2

?1

IS THIS A TEST

?YES

WHAT Z

?5

WHAT N

?7

B 12

WHAT NUCLEAR REACTION

?0

C 12

SHORT-LIVED ISOTOPE.

BE 8

SHORT-LIVED ISOTOPE.

HE 4

O 17 NOT INCLUDED IN GAME ROUTE.  
YOU WENT TO HELIUM 4 TOO SOON  
GAME LOST

END OF GAME  
DO YOU WANT A FINAL DISPLAY  
?YES

|                |   |   |   |   |   |   |   |
|----------------|---|---|---|---|---|---|---|
| OXYGEN (O)     |   |   | 0 | 0 | 0 | 0 | 0 |
| NITROGEN (N)   |   |   | 0 | 0 | 0 | 0 | 0 |
| CARBON (C)     |   | 0 | 0 | 1 | 0 | 0 |   |
| BORON (B)      |   | 0 | 0 | 0 | 1 |   |   |
| BERYLLIUM (BE) | 0 | 0 | 1 | 0 |   |   |   |
| LITHIUM (LI)   | 0 | 0 | 0 |   |   |   |   |
| HELIUM (HE)    | 1 | 0 | 0 |   |   |   |   |

DONE

RUN  
BOLA

HOW MANY PLAYERS, 0, 1, OR 2  
?2  
IS THIS A TEST  
?NO

LI 7

PLAYER 1

WHAT NUCLEAR REACTION  
?2  
B 10

PLAYER 1

WHAT NUCLEAR REACTION  
?1  
C 13

PLAYER 2

WHAT NUCLEAR REACTION  
?9  
C 14

PLAYER 2

WHAT NUCLEAR REACTION  
?0

PLAYER 1'S SCORE IN MEV= 1.21  
PLAYER 2'S SCORE IN MEV= 8.36  
N 14

ISOTOPE COUNT= 5  
TRANSITIONS MADE= 4

DO YOU WANT A CHECKLIST DISPLAY  
?NO  
N 14

PLAYER 1

WHAT NUCLEAR REACTION  
?  
DONE

RUN  
BOLA

HOW MANY PLAYERS, 0, 1, OR 2  
?1  
IS THIS A TEST  
?NO

LI 7

WHAT NUCLEAR REACTION  
?2  
B 10

WHAT NUCLEAR REACTION  
?5  
B 9

SHORT-LIVED ISOTOPE.

BE 8

SHORT-LIVED ISOTOPE.

HE 4

O 17 NOT INCLUDED IN GAME ROUTE.  
YOU WENT TO HELIUM 4 TOO SOON  
GAME LOST

END OF GAME  
DO YOU WANT A FINAL DISPLAY  
?YES

|                |   |   |   |   |   |   |   |
|----------------|---|---|---|---|---|---|---|
| OXYGEN (O)     |   |   | 0 | 0 | 0 | 0 | 0 |
| NITROGEN (N)   |   |   | 0 | 0 | 0 | 0 | 0 |
| CARBON (C)     |   | 0 | 0 | 0 | 0 | 0 |   |
| BORON (B)      |   | 1 | 1 | 0 | 0 |   |   |
| BERYLLIUM (BE) | 0 | 0 | 1 | 0 |   |   |   |
| LITHIUM (LI)   | 0 | 0 | 1 |   |   |   |   |
| HELIUM (HE)    | 1 | 0 | 0 |   |   |   |   |

DONE

CALORI  
36314**TITLE:** CALORI: Calorimetry Experiment

**DESCRIPTION:** Calorimetry experiments are simulated by the computer permitting the student to enter the mass and temperatures of two quantities of water. The computer calculates and prints out the equilibrium temperature of the mixture. The student must then determine the heat energy, in calories, to be supplied (or removed) from each mass to obtain the equilibrium temperature.

OBJECTIVES:

- A. To acquaint the students with conservation of energy concepts involving calorimetry.
- B. To determine the equations governing these relationships.

**INSTRUCTIONS:** PRELIMINARY PREPARATION:

- A. Student - Must know definitions for calorie and specific heat.
- B. Materials - Table of Specific heats

DISCUSSION:

Calorimetry, in its simplest form, is presented as part of a class lesson. The concept of heat energy balance is developed by presenting several examples, with the computer, based on the definition of the "calorie". Specific heat is introduced by a similar approach (replacing the water of the initial examples, with alcohol; specific heat of 6 cal/gm-0°C.)

The program can be modified (with relative ease) to incorporate different materials or combinations of different materials.

When this program was used as an introduction to calorimetry, it was noted that many students were able to determine the equations describing the phenomenon by utilizing the stated results from the computer.

**ACKNOWLEDGEMENTS:** Huntington Project  
Polytechnic Institute of Brooklyn

RUN  
RUN  
CALORI

HEAT AND CALORIMETRY

\*\*\*\*\*

YOU HAVE TWO BEAKERS OF WATER .  
WHAT IS THE MASS (IN GRAMS) AND THE TEMP (IN DEGREES) OF THE  
WATER IN THE FIRST BEAKER?80,50

WHAT IS THE MASS (IN GRAMS) AND THE TEMP (IN DEGREES) OF THE  
WATER IN THE SECOND BEAKER?40,60

THE FINAL TEMPERATURE OF THE MIXTURE IS 53.33 DEGREES.

HOW MANY CALORIES WERE INVOLVED IN CHANGING THE TEMP OF  
THE FIRST BEAKER FROM 50 TO 53.33 DEGREES?260

YOU'RE CLOSE ENOUGH. THE CORRECT ANSWER IS 266.4 CALORIES.

HOW MANY CALORIES WERE INVOLVED IN CHANGING THE TEMP OF  
THE SECOND BEAKER FROM 60 TO 53.33 DEGREES?240

YOU'RE MORE THAN 3 PERCENT OFF. YOU SHOULD HAVE SAID  
266.8 CALORIES.

WANT TO TRY AGAIN (1=YES, 0=NO) : ?1  
CHOOSE A LIQUID : 0=WATER, 1=ALCOHOL. WHICH?1

\*\*\*\*\*

YOU HAVE TWO BEAKERS OF ALCOHOL .  
WHAT IS THE MASS (IN GRAMS) AND THE TEMP (IN DEGREES) OF THE  
ALCOHOL IN THE FIRST BEAKER?100,50

WHAT IS THE MASS (IN GRAMS) AND THE TEMP (IN DEGREES) OF THE  
ALCOHOL IN THE SECOND BEAKER?100,70

THE FINAL TEMPERATURE OF THE MIXTURE IS 60 DEGREES.

HOW MANY CALORIES WERE INVOLVED IN CHANGING THE TEMP OF  
THE FIRST BEAKER FROM 50 TO 60 DEGREES?610

YOU'RE CLOSE ENOUGH. THE CORRECT ANSWER IS 600 CALORIES.

HOW MANY CALORIES WERE INVOLVED IN CHANGING THE TEMP OF  
THE SECOND BEAKER FROM 70 TO 60 DEGREES?700

YOU'RE MORE THAN 3 PERCENT OFF. YOU SHOULD HAVE SAID  
600 CALORIES.

WANT TO TRY AGAIN (1=YES, 0=NO) : ?0

DONE

CHARG  
36621**TITLE:**

MILLIKAN'S OIL-DROP EXPERIMENT

**DESCRIPTION:**

This simulation of a modern version of the Millikan Oil Drop Experiment is designed to demonstrate to the student the existence of a discrete unit of electrical charge. CHARG (which was originally named CHARGE) was developed by the Huntington II Project at the State University of New York under the direction of Ludwig Braun. This work was partially supported by the National Science Foundation, Grant GW-5883.

**INSTRUCTIONS:**

The computer will request a new voltage or an option change by printing out " V = X? ", where X is the old voltage. After the question mark, you may either type in a new voltage between -1000 and +1000 volts, type in the old voltage again, or enter one of the following code numbers for an option to be performed.

- 2000 - to request calculation of charge for a drop with velocity = 0
- 3000 - to request a new batch of drops
- 4000 - to end the program

**SPECIAL  
CONSIDERATIONS:**

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                          |               |
|--------------------------|---------------|
| <b>Student Workbook</b>  | <b>\$ .30</b> |
| <b>Teachers Guide</b>    | <b>.30</b>    |
| <b>Resource Handbook</b> | <b>.50</b>    |

**ACKNOWLEDGEMENTS:**

Huntington II Project  
State University of New York



RUN

RUN  
CHARG

MILLIKAN OIL DROP EXPERIMENT

INSTRUCTIONS (1=YES, 0=NO)?1

INSTRUCTIONS -- AFTER EACH QUESTION MARK, (V= ?), YOU MAY:

TYPE IN VOLTAGE BETWEEN -1000 AND 1000 (IN ORDER TO MAKE THE VELOCITY PRINTED OUT AS CLOSE TO ZERO AS POSSIBLE), REQUEST CALCULATION OF CHARGE FOR STOPPED DROP (TYPE IN 2000), REQUEST NEW BATCH OF DROPS (TYPE IN 3000), OR END THE PROGRAM (TYPE IN 4000).

NO ELECTRIC FIELD

| DROP:                                              | 1     | 2     | 3     | 4     |
|----------------------------------------------------|-------|-------|-------|-------|
|                                                    | ---   | ---   | ---   | ---   |
| VELOCITY<br>(METERS/SEC)<br>( X 10 <sup>-6</sup> ) |       |       |       |       |
|                                                    | -29.9 | -30.3 | -30.5 | -30.3 |
| V= 0 ?100                                          | -10.9 | -11.5 | -16.4 | -30.3 |
| V= 100 ?150                                        | -1.5  | -2.1  | -9.3  | -30.3 |
| V= 150 ?151                                        | -1.3  | -1.9  | -9.2  | -30.3 |
| V= 151 ?160                                        | .4    | -.2   | -7.9  | -30.3 |
| V= 160 ?158                                        | .1    | -.6   | -8.2  | -30.3 |
| V= 158 ?157                                        | -.1   | -.8   | -8.4  | -30.3 |
| V= 157 ?157.5                                      | 0     | -.7   | -8.3  | -30.3 |
| V= 157.5 ?2000                                     |       |       |       |       |

CALCULATION FOR WHICH DROP?1

CHARGE ON DROP 1 IS 6.52 X 10<sup>-19</sup> COULOMBS.

|               |     |    |      |       |
|---------------|-----|----|------|-------|
| V= 157.5 ?164 | 1.2 | .6 | -7.4 | -30.3 |
| V= 164 ?162   | .8  | .2 | -7.7 | -30.3 |
| V= 162 ?161   | .6  | 0  | -7.8 | -30.3 |
| V= 161 ?2000  |     |    |      |       |

CALCULATION FOR WHICH DROP?2

CHARGE ON DROP 2 IS 6.37 X 10<sup>-19</sup> COULOMBS.

|             |      |     |      |       |
|-------------|------|-----|------|-------|
| V= 161 ?200 | 8    | 7.3 | -2.3 | -30.3 |
| V= 200 ?225 | 12.8 | 12  | 1.2  | -30.3 |

|        |       |      |      |    |       |
|--------|-------|------|------|----|-------|
| V= 225 | ?220  | 11.8 | 11.1 | .5 | -30.3 |
| V= 220 | ?216  | 11.1 | 10.3 | 0  | -30.3 |
| V= 216 | ?2000 |      |      |    |       |

## CALCULATION FOR WHICH DROP?3

CHARGE ON DROP 3 IS 4.75 X 10<sup>-19</sup> COULOMBS.

V= 216 ?3000

|          |        |       |       |      |      |
|----------|--------|-------|-------|------|------|
| DROP:    | 5      | 6     | 7     | 8    |      |
|          | ---    | ---   | ---   | ---  |      |
|          | 10.6   | -30.3 | -.2   | .7   |      |
| V= 216   | ?175   | 2.9   | -30.3 | -5.9 | -5.1 |
| V= 175   | ?165   | 1     | -30.3 | -7.3 | -6.5 |
| V= 165   | ?160   | .1    | -30.3 | -8.1 | -7.2 |
| V= 160   | ?161   | .2    | -30.3 | -7.9 | -7.1 |
| V= 161   | ?159   | -.1   | -30.3 | -8.2 | -7.4 |
| V= 159   | ?159.5 | 0     | -30.3 | -8.1 | -7.3 |
| V= 159.5 | ?2000  |       |       |      |      |

## CALCULATION FOR WHICH DROP?5

CHARGE ON DROP 5 IS 6.43 X 10<sup>-19</sup> COULOMBS.

|          |       |      |       |    |     |
|----------|-------|------|-------|----|-----|
| V= 159.5 | ?220  | 11.4 | -30.3 | .4 | 1.3 |
| V= 220   | ?217  | 10.8 | -30.3 | 0  | .9  |
| V= 217   | ?2000 |      |       |    |     |

## CALCULATION FOR WHICH DROP?7

CHARGE ON DROP 7 IS 4.73 X 10<sup>-19</sup> COULOMBS.

|        |       |      |       |     |    |
|--------|-------|------|-------|-----|----|
| V= 217 | ?213  | 10.1 | -30.3 | -.6 | .3 |
| V= 213 | ?211  | 9.7  | -30.3 | -.9 | 0  |
| V= 211 | ?2000 |      |       |     |    |

## CALCULATION FOR WHICH DROP?8

CHARGE ON DROP 8 IS 128.28 X 10<sup>-19</sup> COULOMBS.

V= 8 ?4000

DONE



**TITLE:**

SELF-CORRECTING CHEMISTRY TEST

**DESCRIPTION:**

This program generates a self-correcting Chemistry test. Ten questions are asked on the ideal gas law, then one mass problem (considered harder than the rest) is asked. This is followed by ten more gas law problems of a different type. The test is scored as follows: full value is given for a correct answer on the first try; if the first answer is within three of the correct answer, the student is given a second try for half value. Each section is valued at ten points. The sectional mark is given after each section, with the total correct out of thirty given at the end.

**INSTRUCTIONS:**

This program is almost completely self explanatory, therefore no instructions are needed. If any difficulty should arise, the user should be able to modify the program to suit his own particular needs.

**SPECIAL  
CONSIDERATIONS:**

This program will run on any 8K or larger HP computer, however if the 8K configuration is used, the matrix package of the BASIC interpreter must be deleted. This is because program "CHEM" requires more storage than what is available when the matrix package is retained.

FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Chemistry.

Student Background Required: Basic High School Chemistry

**ACKNOWLEDGEMENTS:**

Paul M. Dunphy  
Nova Scotia Eastern Institute of Technology

RUN

RUN  
CHEM

\*\*\*CHEM TEST\*\*\*

THERE ARE 3 PARTS: PART 1 IS ON THE IDEAL GAS LAW,  
PART 2 IS A MASS PROBLEM, AND PART 3 IS  
ALSO ON THE IDEAL GAS LAW.

DIRECTIONS: WHEN THE COMPUTER ASKS FOR THE ANSWER, TYPE IT  
IN, THEN PUSH 'RETURN'.

USE THE FOLLOWING FORMULA TO CALCULATE THE ANSWERS FOR PARTS  
1 AND 3:  $V_2 = V_1 * (P_1 / P_2) * (T_2 / T_1)$ . AT S.T.P.,  $P_1 = 760$  MM HG AND  
 $T_1 = 273$  DEGREES KELVIN.

YOUR MARK OUT OF 30 WILL BE GIVEN AT THE END.

VALUES: PART 1---10 QUESTIONS-1 POINT EACH.

PART 2---1 QUESTION-10 POINTS.

PART 3---10 QUESTIONS-1 POINT EACH.

PART 1

\*\*\*\*\*

\*\*\*\*\*

1 .IF A 453 ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.  
AND SUBJECTED TO 750 MM HG AND 285 DEGREES KELVIN WHAT WILL  
ITS FINAL VOLUME BE

?479

CORRECT-----1 POINT

\*\*\*\*\*

2 .IF A 453 ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.  
AND SUBJECTED TO 751 MM HG AND 287 DEGREES KELVIN WHAT WILL  
ITS FINAL VOLUME BE

?482

CLOSE, YOU ARE WITHIN 3 MLS, TRY AGAIN.

?481

CORRECT ON YOUR SECOND TRY-----1/2 POINT

\*\*\*\*\*

3 .IF A 454 ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.  
AND SUBJECTED TO 754 MM HG AND 295 DEGREES KELVIN WHAT WILL  
ITS FINAL VOLUME BE

?494

CORRECT-----1 POINT

\*\*\*\*\*

4 .IF A 457 ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.  
AND SUBJECTED TO 757 MM HG AND 298 DEGREES KELVIN WHAT WILL  
ITS FINAL VOLUME BE

?500

CORRECT-----1 POINT

\*\*\*\*\*

5 .IF A 461 ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.  
AND SUBJECTED TO 760 MM HG AND 299 DEGREES KELVIN WHAT WILL  
ITS FINAL VOLUME BE

?504

CORRECT-----1 POINT

\*\*\*\*\*

6 .IF A 470 ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.  
AND SUBJECTED TO 762 MM HG AND 305 DEGREES KELVIN WHAT WILL  
ITS FINAL VOLUME BE

?523

CORRECT-----1 POINT

\*\*\*\*\*

7 .IF A 470 ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.  
AND SUBJECTED TO 770 MM HG AND 313 DEGREES KELVIN WHAT WILL  
ITS FINAL VOLUME BE

?531

CORRECT-----1 POINT

\*\*\*\*\*

8 .IF A 473 ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.  
AND SUBJECTED TO 776 MM HG AND 320 DEGREES KELVIN WHAT WILL  
ITS FINAL VOLUME BE

?543

CORRECT-----1 POINT

\*\*\*\*\*

9 .IF A 478 ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.  
AND SUBJECTED TO 778 MM HG AND 326 DEGREES KELVIN WHAT WILL  
ITS FINAL VOLUME BE

?556

CLOSE, YOU ARE WITHIN 3 MLS, TRY AGAIN.

?557

CORRECT ON YOUR SECOND TRY-----1/2 POINT

\*\*\*\*\*

10 .IF A 481 ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.  
AND SUBJECTED TO 781 MM HG AND 332 DEGREES KELVIN WHAT WILL  
ITS FINAL VOLUME BE

?569

CORRECT-----1 POINT

\*\*\*\*\*

9 POINTS OUT OF 10

\*\*\*\*\*

YOU HAVE NOW COMPLETED PART 1. IF YOU WISH TO TRY IT  
AGAIN WITH THE SAME VALUES, TYPE '2'. IF YOU WANT TO  
TRY IT AGAIN WITH DIFFERENT VALUES, TYPE '1'. IF YOU  
WANT TO PROCEED WITH THE REST OF THE TEST, TYPE '0'.  
IF YOU DON'T WANT TO DO ANY MORE, TYPE '3'.

?0

\*\*\*\*\*END OF PART 1\*\*\*\*\*

\*\*\*\*\*

#### PART 2

\*\*\*\*\*

IN THE FOLLOWING REACTION:  
 $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$  (SODIUM HYDROXIDE + HYDROCHLORIC  
ACID YIELDS SODIUM CHLORIDE AND WATER), HOW MUCH  
SODIUM HYDROXIDE (IN GRAMS) IS NEEDED TO PRODUCE  
470 GRAMS OF SODIUM CHLORIDE?

ATOMIC WEIGHTS: 1. SODIUM=22.98  
2. CHLORINE=35.45  
3. HYDROGEN=1.0079  
4. OXYGEN=15.99

HOW MANY GRAMS

?685

YOU ARE WITHIN 10 GRAMS, TRY AGAIN FOR 1/2 VALUE.

?683

SORRY, YOU ARE WRONG AGAIN, CORRECT ANSWER IS 686 GRAMS

\*\*\*\*\*END OF PART 2\*\*\*\*\*

\*\*\*\*\*

YOU HAVE NOW COMPLETED PART 2. TO CONTINUE, TYPE '0'.  
TO END HERE, TYPE '1'.

?0

\*\*\*\*\*

#### PART 3

\*\*\*\*\*

THE FOLLOWING TEST IS THE SAME AS IN PART 1  
EXCEPT THAT THE GAS IS NOT COLLECTED AT S.T.P

\*\*\*\*\*

1 .IF A 342 ML SAMPLE OF GAS IS COLLECTED AT 753 MM HG AND  
376 DEGREES KELVIN, THEN SUBJECTDD TO 739 MM HG  
AND 230 DEGREES KELVIN  
WHAT WILL ITS FINAL VOLUME BE

?213

CORRECT-----1 POINT

\*\*\*\*\*

2 .IF A 343 ML SAMPLE OF GAS IS COLLECTED AT 760 MM HG AND  
383 DEGREES KELVIN, THEN SUBJECTDD TO 746 MM HG  
AND 233 DEGREES KELVIN  
WHAT WILL ITS FINAL VOLUME BE  
?212

CORRECT-----1 POINT

\*\*\*\*\*

3 .IF A 348 ML SAMPLE OF GAS IS COLLECTED AT 761 MM HG AND  
385 DEGREES KELVIN, THEN SUBJECTDD TO 749 MM HG  
AND 233 DEGREES KELVIN  
WHAT WILL ITS FINAL VOLUME BE  
?213

CORRECT-----1 POINT

\*\*\*\*\*

4 .IF A 350 ML SAMPLE OF GAS IS COLLECTED AT 764 MM HG AND  
385 DEGREES KELVIN, THEN SUBJECTDD TO 757 MM HG  
AND 236 DEGREES KELVIN  
WHAT WILL ITS FINAL VOLUME BE  
?219

CLOSE, YOU ARE WITHIN 3 MLS, TRY AGAIN.

?218

SORRY, YOU ARE WRONG AGAIN, THE CORRECT ANSWER IS 216 MLS.

\*\*\*\*\*

5 .IF A 350 ML SAMPLE OF GAS IS COLLECTED AT 768 MM HG AND  
393 DEGREES KELVIN, THEN SUBJECTDD TO 765 MM HG  
AND 243 DEGREES KELVIN  
WHAT WILL ITS FINAL VOLUME BE  
?226

WRONG, THE CORRECT ANSWER IS 217 MLS

\*\*\*\*\*

6 .IF A 359 ML SAMPLE OF GAS IS COLLECTED AT 777 MM HG AND  
402 DEGREES KELVIN, THEN SUBJECTDD TO 774 MM HG  
AND 244 DEGREES KELVIN  
WHAT WILL ITS FINAL VOLUME BE  
?218

CORRECT-----1 POINT

\*\*\*\*\*

7 .IF A 362 ML SAMPLE OF GAS IS COLLECTED AT 778 MM HG AND  
404 DEGREES KELVIN, THEN SUBJECTDD TO 778 MM HG  
AND 245 DEGREES KELVIN  
WHAT WILL ITS FINAL VOLUME BE  
?219

CORRECT-----1 POINT

\*\*\*\*\*

8 .IF A 366 ML SAMPLE OF GAS IS COLLECTED AT 779 MM HG AND  
406 DEGREES KELVIN, THEN SUBJECTDD TO 787 MM HG  
AND 252 DEGREES KELVIN  
WHAT WILL ITS FINAL VOLUME BE  
?224

CORRECT-----1 POINT

\*\*\*\*\*

9 .IF A 373 ML SAMPLE OF GAS IS COLLECTED AT 779 MM HG AND  
407 DEGREES KELVIN, THEN SUBJECTDD TO 791 MM HG  
AND 255 DEGREES KELVIN  
WHAT WILL ITS FINAL VOLUME BE  
?230

CORRECT-----1 POINT

\*\*\*\*\*

10 .IF A 379 ML SAMPLE OF GAS IS COLLECTED AT 781 MM HG AND  
412 DEGREES KELVIN, THEN SUBJECTDD TO 796 MM HG  
AND 264 DEGREES KELVIN  
WHAT WILL ITS FINAL VOLUME BE  
?238

CORRECT-----1 POINT

\*\*\*\*\*

8 POINTS OUT OF 10

\*\*\*\*\*

YOUR MARK IS 17 OUT OF 30.

\*\*\*\*\*THE END\*\*\*\*\*

DONE

CONTRIBUTED PROGRAM **BASIC**

CHEM1  
36878

**TITLE:** CAI IN CHEMISTRY

**DESCRIPTION:** This package includes four programs, CHEM1, CHEM2, INPUT and TEACH. Also included are 3 exercise files, EX1, EX2 and EX3. CHEM1 is a general CAI program which conducts exercises requiring the user to respond with alphanumeric short answers. CHEM2 is similar to CHEM1 except that the response may contain different parts or terms separated by '+'. Each part of the user's response is checked separately. Only one multiple term answer is correct.

**INSTRUCTIONS:** Both programs are very similar except for one significant difference. CHEM1 is designed to accept one short answer in response to a question. CHEM2 is designed to accept one answer, but this answer of multiple parts is the only one that is acceptable. For example, in the identification of elements and compounds (CHEM1), the compound HCl may be identified as hydrogen chloride or hydrochloric acid. Both are correct. On the other hand, in chemical reactions there may be many products. (CHEM2)

$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

The second program (CHEM2) breaks the response into the various parts of the answer: CO2 and 2H2O. Then it compares each against the various parts of the correct answer.

None of the questions and answers are retained in the programs but are saved separately in an Exercise file. The user selects the exercise he wishes to work on when either program is run.

The Exercise File

An exercise may have levels of difficulty (or levels corresponding to different aspects of the same topic). If the exercise is multi-level, the computer will request the user to specify the level he wishes to work on. Afterwards, only questions from that level will be used in the exercise.

In some instances, it is advantageous to be able to interchange the questions and answers. For example, in the identification of elements and compounds, the user is able to specify whether he wants the symbol or the name of the substance to be given as the questions to which he will respond the reverse. This capability is referred to throughout as the 'order option'. If the exercise allows the order option, then the user is requested to specify the order.

CONTINUED ON NEXT PAGE.

**SPECIAL CONSIDERATIONS:** When running the program do NOT interrupt the normal course of execution. If you must halt the program type 'STOP' in response to a question in the exercise. The program will then exit in the quickest way possible. The teacher's record is written in the last part of the program, so if you stop it before it reaches that portion of the program, there will be no record of your work.

**ACKNOWLEDGEMENTS:** J. Glenn Allan  
University of Lethbridge  
Alberta, Canada



INSTRUCTIONS: Continued.

Any exercise file may contain 128 records which is space for approximately 250 or 300 questions.

#### Initialization

The initialization routine consists of a series of questions which the computer asks the user. First, the user must give his name and the name of the exercise he wishes to work on. At the beginning of the exercise file, the levels and the order option are specified. If the file is multi-level, the computer requests the level. If the order option is available, it is also asked. Once this information is supplied the exercise is ready to begin.

#### Main Exercise

If the user fails to respond the correct answer, the computer prints the correct answer and types over the answer until it is illegible. Then the computer selects another question and continues the exercise.

#### Retest

When all the questions in the main exercise (that level) have been exhausted, the computer automatically begins the retest. The computer searches all the questions to find those that were missed and asks them again. Now the user only has one chance to get the question right.

#### Finalization

After the retest, the computer calculates the scores on both the main exercise and retest and prints them for the user. It then writes all pertinent information about the user and his performance on a record file for the instructor's use. The program then stops.

#### The Record File and the Teacher's Program

In the initialization, the user gives information which is stored. The information on the user is listed below:

- Users Name
- The Exercise
- Level
- Order (if any)
- Date
- Time (start and finish)
- Elapsed Run Time
- Number of Questions in Main Exercise and Retest
- Scores on Main Exercise and Retest

There is a record file called RECI on which this information is stored. This file must be opened by the user.

To start the program type 'RUN' and then wait for instructions. First will come the 'STUDENT INFORMATION'. When the computer types 'YOUR NAME : ?', type your name in the following way. DO NOT USE ANY COMMAS!

EXAMPLE:

If your name happens to be John D. Smith, type your last name first followed by your first and middle initials.

YOUR NAME : ? SMITHJD

The computer will then ask 'TOPIC : ?' to which you must respond the name of the exercise your wish to work on.

There may be an option available to you in respect to which order you want the questions presented. If it is a French vocabulary exercise, you may have to option of having the question be either the English or the French word to which you will respond the other. If such an option is available, the next thing that will appear is the question 'ORDER'. The options will be printed in brackets. You must then type one or the other option. It might appear like this:

ORDER [FRENCH OR ENGLISH] : ? FRENCH

Some exercises may be multi-level. That is, you have the choice of working on different levels of difficulty or, depending on the arrangement of the exercise, on different aspects of the same topic. If this option is available to you, the next line the computer will type will be 'LEVEL -- (1 to 4) --?'. This means that there are four (4) levels in the exercise. You must now select a level number by typing either 1,2,3 or 4. You should not use anything but a whole number. If the levels denote difficulty, the easiest level will be level 1 and the most difficult will be level 4.

INSTRUCTIONS: Continued.



EXAMPLE: LEVEL--(1 to 6)--? 6

With the above example, you have selected the most difficult level.

A list of legal commands which you may use will now be printed for you. These commands can be used at any time during the Main Exercise in response to a question. Here is the list of those commands

WRONG,END,STOP,LEVEL,SCORE,TIME,NUMBER,ORDER,RTIME,REPEAT,IDENT

Each command is explained below:

#### WRONG

For every question in the Main Exercise you have 3 tries at the correct answer. If a question appears to which you don't have the slightest idea what the answer is, just type 'WRONG'. The remainder of your tries will be skipped. The computer will score you incorrect on the question and immediately proceed to the next question. If there is a chance that you might get the answer don't use this command.

#### END

If you wish to end the main exercise before you have exhausted all the questions, type 'END'. This will tell the computer that you don't wish to continue in the main exercise routine but wish to start finishing up (RETEST).

The computer will then proceed to retest you on all the questions you missed in the Main Exercise. You have only one chance at each question. At the end of the retest, your score on the Main Exercise as well as your score on the retest will be given.

If you exhaust the questions without typing 'END', the computer will automatically go into the retest.

#### STOP

A time may arise when you must stop the program immediately during the Main Exercise or the Retest. In response to a question, type 'STOP' and the program will finish up as soon as possible. If you stop the program by some other means, the record of your work will not be written.

#### LEVEL

Perhaps you are working on a multi-level exercise. You find that the level is either too difficult or too easy. You may change the level during the Main Exercise by typing 'LEVEL' in response to a question. The computer will write your present score on your record and then ask you for your 'NEW LEVEL --?'. Type the number (integer, please) of the new level and the exercise will begin again. If you have incorrectly asked for a level which does not exist, the computer will tell you so and ask you again. If the exercise is not multi-level, the computer will tell you so and the exercise will resume where you left off.

#### SCORE

If you are curious about your score while you are working on the Main Exercise, type 'SCORE' in response to a question. The computer will give it to you. It will then resume with the next question.

#### TIME

By typing 'TIME', the computer will tell you the time at which you started the program and the present time. If you don't have a watch, this is one way to find out if you are late to your next class. The computer will then resume with the next question.

#### NUMBER

The number of questions in the exercise (all levels), the number of questions in the present level, and the number of questions that have been asked to date can be found by typing 'NUMBER' in response to a question. Like above, the computer will then restate the present question.

#### ORDER

If the order option is available (Remember the French-to-English example?), you may change it in the middle of the Main Exercise just as you can the level by typing 'ORDER'. Your present score will be recorded on your record and then the computer will request the new order. Then the Main Exercise will begin again. If the order option is not available, the computer will state that and resume the Main Exercise where you left off. If you mistype the new order or give an order not allowed, it will ask you to repeat it.

INSTRUCTIONS: Continued.

### RTIME

The elapsed running time will be printed for you if you type 'RTIME' in response to a question. This is the amount of time the computer has spend in executing the program. The program takes over a second of run time to get started. The run time required to process your answers will be very small in comparison.

### REPEAT

Sometimes the ribbons on these machines get worn. Perhaps you can't read part of the question for one reason or another. You don't have to make a stab in the dark. Type 'REPEAT' and the computer will repeat the question.

### IDENT

The program command 'IDENT' can be used in place of a response. The following information will be given:

EXAMPLE:

```
NAME: SMITHJD
TOPIC: ELEMENTS
ORDER: SYMBOL
LEVEL: 3
# OF QUESTIONS ASKED: 12
SCORE: 83%
BEGAN AT 09:39:27
TIME IS 09:45:25
ELAPSED TIME (RUN): 1.568 (to nearest 1/64 or a second)
```

After the IDENT information is given, the program will repeat the present question.

### RUN

CRE-EX1,15,64

```
GET-INPUT
5 FILES EX1
RUN
INPUT
```

THIS PROGRAM WRITES THE FILES FOR USE WITH CHEM1 AND CHEM2  
MAKE SURE A FILE HAS BEEN OPENED AND DECLARED IN STATEMENT  
FIVE OF THIS PROGRAM.

```
IS THERE ORDER?YES
WHAT IS THE FIRST ITEM?SYMBOL
AND THE SECOND?NAME
HOW MANY LEVELS ARE THERE?4
HOW MANY QUESTIONS IN LEVEL 1      ?25
HOW MANY QUESTIONS IN LEVEL 2      ?25
HOW MANY QUESTIONS IN LEVEL 3      ?25
HOW MANY QUESTIONS IN LEVEL 4      ?26
INPUT TO LEVEL 1
FIRST ITEM
?AG
# ANSWERS?1
# 1    ?SILVER
FIRST ITEM
?AL
# ANSWERS?1
# 1    ?ALUMINUM
FIRST ITEM
?AR
# ANSWERS?1
# 1    ?ARGON
```

FIRST ITEM  
?AU  
# ANSWERS?1  
# 1 ?GOLD  
FIRST ITEM  
?B  
# ANSWERS?1  
# 1 ?BORON  
FIRST ITEM  
?BR  
# ANSWERS?1  
# 1 ?BROMINE  
FIRST ITEM  
?C  
# ANSWERS?1  
# 1 ?CARBON  
FIRST ITEM  
?CA  
# ANSWERS?1  
# 1 ?CALCIUM  
FIRST ITEM  
?CL  
# ANSWERS?1  
# 1 ?CHLORINE  
FIRST ITEM  
?CU  
# ANSWERS?1  
# 1 ?COPPER  
FIRST ITEM  
?F  
# ANSWERS?1  
# 1 ?FLORINE  
FIRST ITEM  
?FE  
# ANSWERS?1  
# 1 ?IRON  
FIRST ITEM  
?H  
# ANSWERS?1  
# 1 ?HYDROGEN  
FIRST ITEM  
?HE  
# ANSWERS?1  
# 1 ?HELIUM  
FIRST ITEM  
?HG  
# ANSWERS?1  
# 1 ?MERCURY  
FIRST ITEM  
?I  
# ANSWERS?1  
# 1 ?IODINE  
FIRST ITEM  
?K  
# ANSWERS?1  
# 1 ?POTASSIUM  
FIRST ITEM  
?N  
# ANSWERS?1  
# 1 ?NITROGEN  
FIRST ITEM  
?NA  
# ANSWERS?1  
# 1 ?SODIUM  
FIRST ITEM  
?NI  
# ANSWERS?1  
# 1 ?NICKEL

CRE-RECL,15,64,  
GET-CHEM1 .  
RUN  
CHEM1

GENERAL IDENTIFICATION PROGRAM

IF YOU WANT INSTRUCTIONS TYPE 'STOP' AFTER THE QUESTION  
MARK AND CONSULT DOCUMENTATION. OTHERWISE, INPUT 'GO'  
AFTER THE QUESTION MARK?GO

STUDENT INFORMATION

YOUR NAME :?SMITHHD  
CHOOSE TOPIC 2 OR 3. WHICH DO YOU WANT?2  
ORDER (SYMBOL OR NAME):?SYMBOL  
LEVEL -- (1 TO 4 ) --?1  
LIST OF COMMANDS:  
WRONG--END--STOP--LEVEL--SCORE--TIME--NUMBER--ORDER--RTIME--REPEAT--  
IDENT--

MAIN EXERCISE

QUEST. # 1 :U?CH--URANIUM  
QUEST. # 2 :B?BORIUM  
----- MISPELLED.  
TRY AGAIN?BORON  
QUEST. # 3 :F?FLURO-INE  
----- MISPELLED.  
TRY AGAIN?FLORINE  
QUEST. # 4 :N?NITROGEN  
QUEST. # 5 :CA?CADIUM  
TRY AGAIN?CADMIUM  
----- MISPELLED.  
TRY AGAIN?CALCIUM  
QUEST. # 6 :I?IODINE  
QUEST. # 7 :AG?SILVER  
QUEST. # 8 :AU?GOLD  
QUEST. # 9 :CL?CLORINE  
TRY AGAIN?CHLORINE  
QUEST. # 10 :K?POTASSIUM  
QUEST. # 11 :BR?BROMIDE  
----- MISPELLED.  
TRY AGAIN?BROMINE  
QUEST. # 12 :SI?SILICON  
QUEST. # 13 :AR?ARGON  
QUEST. # 14 :HE?HELIUM  
QUEST. # 15 :C?CARBON  
QUEST. # 16 :FE?IRON  
QUEST. # 17 :H?HYDROGEN  
QUEST. # 18 :AL?ALUMINUM  
QUEST. # 19 :HG?MERCURY  
QUEST. # 20 :O?OXYGEN  
QUEST. # 21 :NA?SODIUM  
QUEST. # 22 :NI?NICKEL  
QUEST. # 23 :ZN?ZINC  
QUEST. # 24 :CU?COPPER  
QUEST. # 25 :S?SULPHUR  
----- MISPELLED.  
TRY AGAIN?SULFUR  
YOU MISSED NO QUESTIONS -- PERFECT SCORE

THE DRILL IS OVER

MAIN DRILL 25 CORRECT OUT OF 25 FOR SCORE OF 100 %

REDRILL: 0 CORRECT OUT OF 0 FOR SCORE OF 100 %

GOODBYE

DONE

CRE-CHEM,14,64

RUN  
CHEM2GENERAL IDENTIFICATION PROGRAM  
-----

IF YOU WANT INSTRUCTIONS TYPE 'STOP' AFTER THE QUESTION  
MARK AND CONSULT DOCUMENTATION. OTHERWISE, INPUT 'GO'  
AFTER THE QUESTION MARK?GO

STUDENT INFORMATION  
-----

YOUR NAME :?JONES,HD  
CHOOSE TOPIC 2 OR 3 OR 4. WHICH DO YOU WANT?4  
LEVEL -- (1 TO 4 ) --?1  
LIST OF COMMANDS:  
WRONG--END--STOP--LEVEL--SCORE--TIME--NUMBER--ORDER--RTIME--REPEAT--  
IDENT--

MAIN EXERCISE  
-----

QUEST. # 1 :H2CO + O2?WRONG  
CORRECT ANSWER --XXXXXXXXXXXXXXXXXXXXXXXXXXXX  
QUEST. # 2 :CH4 + 2O2?REPEAT  
QUEST. # 2 :CH4 + 2O2?LEVEL

NEW LEVEL --?4  
LEVEL CHANGED -- NEW BALL GAME

MAIN EXERCISE  
-----

QUEST. # 1 :2NA(S) + 2H2O?SCORE

0 OUT OF 0  
OVERFLOW - WARNING ONLY IN LINE 1870

OVERFLOW - WARNING ONLY IN LINE 1870  
1.70141E+38 %

QUEST. # 1 :2NA(S) + 2H2O?TIME

BEGAN AT: 24 MIN. 11 HRS. 105 DAYS.  
TIME NOW IS: 27 MIN. 11 HRS. 105 DAYS.

QUEST. # 1 :2NA(S) + 2H2O?NUMBER

TOTAL # OF QUESTIONS : 47  
# OF QUESTIONS IN LEVEL 4 : 6  
# OF QUESTIONS ASKED : 1

QUEST. # 1 :2NA(S) + 2H2O?ORDER

ORDER CAN'T BE CHANGED -- SORRY

QUEST. # 1 :2NA(S) + 2H2O?RTIME

ELAPSED RUN TIME : 3 MIN.

QUEST. # 1 :2NA(S) + 2H2O?IDENT

NAME : JONES,HD  
TOPIC : 4  
ORDER : NONE  
LEVEL : 4  
# OF QUESTIONS ASKED : 1  
SCORE : 100  
BEGAN AT : 24 MIN. 11 HRS. 105 DAYS.  
TIME IS : 27 MIN. 11 HRS. 105 DAYS.  
ELAPSED RUN TIME : 3 MIN.



CONTRIBUTED PROGRAM **BASIC**CLIMAT  
36760

## CLIMATE TEACHING PROGRAM

**TITLE:****DESCRIPTION:**

There are 10 programs in this package: CL1Z1, CL1Z2, CL2Z1, CL2Z2, CL3Z1, CL3Z2, CL4Z1, CL5Z1 and CL5Z2. They form a series of conversational teaching programs on climate classification, adapted from Dartmouth College's Kiewit Computation Center programs CLIMAT-1 through CLIMAT-5. Programs use temperature and rainfall data from well-known locations in the world and ask the user to give the geographical locations of the stations. Koppen symbols are used extensively.

**INSTRUCTIONS:**

The programs are completely conversational. The user accesses each of the five main programs (i.e., CL1-1, CL2-1, etc.). Chaining is automatic to the second program of each of the five main programs.

Create file SCRA 10 records long.

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES:  
Suitable courses: Courses requiring knowledge of climate classification  
Student background required: University level Geography

**ACKNOWLEDGEMENTS:**

Harry Lilleniit  
University of Lethbridge, Canada



RUN

CRE-SCRA,50  
GET-CL1Z1  
RUN  
CL1Z1

HI, I AM CALLED MISS TELETYPE - WHAT WOULD YOU LIKE ME TO CALL YOU?PETE

HELLO, PETE! WELCOME TO THE WORLD OF COMPUTER ASSISTED INSTRUCTION. TOGETHER WE WILL LEARN THE LOGIC OF LOCATING A SET OF CLIMATE DATA ON THE GLOBE AND ALSO LEARN TO IDENTIFY THE APPROPRIATE KOPPEN SYMBOLS.

IN THE FOLLOWING CLIMATE DATA MONTHLY AVERAGE TEMPERATURES AND THE MONTHLY AVERAGE RAINFALL FOR A SPECIFIC STATION ARE GIVEN IN FAHRENHEIT AND INCHES. I WILL ASK A NUMBER OF QUESTIONS ABOUT THE DATA AND YOU WILL PLEASE ANSWER IN YOUR OWN WORDS. IF YOU DON'T UNDERSTAND OR NEED HELP - JUST LET ME KNOW. YOU ARE LIMITED TO A SINGLE LINE FOR EACH ANSWER!!!!

TEMPERATURE THEN RAINFALL BY MONTHS

| J.,  | F.,  | M.,  | A.,  | M.,  | J.,  | J.,  | A.,  | S.,  | O.,  | N.,  | D.  |
|------|------|------|------|------|------|------|------|------|------|------|-----|
| 17,  | 18,  | 28,  | 42,  | 55,  | 63,  | 69,  | 66,  | 59,  | 48,  | 34,  | 21  |
| 2.6, | 2.3, | 2.6, | 2.3, | 3.2, | 3.4, | 3.5, | 3.6, | 3.1, | 3.1, | 2.7, | 2.6 |

YEARLY AVERAGE TEMP. 43.1 DEGREES F.  
YEARLY RAINFALL TOTAL 35.6 INCHES

STUDY VERY CAREFULLY THE TEMPERATURE RANGE - NOTE THE MONTHS OF MAXIMUM AND OF MINIMUM READINGS. THIS IS A REAL PLACE.

IN WHICH HEMISPHERE IS THE STATION LOCATED?NORTHERN

GOOD - YOU KNEW BECAUSE JAN. IS COLD WHILE JULY IS QUITE WARM NOW TELL ME ABOUT THE RELATIVE LATITUDE WITHIN THE N. HEMISPHERE ?60

WHAT I REALLY WANT TO KNOW IS THIS. IS THE STATION IN THE POLAR, MID-LATITUDE OR EQUATORIAL REGION ?MID-LAT

VERY GOOD, PETE. YOU KNEW BECAUSE OF THE QUITE LARGE TEMP. RANGE AND WARM SUMMERS - MARKED SEASONALITY. WITHIN THIS MID-LATITUDE REGION IS THE STATION CLOSER TO THE POLEWARD OR TO THE EQUATORIAL INFLUENCE?POLE

PETE, YOU ARE DOING WELL. YOU KNEW BECAUSE WINTERS ARE COLD AND SUMMERS NOT REALLY HOT. BY THE WAY, ARE THE TERMS 'SUMMER' AND 'WINTER' CLEAR IN YOUR MIND? PLEASE WRITE A DEFINITION OF THE TERM 'SUMMER' ?JUNE,JULY,AUG

A WORKING DEFINITION FOR OUR USE MIGHT BE; 'THAT HALF OF THE YEAR WHEN THE NOONDAY RAYS OF THE SUN MOST NEARLY APPROACH THE VERTICAL - OR, MORE ROUGHLY, THE WARMEST HALF OF THE YEAR.

IN CHICAGO, ROME AND SHANGHAI THE SUMMER HALF OF THE YEAR EXTENDS FROM APRIL THROUGH SEPTEMBER.

IN BUENOS AIRES, JOHANNESBURG AND MELBOURNE SUMMER HALF OF THE YEAR EXTENDS?OCTOBER THRU MARCH

PERFECT, PETE. I GUESS YOU REALLY DO UNDERSTAND THE TERMS NOW BACK TO THE ORIGINAL PROBLEM; OUR STATION IS:  
NORTHERN HEMISPHERE  
UPPER MID-LATITUDES

FROM YOUR KNOWLEDGE OF THE WORLD MAP YOU KNOW THAT A LARGE CONTINENT IS INVOLVED.  
PLEASE COMMENT ON THE RELATIVE LOCATION ON THIS CONTINENT OF OUR STATION  
?COAST

TOUCHE - MARINE INFLUENCE IS INDICATED BY THE RAINFALL PATTERN  
HOWEVER, YOU FORGOT TO TELL ME WHICH COAST  
?WEST

AT A WEST COAST LOCATION IN THE MID-LATITUDES THE RAINFALL  
ALWAYS SHOWS A MARKED CONCENTRATION IN THE WINTER MONTHS  
IS THIS THE CASE AT OUR STATION? TRY AGAIN  
?EAST

EXCELLENT, PETE. I ASSUME YOU CHOSE AN EAST COAST LOCATION  
BECAUSE OF THE FAIRLY HIGH RAINFALL AND ITS EVEN DISTRIBUTION  
FROM SEASON TO SEASON.

AS YOU STUDY THE MAP YOU WILL REALIZE THAT YOU HAVE LIMITED  
THE POSSIBLE LOCATION OF OUR STATION TO NORTHEASTERN NORTH  
AMERICA OR NORTHEASTERN ASIA. WHICH OF THESE IS CORRECT  
?NORTH AMERICA

I ASSUME THAT YOU CHOSE NORTH AMERICA BECAUSE OF THE LACK OF  
MONSOON RHYTHM IN THE RAINFALL PATTERN. IF I'M RIGHT, PETE  
YOU ARE DOING BRILLIANTLY.

NOW LET'S TRY GETTING THE CORRECT KOPPEN CLASSIFICATION  
FOR THE STATION THE DATA FOR WHICH APPEARED ABOVE  
IS THE STATION HUMID OR ARID  
?HUMIS-D

HUMID CLIMATES (IN THE KOPPEN SYSTEM) ARE:

- 'A' (ALL MONTHS ABOVE 64.4 F.)
- 'C' (ALL MONTHS WARMER THAN 26.6 F.)
- 'D' (AT LEAST ONE MONTH BELOW 26.6 F.)
- 'E' (ALL MONTHS 50 F. OR COLDER)

WHICH IS THE CORRECT FIRST LETTER IN THIS CASE?D

GOOD - CLEARLY OUR STATION HAS A SEVERE WINTER WITH TEMPS.  
WELL BELOW 26.6 DEGREES BUT WITH SUMMER TEMPS. ABOVE 50 F.

SECOND LETTER CHOICES REFER TO THE RAINFALL PATTERN:

- 'S' (SUMMER DROUGHT)
- 'W' (WINTER DROUGHT)
- 'F' (HUMID ALL YEAR WITH NO MARKED DROUGHT)

WHICH OF THESE CHOICES BEST FITS OUR STATION?F

FINE, PETE - YOU CHOSE 'F' BECAUSE OF THE VERY EVEN  
DISTRIBUTION OF THE RAINFALL AND THE LACK OF A MARKED DRY SEASON

THIRD LETTER CHOICES REFER TO TEMPERATURE EXTREMES:

THIRD LETTER POSSIBILITIES FOR 'D' CLIMATES ARE:

- 'A' (AT LEAST ONE MONTH WARMER THAN 71.6 F.)
- 'B' (>3 MONTHS WARMER THAN 50 F. NONE ABOVE 71.6 F.)
- 'C' (<4 MONTHS WARMER THAN 50 F.)
- 'D' (AT LEAST 1 MONTH COLDER THAN -36.4 F.)

WHICH OF THESE IS MOST APPROPRIATE?B

EXCELLENT, JULY, THE WARMEST MONTH, IS COOLER THAN 71.6 F. AND  
THERE ARE MORE THAN THREE MONTHS WARMER THAN 50 F.

NOW, PETE, YOU KNOW THE CLIMATE IS 'DFB'

YOU ALSO KNOW THAT THE LOCATION IS:

- NORTHERN HEMISPHERE
- UPPER MID-LATITUDES
- NEAR THE EAST COAST AND IN
- NORTH AMERICA

NOW, ALL THAT IS LEFT IS TO NAME THE TOWN(OR CITY) AND THE  
STATE (OR PROVINCE)!

?NOVA SCOTIA, CANADA

WELL, MY MAP SAYS THAT YOUR GUESS IS NOT BAD - BUT JULY  
TEMPS. AT NOVA SCOTIA, CANADA WOULD BE A BIT COOLER  
THAN AT OUR STATION. MOVE SOUTH.

?BOSTON, MASS

BOSTON, MASS IS SOUTH OF OUR STATION BY ABOUT 150 MILES.  
FIND A PLACE FURTHER TO THE NORTH.  
?HANOVER, NEW HAMPSHIRE

PERFECT - THAT WASN'T HARD WAS IT!

SO LONG FOR NOW, PETE, PLEASE GIVE ME A CALL AGAIN - SOON

DONE

GET-CL5Z1  
RUN  
CL5Z1

HELLO AND WELCOME TO THE 5TH LESSON ON CLIMATOLOGY

YOU KNOW WHO I AM BUT I DON'T KNOW WHO YOU ARE. WHAT MAY  
I CALL YOU?PETE

HELLO, PETE. I WILL GIVE YOU SOME INFORMATION AND THEN ASK  
A QUESTION OR TWO. YOU RESPOND BRIEFLY AND IN YOUR OWN WORDS.

IN THE FOLLOWING CLIMATE DATA MONTHLY AVERAGE TEMPERATURES  
AND THE MONTHLY AVERAGE RAINFALL FOR A SPECIFIC STATION ARE  
GIVEN IN FAHRENHEIT AND INCHES. YOU WILL ANSWER A NUMBER OF  
QUESTIONS ABOUT THIS STATION AND OTHER PLACES WITH SIMILAR  
RAINFALL AND TEMPERATURE PATTERNS. IF YOU ARE STUCK ON THE  
ANSWER TO A QUESTION, JUST TELL ME OR ASK FOR HELP.

J., F., M., A., M., J., J., A., S., O., N., D.

74, 74, 70, 64, 58, 54, 52, 54, 57, 61, 67, 71  
0.7, 0.8, 1.0, 1.7, 2.7, 3.1, 2.6, 2.4, 2.1, 1.7, 1.1, 0.9

YEARLY AVERAGE TEMP. 60.5 DEGREES F.  
YEARLY RAINFALL TOTAL 20.8 INCHES

STUDY VERY CAREFULLY THE TEMPERATURE RANGE - NOTE THE MONTH  
OF MINIMUM TEMP. AND THE PERIOD OF MAXIMUM TEMP. NOTE  
ALSO THE SEASONAL DISTRIBUTION OF RAINFALL. THIS IS A REAL  
PLACE, AT AN ELEVATION OF LESS THAN 500 FEET.

DO YOU JUDGE THIS STATION TO BE NORTH OR SOUTH OF THE EQUATOR  
?SOUTH

RIGHT - BUT THAT WASN'T HARD - NOW GIVE ME THE APPROXIMATE  
LATITUDE OF THE STATION. (PLEASE USE DIGITS ONLY)

?40

YOU ARE IN THE BALL PARK - THE STATION IS INDEED BETWEEN 30  
AND 40 SOUTH LAT. IN THIS CASE IT IS AT ALMOST EXACTLY  
35 DEGREES. PETE, YOU ARE DOING WELL SO FAR.

WHICH OF THE FOLLOWING AMERICAN CITIES IS THE BEST ANALOGUE  
TO THE STATION GIVEN ABOVE?

ATLANTA, EL PASO, OR SANTA BARBARA

?SANTA BARBARA

EXCELLENT, PETE, THIS IS CLEARLY A WEST COAST LOCATION.

NOW, PETE, IF YOU WERE TO TAKE A SWIM IN THE OCEAN AT OUR  
STATION YOU WOULD DISCOVER THE WATER TEMPERATURE TO BE  
RELATIVELY (FILL IN AN APPROPRIATE WORD)  
?WARM

ONE OF THE CHARACTERISTICS OF THIS CLIMATE TYPE IS THAT THE ADJACENT OCEAN CURRENT IS COOL. THIS HELPS TO ACCOUNT FOR THE LOW SUMMER RAINFALL.

NOW, PETE, DURING THE WINTER SEASON (MAY, JUNE, JULY, AUG.) THE PREVAILING WIND AT OUR STATION IS FROM WHICH DIRECTION  
?WEST

YES, FROM WEST, NORTHWEST OR SOUTHWEST. THIS IS THE QUITE WELL DEFINED BELT OF THE WESTERLIES.

WITHIN THE WESTERLIES LOCAL LOW PRESSURE CENTERS MIGRATE FROM WEST TO EAST AND CAUSE PRECIPITATION. THESE ARE KNOWN AS  
?DONT KNOW

A REGION OF LOW ATMOSPHERIC PRESSURE SOMETIMES CALLED A DEPRESSION IS MORE OFTEN KNOWN AS A ( )?  
?HELP

A REGION OF LOW ATMOSPHERIC PRESSURE SOMETIMES CALLED A DEPRESSION IS MORE OFTEN KNOWN AS A ( )?  
?FRONT

IT IS EASY TO SEE THAT YOU, PETE KNOW YOUR CONTROLS

CYCLONIC STORMS ARE IMPORTANT DURING THE WINTER, BUT, BY CONTRAST, DURING THE SUMMER THE WIND IS LIGHT AND VARIABLE WITH A COMPONENT PARALLEL TO THE SHORE. THE PATHS OF CYCLONIC STORMS ARE THEN WELL POLEWARD OF THIS STATION.

NOW PETE , PLEASE TELL ME THE KOPPEN SYMBOLS FOR THIS STATION (TYPE 'HELP' IF YOU NEED IT)  
?HELP

HINTS - HUMID CLIMATE, QUITE WARM, MARKED SUMMER DROUGHT TRY THE FIRST LETTER AT LEAST.  
?C

'C' IS THE CORRECT FIRST LETTER.  
SECOND LETTER: 'S'(SUMMER DRY), 'W'(WINTER DRY), 'F'(WET)

THIRD LETTER CHOICES ARE:  
'A' (AT LEAST ONE MONTH ABOVE 71.6 F.)  
'B' (> 3 MONTHS ABOVE 50 F., NONE ABOVE 71.6)  
'C' (< 4 MONTHS ABOVE 50)  
OUR STATION IS 'CSA' - MEDITERRANEAN.

BY FAR THE LARGEST AND MOST SIGNIFICANT AREA OF THIS CLIMATE IS IN EUROPE WHERE IT EXTENDS FROM LISBON TO BEIRUT AND FROM CASABLANCA TO MARSEILLE.

PETE, I WOULD LIKE YOU TO DESCRIBE THE NATURAL VEGETATION OF THE MEDITERRANEAN AREA IN YOUR OWN WORDS. (YOU MAY USE UP TO A FULL LINE)  
?PALM TREES,DATES,FIGS,BROAD LEAFED TROPICALS

I THINK THAT YOU HAVE NAMED SOME COMMON PLANTS. I WANT A MORE GENERAL DESCRIPTION OF THE VEGETATION. TRY AGAIN.  
?LOW VEGETATIONS-, SUCCULENTS THAT CAN WITHSTAND DROUGHT

YOU HAVE THE RIGHT IDEA. NATURAL VEGETATION IS DROUGHT RESISTANT; A MIXTURE OF SHORT, WIDELY SPACED TREES, MANY SHRUBS AND SOME GRASS. OFTEN CALLED CHAPARRAL.

NOW, WITHOUT NAMING CROPS, PLEASE CHARACTERIZE MEDITERRANEAN AGRICULTURE. (LIMIT OF 1 LINE)  
?AREA IS HILLY, REQUIRES TERRACING, SHORT SEASON

I AM SORRY BUT I DON'T UNDERSTAND YOUR ANSWER. HAVE YOU MISSPELLED AN IMPT. WORD? PLEAS CHECK AND REPHRASE YOUR ANSWER.  
?WOULD NEED IRRIGATION IN SUMMER

NOT BAD - INTENSIVE FARMING WITH WINTER GRAINS, ORCHARDS,  
AND VEGETABLES; OFTEN IN TWO STORY COMBINATION, AND WITH  
SOME IRRIGATION IS COMMON.

WHAT SPECIFIC CROPS WOULD YOU EXPECT TO FIND IN SUCH AN AREA  
? FIGS, DATES, GRAPES

GRAPES, OLIVES, FIGS, WINTER WHEAT, BARLEY, CITRUS, NUTS,  
VEGETABLES AND OAK CORK ARE COMMON. PETE YOU ARE RIGHT.

WHAT ARE SOME IMPORTANT CHARACTERISTICS OF ANIMAL HUSBANDRY  
IN THIS CLIMATIC REGION  
? SMALL FARMS FOR ANIMALS, NOT MUCH GRAZING

I AM SORRY BUT I DON'T UNDERSTAND YOUR ANSWER. HAVE YOU  
MISPELLED AN IMPT. WORD? PLEASE CHECK AND REPHRASE YOUR  
ANSWER.

? A FEW GOATS AND SHEEP

GOOD TRY - MANY SHEEP AND GOATS SHARE THE DRY GRASSES OF  
OVERGRAZED SLOPES WITH A FEW CATTLE AND DONKEYS.

THE ORIGINAL DATA WAS FOR ADELAIDE, AUSTRALIA.  
THE RAINFALL AND TEMPERATURE PATTERNS AT THAT LOCATION ARE  
TYPICAL OF ANY OF THE FIVE AREAS OF 'MEDITERRANEAN' CLIMATE  
SCATTERED THROUGHOUT THE WORLD.

I HAD FUN - HOPE YOU DID TOO. GOOD BYE, PETE.

DONE

**TITLE:**

CLOUDS: Cloud Formation

**DESCRIPTION:**

This program tests student ability to solve problems related to the formation of cumuliform clouds (i.e. L.C.L., temperature at various altitudes). In Phase I of the program students enter the variables and unknowns of previously assigned problems. The computer checks the students' answers and supplies the correct answers if an error is detected.

When Phase I is completed the computer automatically presents a group of new problems for the student to solve and check at the machine.

**OBJECTIVES:**

The program attempts to reinforce and apply the following concepts:

- A. There is a specific rate at which temperature drops in a rising parcel of unsaturated air.
- B. Once air becomes saturated and condensation begins, the lapse rate decreases due to the release of latent heat of vaporization.
- C. The base level of a cloud (LCL), and temperatures within it can be calculated from ground level data.

**INSTRUCTIONS:****PRELIMINARY PREPARATION:**

- A. Student - Students should be familiar with the terms and values of the dry and wet adiabatic lapse rates, normal lapse rate, and the formula for calculating the Lifting-Condensation Level.
- B. Materials - Printed sets of problems with the following variables and unknowns:
  - 1. Air temperature on the ground.
  - 2. Dew point on the ground.
  - 3. Temperature at the base of the cloud.
  - 4. The elevation, in feet, of the base of the cloud (LCL).

Continued on following page.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

DISCUSSION:

This program is designed for average students. Individuals should be permitted to go to the computer to check any problem or groups of problems whenever the machine is free. The teacher in the lesson acts solely as a resource person to help those students unable to arrive at correct responses because of conceptual errors - not mechanical errors.

To speed the lesson, Phase II of the program may be omitted entirely, by procedure 1, or from early runs by procedure 2.

Procedure 1

Erase lines 1560 - 1810, 1760 - 1800,  
and change line 1520 to read:  
If P > 1 then 2060.

Procedure 2

Change line 1520 to read:  
If P > 1 then 2060.  
When you are ready to use Phase II merely  
retype line 1520 as originally listed.

RUN  
RUN  
CLOUDS

CLOUD NINE  
=====

STRONG CONVECTION CURRENTS ARE CAUSING ADIABATIC COOLING OF AIR WHERE YOU ARE AND ARE RESPONSIBLE FOR THE FORMATION OF A CLOUD. BOTH THE DRY AND THE MOIST ADIABATIC (AS WELL AS THE NORMAL LAPSE RATES) ARE CONSIDERED IN THIS PROGRAM.

LEGEND  
=====

- 1=THE TEMPERATURE ON THE GROUND
- 2=THE DEW POINT TEMPERATURE ON THE GROUND
- 3=THE TEMPERATURE AT THE BASE OF THE CLOUD
- 4=THE ELEVATION, IN FEET, OF THE CLOUD BASE

CHOOSE ANY TWO OF THE ABOVE VARIABLES AND SELECT VALUES FOR THEM. TYPE THEM IN AS:  
VARIABLE CODE ,VALUE, VARIABLE CODE ,VALUE...(E.G. 1,50,2,30)

?1,50,2,41

OKAY, TYPE IN YOUR CALCULATED VALUE FOR THE TEMPERATURE AT THE BASE OF THE CLOUD FOLLOWED BY A COMMA, AND THEN TYPE IN YOUR VALUE FOR THE ELEVATION, IN FEET, OF THE CLOUD BASE  
~~?30,9,2000~~

VERY GOOD. VERY, VERY GOOD.

DO YOU HAVE ANY OTHER PROBLEMS YOU WOULD LIKE TO TRY?  
(1=YES, 0=NO) : ?1

USING THE SAME LEGEND AS BEFORE...  
CHOOSE ANY TWO OF THE ABOVE VARIABLES AND SELECT VALUES FOR THEM. TYPE THEM IN AS:  
VARIABLE CODE ,VALUE, VARIABLE CODE ,VALUE...(E.G. 1,50,2,30)

?1,60,3,25

OKAY, TYPE IN YOUR CALCULATED VALUE FOR THE DEW POINT TEMPERATURE ON THE GROUND FOLLOWED BY A COMMA, AND THEN TYPE IN YOUR VALUE FOR THE ELEVATION, IN FEET, OF THE CLOUD BASE  
~~?30,4000~~

IT LOOKS LIKE WE GOOFED SOME PLACE.  
LET'S SEE WHAT THE CORRECT VALUES ARE.

60 DEGREES - THE TEMPERATURE ON THE GROUND  
31.3636 DEGREES - THE DEW POINT TEMPERATURE ON THE GROUND  
25 DEGREES - THE TEMPERATURE AT THE BASE OF THE CLOUD  
6363.64 FEET - THE ELEVATION, IN FEET, OF THE CLOUD BASE

DO YOU HAVE ANY OTHER PROBLEMS YOU WOULD LIKE TO TRY?  
(1=YES, 0=NO) ; ?0

WELL, BEFORE YOU LEAVE, I HAVE A FEW I'D LIKE YOU TO TRY...  
BASED ON YOUR VALUES, THE HEIGHT OF THE CLOUD  
(MEASURED FROM THE CLOUD BASE) IS 25454.5 FT. CAN YOU TELL ME:

WHAT IS THE TEMPERATURE AT EACH OF THESE ALTITUDES:

|   |        |    |
|---|--------|----|
| 1 | 4455   | FT |
| 2 | 44545. | FT |
| 3 | 19091  | FT |

THE TEMPERATURE AT 4455 FT. IS .732.5

SORRY. YOU WERE DOING GREAT THERE FOR A WHILE.  
WELL, BACK TO THE BOOKS. THE VALUES YOU SHOULD HAVE ARE:

|   |                           |         |          |         |
|---|---------------------------|---------|----------|---------|
| 1 | THE TEMPERATURE AT 4455   | FEET IS | 35.5     | DEGREES |
| 2 | THE TEMPERATURE AT 44545. | FEET IS | -95.9091 | DEGREES |
| 3 | THE TEMPERATURE AT 19091  | FEET IS | -13.1818 | DEGREES |

DONE





|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>TITLE:</b>                  | TEMPERATURE SCALE CONVERSION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CONVRT<br>36685 |
| <b>DESCRIPTION:</b>            | This program converts a given temperature in one of the four temperature scales (Centigrade, Fahrenheit, Kelvin, and Rankine) to the equivalent in the others.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |
| <b>INSTRUCTIONS:</b>           | Instructions are given in the program. The user enters the numeric value of the temperature followed by a single letter indicating which scale it is in. The program returns the value in all four temperature scales.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |
| <b>SPECIAL CONSIDERATIONS:</b> | FOR INSTRUCTIONAL PURPOSES<br>Suitable Courses: Introductory Physics and Astronomy<br><br>Student Background Required: None<br><br>This program is not extremely complicated. For students in any mathematically oriented physics class it is quite useless. However, for students in a descriptive physics or astronomy who would have a bit of trouble in doing the conversion manually, this program very quickly allows them to get a comparison between the familiar temperature scale of Fahrenheit (at least in the United States) and the temperature scale used in describing the physical world they are studying, i.e., astronomy-Kelvin, low temperature physics-Kelvin, and ordinary temperatures-Centigrade. The input to the program is into a string variable. This allows the input to be quite user adapted. The program has also been used as an example to a computer programming class on the value of using string inputs for numeric quantities. |                 |
| <b>ACKNOWLEDGEMENTS:</b>       | Lawrence E. Turner<br>Pacific Union College                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |

RUN

TEMPERATURE CONVERSION

ENTER TEMPERATURE AND SCALE AS: 37.56 C  
USE 'F', 'C', 'K', OR 'R' FOR THE SCALE.

ENTER TEMP ?398 C  
T = F 748.4 C 398 K 671.15 R 1208.07

ENTER TEMP ?0 K  
T = F -459.67 C -273.15 K 0 R 0

ENTER TEMP ?5800 K  
T = F 9980.33 C 5526.85 K 5800 R 10440

ENTER TEMP ?98.6F  
T = F 98.6 C 37 K 310.15 R 558.27

ENTER TEMP ?  
DONE

DECAY1  
36306**TITLE:**

DECAY1: Radioactive Decay Game

**DESCRIPTION:**

Radioactive decay is treated pseudo-quantitatively, by permitting the student to determine the approximate number of radioactive particles remaining after various times.

OBJECTIVES:

To induce a "feel" for exponential decay, by repeated exercises.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - Awareness of terms: Half-life, exponential, and radioactivity
- B. Materials - none

DISCUSSION:

The concept of radioactive decay is presented in a game format, allowing the student to challenge his own ability in determining (with 5, 10, or 20% error), the number of radioactive "chips" remaining after various times. The number of chips successively decreases with each trial, increasing the level of difficulty as the program runs. In each case, the exact number remaining is given, following the students' entered value.

Individuals or small groups find this program exciting. They enjoy the game approach, at least the first time through it, and seem to be motivated by the opportunity to "break the bank."

This program can be used as an integral part of a class lesson to introduce the concept, or to motivate group discussion and participation concerning the phenomenon.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN  
 RUN  
 DECAY1

---THE NEW CLEA CASINO---

MR. A. TOM MICK, GENERAL MANAGER OF THE NEW CLEA CASINO, HAS, AT TIME T=0, DISCOVERED 100,000 RADIOACTIVE PLAYING CHIPS AT HIS TABLE. THEIR HALF-LIFE IS 10 MINUTES. EACH CHIP TRANSMUTES SPONTANEOUSLY AND COMPLETELY IN A RANDOM FASHION.

AT VARIOUS TIMES T, AFTER T=0, YOU MUST DETERMINE WITHIN A CERTAIN PERCENTAGE, HOW MANY CHIPS ARE LEFT.

TO FURTHER THE INTEREST OF THE GAME, YOU WILL START WITH \$1,000 AND THE HOUSE WITH AN UNSPECIFIED AMOUNT. HALF THE MONEY YOU HAVE WILL RIDE ON EACH GUESS YOU TAKE. LET'S SEE IF YOU CAN BREAK THE HOUSE BEFORE THE CHIPS RUN OUT.

- THE HOUSE OFFERS THE FOLLOWING ODDS:
- 2) 2 TO 1 ODDS FOR GUESSING WITHIN 20 PERCENT
  - 4) 4 TO 1 ODDS FOR GUESSING WITHIN 10 PERCENT
  - 8) 8 TO 1 ODDS FOR GUESSING WITHIN 5 PERCENT.

ENTER THE NUMBER 2, 4, OR 8 FOR THE ODDS YOU WANT AFTER THE QUESTION MARK IN THE COLUMN LABELLED ODDS.

| YOUR \$                              | HOUSE \$    | TIME (MIN) | ODDS |
|--------------------------------------|-------------|------------|------|
| 1000                                 | 1.00000E+06 | 4.9        | ?8   |
| HOW MANY CHIPS LEFT ?71200           |             |            |      |
| ACTUAL NUMBER LEFT IS 71207.         |             |            |      |
| YOU WON. TRY AGAIN.                  |             |            |      |
| 5000                                 | 996000.     | 16.3       | ?8   |
| HOW MANY CHIPS LEFT ?342500          |             |            |      |
| ACTUAL NUMBER LEFT IS 32316          |             |            |      |
| TOO BAD, YOU LOST. TRY AGAIN.        |             |            |      |
| 2500                                 | 998500.     | 25.4       | ?4   |
| HOW MANY CHIPS LEFT ?18612           |             |            |      |
| ACTUAL NUMBER LEFT IS 17200          |             |            |      |
| YOU WON. TRY AGAIN.                  |             |            |      |
| 7500                                 | 993500.     | 32.4       | ?3   |
| SORRY PAL, WE DONT OFFER THOSE ODDS. |             |            |      |
| 7500                                 | 993500.     | 32.4       | ?4   |
| HOW MANY CHIPS LEFT ?11180           |             |            |      |
| ACTUAL NUMBER LEFT IS 10589          |             |            |      |
| YOU WON. TRY AGAIN.                  |             |            |      |
| 22500                                | 978500.     | 42.1       | ?4   |
| HOW MANY CHIPS LEFT ?6890            |             |            |      |
| ACTUAL NUMBER LEFT IS 5406           |             |            |      |
| TOO BAD, YOU LOST. TRY AGAIN.        |             |            |      |
| 11250                                | 989750.     | 51.2       | ?4   |
| HOW MANY CHIPS LEFT ?2803            |             |            |      |
| ACTUAL NUMBER LEFT IS 2877           |             |            |      |
| YOU WON. TRY AGAIN.                  |             |            |      |
| 33750.                               | 967250.     | 66.5       | ?4   |
| HOW MANY CHIPS LEFT ?720             |             |            |      |
| ACTUAL NUMBER LEFT IS 996            |             |            |      |
| TOO BAD, YOU LOST. TRY AGAIN.        |             |            |      |
| 16875                                | 984125.     | 75.6       | ?8   |
| HOW MANY CHIPS LEFT ?500             |             |            |      |
| ACTUAL NUMBER LEFT IS 530            |             |            |      |
| TOO BAD, YOU LOST. TRY AGAIN.        |             |            |      |
| 8437                                 | 992563.     | 87         | ?4   |
| HOW MANY CHIPS LEFT ?215             |             |            |      |
| ACTUAL NUMBER LEFT IS 240            |             |            |      |
| TOO BAD, YOU LOST. TRY AGAIN.        |             |            |      |

4218                    996782.                    90.7                    ?2  
 HOW MANY CHIPS LEFT ?200  
 ACTUAL NUMBER LEFT IS 186  
 YOU WON. TRY AGAIN.

8436                    992564.                    101.6                    ?4  
 HOW MANY CHIPS LEFT ?95  
 ACTUAL NUMBER LEFT IS 87  
 YOU WON. TRY AGAIN.

25308                    975692.                    110.9                    ?4  
 HOW MANY CHIPS LEFT ?45  
 ACTUAL NUMBER LEFT IS 45  
 YOU WON. TRY AGAIN.

75924.                    925076.                    126.4                    ?2  
 HOW MANY CHIPS LEFT ?13  
 ACTUAL NUMBER LEFT IS 15  
 YOU WON. TRY AGAIN.

151848.                    849152.                    137.4                    ?2  
 HOW MANY CHIPS LEFT ?7  
 ACTUAL NUMBER LEFT IS 7  
 YOU CAN BREAK THE HOUSE IF YOU TRY A LONG SHOT.

303696.                    697304.                    148.3                    ?2  
 HOW MANY CHIPS LEFT ?3  
 ACTUAL NUMBER LEFT IS 3  
 YOU CAN BREAK THE HOUSE IF YOU TRY A LONG SHOT.

607392.                    393608.                    159.2                    ?2  
 HOW MANY CHIPS LEFT ?1  
 ACTUAL NUMBER LEFT IS 1  
 YOU BROKE THE HOUSE. YOU NEEDED ONLY 16 GUESSES.  
 CONGRATULATIONS.  
 YOU MUST KNOW A LOT ABOUT RADIOACTIVITY AND THINGS.  
 THANKS FOR PLAYING..

-----

CHECK NO. 17

DATE: -----19--

PAY TO THE ORDER OF-----CASH-----\$ 1.00100E+06

THE NEW CLEA CASINO

A. TOM MICK  
 GENERAL MANAGER

-----

DONT SPEND IT ALL IN ONE PLACE.

DONE



DECAY2  
36307**TITLE:**

DECAY2: Nuclear Decay

**DESCRIPTION:**

This program will do the following:

- A. Calculate half-life from 2 readings on a geiger counter, and the time between them.
- B. Calculate mass of a radioactive sample remaining after some given amount of time.
- C. Prints out a table showing mass or number of particles of a radioactive sample remaining vs. some range of time.

OBJECTIVES:

- A. To provide tables and graphs for a better understanding of the exponential decay of a radioactive substance.
- B. To provide a calculator for determining the amount of mass of a radioactive sample remaining after some given amount of time.
- C. To provide a calculator for half-life experiments.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - The student should have a general introduction to half-life before the use of the program.
- B. Materials - none

DISCUSSION:

It is difficult to teach about the exponential (logarithmic) manner by which radioactive elements decay without meaningful illustrations and simulations.

Continued on following page.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn



DISCUSSION continued

With this program, a number of interesting possibilities are available. For example, if the initial mass is 100 g and the time is equal to 10 half-lives with an increment equal to the half-life, the student will see the mass decrease to 0.1 g during that time. More important, the example may be generalized to show that for any radioactive sample:

- after 1 half-life 50% of the substance remains
- after 2 half-life 25% of the substance remains
- after 3 half-life 12.5% of the substance remains
- after 10 half-life 0.1% of the substance remains

You may also illustrate nuclear decay by using particles instead of mass. Use Avogadro's number of particles with students who feel comfortable with scientific notation. For the others, you may use a number up to 1,000,000 without having exponential numbers print out in the table.

The fact that the teletype unit takes about 8 seconds to type out a line provides you with cute little gimmicks. Set up a run with 8 seconds (or any multiple of 8) and the print-out of the table will keep time with the decay of the sample substance.

Please note that the half-life calculations are not accurate for a small number of particles, thus it is misleading to make runs go to zero mass or zero particles.

RUN

RUN  
DECAY2

```
DO YOU WANT INSTRUCTIONS (1=YES, 0=NO) : ?1
THIS PROGRAM WILL DO THE FOLLOWING:
CHOICE 1 - CALCULATES HALF-LIFE FROM TWO READINGS
           ON A GEIGER COUNTER.
CHOICE 2 - CALCULATES HOW MUCH OF A RADIOACTIVE SAMPLE
           WILL REMAIN AFTER SOME GIVEN AMOUNT OF TIME
CHOICE 3 - PRINTS OUT A TABLE SHOWING MASS OF SAMPLE
           VS. TIME OR NO. OF PARTICLES VS. TIME.
           (GRAPH OPTIONAL) NOTE: FOR THE TABLE YOU
           MUST INPUT TOTAL TIME AND TIME INCREMENT.
           EXAMPLE: IF TOTAL TIME=100 AND TIME
           INCREMENT=10, THEN TIME IN THE TABLE WILL
           BE 10,20,30,.....,100.
CHOICE 4 - END OF PROGRAM
```

NOTE: IN ANY ONE PROBLEM, TIME MUST ALWAYS BE INPUTED IN THE SAME UNITS OF MEASURE (IE: SECS., MINS., ETC.)

\*\*\*\*\*

WHAT IS YOUR CHOICE?1

WHAT IS THE INITIAL READING ON THE GEIGER COUNTER,  
THE SECOND READING, AND THE TIME BETWEEN READINGS.  
?1500,3000,36

INITIAL READING= 1500      SECOND READING 3000      TIME= 36  
HALF-LIFE= 35.9976

\*\*\*\*\*

WHAT IS YOUR CHOICE?2

WHAT IS THE HALF-LIFE, INITIAL MASS OF SAMPLE, AND  
TOTAL TIME OF DECAY?18,56,76

HALF-LIFE= 18      INITIAL MASS= 56      TOTAL TIME= 76  
MASS OF SAMPLE REMAINING= 3.00095

\*\*\*\*\*

WHAT IS YOUR CHOICE?3

DO YOU WANT TO WORK WITH PARTICLES OR MASS? (ANSWER 1 FOR  
PARTICLES OR 2 FOR MASS) ?1

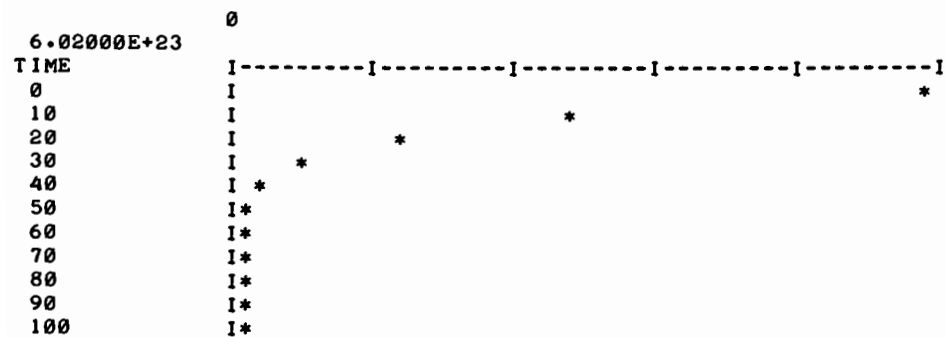
WHAT IS THE HALF-LIFE, INITIAL NUMBER OF PARTICLES IN THE SAMPLE, TOTAL ELAPSED TIME FOR DECAY, AND THE INCREMENT OF ELAPSED TIME?10,6.02E23,100,10

HALF-LIFE= 10 INITIAL NO. OF PARTICLES= 6.02000E+23  
 TOTAL TIME= 100 INCREMENT= 10

| TIME | PARTICLES   | PART. LOSS  | TOTAL PART. LOSS |
|------|-------------|-------------|------------------|
| 0    | 6.02000E+23 | 0           | 0                |
| 10   | 3.01014E+23 | 3.00986E+23 | 3.00986E+23      |
| 20   | 1.50514E+23 | 1.50500E+23 | 4.51486E+23      |
| 30   | 7.52606E+22 | 7.52536E+22 | 5.26739E+23      |
| 40   | 3.76321E+22 | 3.76285E+22 | 5.64368E+23      |
| 50   | 1.88169E+22 | 1.88152E+22 | 5.83183E+23      |
| 60   | 9.40891E+21 | 9.40803E+21 | 5.92591E+23      |
| 70   | 4.70468E+21 | 4.70423E+21 | 5.97295E+23      |
| 80   | 2.35245E+21 | 2.35223E+21 | 5.99648E+23      |
| 90   | 1.17628E+21 | 1.17617E+21 | 6.00824E+23      |
| 100  | 5.88168E+20 | 5.88112E+20 | 6.01412E+23      |

DO YOU WANT THE ABOVE DATA GRAPHED? (1=YES, 0=NO)?2-1

MASS (OR PARTICLES) REMAINING



\*\*\*\*\*

WHAT IS YOUR CHOICE?3

DO YOU WANT TO WORK WITH PARTICLES OR MASS? (ANSWER 1 FOR PARTICLES OR 2 FOR MASS) ?2

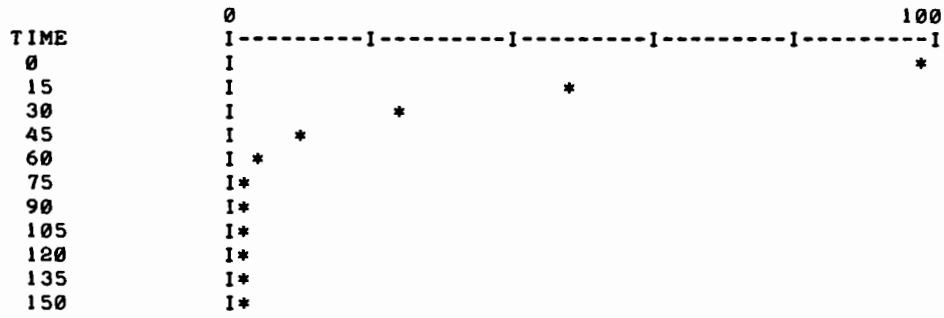
WHAT IS THE HALF-LIFE, INITIAL MASS OF SAMPLE, TOTAL ELAPSED TIME FOR DECAY, AND THE INCREMENT OF ELAPSED TIME?15,100,150,15

HALF-LIFE= 15 INITIAL MASS= 100 TOTAL TIME= 150 INCREMENT= 15

| TIME | MASS        | MASS LOSS | TOTAL MASS LOSS |
|------|-------------|-----------|-----------------|
| 0    | 100         | 0         | 0               |
| 15   | 50.0024     | 49.9976   | 49.9976         |
| 30   | 25.0024     | 25.       | 74.9976         |
| 45   | 12.5018     | 12.5006   | 87.4982         |
| 60   | 6.25118     | 6.25059   | 93.7488         |
| 75   | 3.12574     | 3.12544   | 96.8743         |
| 90   | 1.56294     | 1.5628    | 98.4371         |
| 105  | .781508     | .781434   | 99.2185         |
| 120  | .390772     | .390735   | 99.6092         |
| 135  | .195395     | .195377   | 99.8046         |
| 150  | 9.77024E-02 | .097693   | 99.9023         |

DO YOU WANT THE ABOVE DATA GRAPHED? (1=YES, 0=NO)?1

MASS (OR PARTICLES) REMAINING



\*\*\*\*\*

WHAT IS YOUR CHOICE?A

DONE

DRAGON  
36785

**TITLE:** SOLAR ECLIPSE SIMULATION

**DESCRIPTION:** This program is a simulation of a solar eclipse for a CRT display terminal that has cursor addressing capabilities such as the Hazeltine 2000. First, the sun is drawn in boldface, then the dragon moon eats the sun, a corona appears, and finally the sun reappears.

**INSTRUCTIONS:** The User "GET"s the program and executes it. Everything follows automatically.

**SPECIAL CONSIDERATIONS:** This program will print garbage if executed on a teletype terminal. It must be used with a terminal with cursor addressing capabilities. This present version uses the subroutine FAZEL (HP 36786) which provides the proper control for a Hazeltine 2000 terminal. Any similar subroutine with the proper entry points designed for a different terminal could easily replace the current one. This would allow the program to be used on any terminal with similar features as the Hazeltine.

FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Beginning Astronomy

Student Background Required: None

This program can be used to illustrate to beginning astronomy students the time sequence of events in a solar eclipse. It was written to be more entertaining than educational since the amount of potential learning in this program is probably quite minimal.

This program also makes an interesting demonstration of the capabilities of a terminal with cursor addressing capability.

**ACKNOWLEDGEMENTS:** Lawrence E. Turner  
Pacific Union College



DROS  
36300**TITLE:**

DROS: Genetic Characteristics

**DESCRIPTION:**

This program determines the genetic characteristics of the offspring of a pair of *Drosophila* flies with specified traits. A game approach is used involving the entire class, in which the students can select different genotypes.

OBJECTIVES:

To show the student:

- A. The result of MEIOSIS and the effect of random assortment.
- B. That various genetic recombinations occur in sex cells and in genotypes of offspring.
- C. That if enough trials are run, Mendelian ratios are verified.
- D. That he can simulate different genotypic conditions and determine the probability of the phenotypic outcome.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - An understanding of the concepts in the computer program GAMGN, A833-36302 in Volume IV. It is best to use DROS as soon as possible after GAMGN.
- B. Materials - Eight containers grouped in two sets of four and labeled A, B, C, D. Designate one of the group of four as male chromosomes, and the other as female. Into each container, place two slips of paper, one marked 1 and the other, 2.

Before beginning the program have a student:

1. Take out one slip of paper from each of the containers of the male group and mark the designation on the chalk board. For instance: A1, B2, C2, D1;
2. Take out one slip from each container of the female group and do the same as with the male group.

Decide what the phenotype would be by discussing it in class.

You will run the program using the information you have on the chalk board. It will give you the correct phenotype. See how the class' answer compares with the computer's.

DISCUSSION: See attached.**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

INSTRUCTIONS: continued

DISCUSSION:

A. Operational Suggestions

1. Student level - average
2. This program can be used on a classroom basis.
3. Pitfalls to avoid - See that the students run the program several times and keep a record of each run. This is necessary to show the various possible combinations that can occur, and their frequencies.

B. Follow-up

After the program has been run:

1. Get as many runs as possible so that percentages can be determined for each phenotype of the offspring.
2. a) Determine the total number of offspring. Each run represents 1 offspring. Count them.  
b) Determine the total number of offspring which lived.  
c) Determine each phenotype and show that a ratio exists between dominant and recessive traits. (This should follow typical Mendelian ratios)
3. Elicit from the students:
  - a) What was their role in the game? (The students conduct meiosis by randomly selecting the genotype of each gamete.)
  - b) (When using a small number of runs) Why did the Mendelian ratios not hold true?

RUN

RUN  
DROS

THIS PROGRAM IS DESIGNED TO GIVE THE GENETIC RESULTANT TRAITS OF OFFSPRING WHOSE PARENTAGE WAS DISCUSSED IN PROGRAM 'GAMGN'

ARE YOU READY? HERE WE GO.

FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?2  
 WHAT IS 'B'?1  
 WHAT IS 'C'?2  
 WHAT IS 'D'?2

FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?2  
 WHAT IS 'B'?1  
 WHAT IS 'C'?1  
 WHAT IS 'D'?1

OFFSPRING HAS NORMAL WINGS  
AND IS RED EYED.

LET'S TRY THIS SEVERAL TIMES AND SEE THE RESULTS WE GET OVER SEVERAL TRIALS. KEEP A RECORD.

SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.  
?1

FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1  
 WHAT IS 'B'?2  
 WHAT IS 'C'?2  
 WHAT IS 'D'?2

FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1  
 WHAT IS 'B'?2  
 WHAT IS 'C'?1  
 WHAT IS 'D'?1

OFFSPRING HAS VESTIGIAL WINGS  
AND IS WHITE EYED

SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.  
?1

FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1  
 WHAT IS 'B'?2  
 WHAT IS 'C'?2  
 WHAT IS 'D'?2

FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1  
 WHAT IS 'B'?2  
 WHAT IS 'C'?1  
 WHAT IS 'D'?2

OFFSPRING HAS VESTIGIAL WINGS  
AND IS WHITE EYED

SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.  
?1

FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1  
WHAT IS 'B'?1  
WHAT IS 'C'?2  
WHAT IS 'D'?2

FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1  
WHAT IS 'B'?2  
WHAT IS 'C'?1  
WHAT IS 'D'?2

OFFSPRING HAS VESTIGIAL WINGS  
AND IS RED EYED.

SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.  
?1

FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1  
WHAT IS 'B'?2  
WHAT IS 'C'?2  
WHAT IS 'D'?2

FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1  
WHAT IS 'B'?2  
WHAT IS 'C'?2  
WHAT IS 'D'?2

OFFSPRING HAS VESTIGIAL WINGS  
AND IS WHITE EYED

SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.  
?1

FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?2  
WHAT IS 'B'?1  
WHAT IS 'C'?1  
WHAT IS 'D'?1

FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1  
WHAT IS 'B'?1  
WHAT IS 'C'?1  
WHAT IS 'D'?1

DEVELOPING EMBRYO HAS DIED DUE TO LETHAL GENE ACTION.

SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.  
?0

I HOPE THAT I HAVE BEEN OF SOME HELP TO YOU,  
AND THAT 6 RUNS PROVIDE ENOUGH INFORMATION.

DONE





EFIELD  
36629**TITLE:**

ELECTRIC FIELD STRENGTH

**DESCRIPTION:**

The electric-field strength at a point near a fixed charge is calculated and printed. A line of charge is then generated by adding charges to either side of the fixed charge. As each additional charge is added, the new electric-field strength is calculated and selected values are printed.

Similarly, the field strength at a point near a plane of charge is calculated and printed as the plane is generated with the addition of other lines to the previous line of charge.

In both cases, the fields can be seen to approach a limiting value which is then printed for an infinite line and plane.

OBJECTIVES:

- A. To show that the electric-field strength approaches limiting values for a line and a plane of charge.
- B. To let the student discover how the field strength depends upon the distance from a point to a line of and to a plane of charge.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - A knowledge of Coulomb's law and the vector addition of electric fields.
- B. Materials - None

DISCUSSION:

The operator chooses a distance ( $y$ ) away from a fixed charge ( $Q_0$ ) at which he wishes to know the field strength. He also chooses the number of charges ( $N$ ), and their spacing ( $C$ ), that he wishes to add to each side of the fixed charge to generate a line of charge. After the line has been generated, the operator enters the number of such lines ( $M$ ) that he wishes to use in building up the plane of charge.

Continued on following page.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

DISCUSSION: continued

Actual values of force are not given, only relative values. When the fixed charge ( $Q_2$ ) is at a distance  $Y=1$  from the test charge ( $Q_1$ ), the force is 1 unit. The force may be calculated in Newtons if all distances are in meters, and the program is slightly changed so that  $Q_1$  and  $Q_2$  are in coulombs. If both of these charges were to be taken as single elementary charges, then the following changes should be made:

```

280 LET Q1 = 1.6*E-19
290 LET Q2 = 1.6*E-19
300 LET K = 9*E9

```

If the spacing (C) is taken as .1 and the number of charges (N) as 1000, then three runs through the program using the distance between the test charge and the fixed charge (y) as 1, 2, and 4 should be sufficient for the relationships to be determined. A casual inspection of the exact values of the field strength for these three distances should yield the following conclusions:

1. The field strength varies inversely with the square of the distance away from a single point charge.
2. The field strength varies inversely with the distance from a line of charge.
3. The field strength remains constant even though the distance from a plane of charge changes.

It should be noted in 2 and 3 above, that the spacing between charges must be small as compared to the distance away from the line or plane of charge, and of course that the line be so long and the plane so broad that any further increase in length or breadth be insignificant.

An interesting bonus to this program is discovered when distances from test charge to plane is decreased to .001, .0001, and .00001. Here it can be seen that the field no longer is constant, but changes as an inverse square law for a single charge because the test charge begins to "see" the fixed charge instead of the whole plane. The "EXACT VALUE ...," is calculated for charges smeared over the whole plane and not in discrete point charges as we have here; hence, the disagreement with actual field values.

This program may be run by an individual student after proper introductory explanation concerning vector addition of electric fields, contributions of the charges being added in the line or lines to the plane. It may also be used as a class demonstration and discussion. When used with a whole class it is best to have a television camera and monitor available for immediate display of print out. A summary table constructed either by the teacher on the board or by students at their desks is useful in analysis of the data.

RUN

RUN  
EFIELD

THIS PROGRAM WILL CALCULATE THE FORCE ON A TEST CHARGE THAT IS PLACED SOME DISTANCE, Y, AWAY FROM ANOTHER CHARGE (A LINE OF CHARGE) AND A PLANE OF CHARGE. YOU MUST ENTER THE DISTANCE AWAY, Y; THE SPACING DESIRED BETWEEN CHARGES, C, AND ALSO BETWEEN LINES OF CHARGE THAT MAKE UP THE PLANE OF CHARGE. YOU MUST ALSO CHOOSE THE NUMBER OF CHARGES IN THE LINE OF CHARGE THAT YOU WOULD LIKE TO USE (500 IS A GOOD VALUE IF YOU USE A SPACING OF .1 FOR C. JUST SO THE CALCULATIONS DON'T GO TOO FAR I'VE INCLUDED A STOP THAT DEPENDS UPON THE ANGLE FROM TEST CHARGE TO THE LAST CHARGE TO BE CALCULATED. IF THE ANGLE IS LESS THAN 2 DEGREES, CALCULATIONS WILL CEASE.

INPUT Y,C,N?1,.1,1000

| NO. OF CHGS.<br>ON EACH SIDE | FORCE |
|------------------------------|-------|
| -----                        | ----- |
| 0                            | 1     |
| 1                            | 2.97  |
| 2                            | 4.86  |
| 3                            | 6.61  |
| 4                            | 8.21  |
| 5                            | 9.65  |
| 6                            | 10.91 |
| 7                            | 12.01 |
| 8                            | 12.96 |
| 9                            | 13.78 |
| 10                           | 14.49 |
| 20                           | 17.98 |
| 30                           | 19    |
| 40                           | 19.42 |
| 50                           | 19.62 |
| 60                           | 19.73 |
| 70                           | 19.8  |
| 80                           | 19.85 |
| 90                           | 19.88 |
| 100                          | 19.9  |
| 200                          | 19.98 |
| 287                          | 19.99 |

EXCESSIVE COMPUTER TIME WOULD BE REQUIRED TO CALCULATE THE FORCE FOR ADDITIONAL CHARGES.

THE EXACT VALUE FOR AN INFINITELY LONG LINE OF CHARGE IS 20

NOW ADD ROWS ON EITHER SIDE OF THE LINE OF CHARGE JUST CALCULATED. THE SPACING BETWEEN ROWS WILL BE THE SAME AS THE SPACING BETWEEN THE CHARGES. ENTER THE NUMBER OF EQUALLY SPACED ROWS YOU WANT ON EACH SIDE ?500

| NO. OF LINES<br>ON EACH SIDE | FORCE  |
|------------------------------|--------|
| -----                        | -----  |
| 0                            | 20     |
| 1                            | 59.58  |
| 2                            | 98.02  |
| 3                            | 134.69 |
| 4                            | 169.16 |
| 5                            | 201.14 |
| 6                            | 230.53 |
| 7                            | 257.36 |
| 8                            | 281.73 |
| 9                            | 303.82 |
| 10                           | 323.81 |
| 20                           | 446.55 |
| 30                           | 501.31 |
| 40                           | 531.19 |
| 50                           | 549.8  |
| 60                           | 562.47 |
| 70                           | 571.62 |
| 80                           | 578.55 |

|     |        |
|-----|--------|
| 90  | 583.96 |
| 100 | 588.3  |
| 200 | 608.03 |
| 287 | 614.05 |

EXCESSIVE COMPUTER TIME WOULD BE REQUIRED TO CALCULATE  
THE FORCE FOR ADDITIONAL LINES OF CHARGE.

THE EXACT VALUE FOR AN INFINITE PLANE OF CHARGE IS 628.318

DO YOU WANT ANOTHER RUN (1=YES, 0=NO) : ?0

DONE

CONTRIBUTED PROGRAM **BASIC**EINDIS  
36716

**TITLE:** EINSTEIN DISTORTIONS

**DESCRIPTION:** Calculates and tabulates Relativistic Effects on a "twin" who is flying by in a rocket ship, as a function of (percent of speed of light) his velocity (speed). Changes in twin's height, weight, age, color of rocket ship are noted.

**INSTRUCTIONS:** The user enters height in inches, weight in pounds, and age in years,  
e.g., ? 70,175,37 (carriage return)

User enters twin's speed as % of speed of light,  
e.g., ? 99 (cannot enter 100)  
(cannot enter 0)  
(repeats request for input)

Program always stops - user must use RUN command for additional RUNs.

**SPECIAL CONSIDERATIONS:** For Instructional Programs: Science, Physics courses, Introduction to relativity theory.

**ACKNOWLEDGEMENTS:** Dr. Robert J. Bennett  
Bergen Community College

RUN

RUN  
EINDIS

ENTER YOUR HEIGHT IN INCHES, YOUR WEIGHT IN LBS., AND  
YOUR AGE IN YEARS.  
?70,175,37

YOUR IDENTICAL TWIN FLIES PAST IN A ROCKET SHIP. CHOOSE  
HIS SPEED AS A % OF THE SPEED OF LIGHT (BETWEEN 0 AND 100).  
?50

FOR A SPEED OF 50 % OF LIGHT, WHICH IS 149.896 MILLION  
METERS/SEC AND 329.5 MILLION MPH,

| YOU           | TWIN'S APPEARANCE |        |  |                        |
|---------------|-------------------|--------|--|------------------------|
| 70 INCHES     | 60.6218           | INCHES |  | - LENGTH CONTRACTION   |
| 79.5455 KGMS. | 91.8512           | KGMS.  |  | - MASS-ENERGY INCREASE |
| 37 YEARS      | 32.0429           | YEARS  |  | - TIME DILATION        |

YOUR TWIN IS ALSO TILTED BY 26.5206 DEGREES, DUE TO DEPTH-  
OF-FIELD ROTATION

FOR EARTH'S GRAVITY FIELD TO PRODUCE AN EQUIVALENT SPACE-  
TIME DISTORTION WOULD REQUIRE THE EARTH'S DIAMETER TO BE  
180.942 MILLION TIMES SMALLER THAN IT IS, OR THE MASS 180.942  
MILLION  
TIMES BIGGER THAN ACTUAL.

YOUR ANTI-MATTER TWIN COULD BE CREATED BY THE COLLISION OF  
2 GAMMA-RAYS EACH HAVING 7.15909 BILLION BILLION JOULES OF  
ENERGY, WHICH EQUALS 1883.97 MILLION TONS OF TNT OR  
37.6794 H-BOMBS (PAIR PRODUCTION).

IF YOU FLY OFF IN THE ROCKET'S OPPOSITE DIRECTION AT THE  
SAME SPEED, 50 % OF C, YOU BOTH WILL SEPARATE AT  
80 % OF C (RELATIVISTIC VELOCITY ADDITION).

WHEN THE PURPLE ROCKET IS MOVING AWAY, IT APPEARS  
RED (RED SHIFT)  
WHEN THE PURPLE ROCKET IS PASSING YOU, IT APPEARS  
BLUE (RED SHIFT)  
OF COURSE YOU APPEAR THE SAME WAY TO YOUR TWIN; AFTER  
ALL, HE IS A RELATIVE !!

DONE

RUN  
EINDIS

ENTER YOUR HEIGHT IN INCHES, YOUR WEIGHT IN LBS., AND  
YOUR AGE IN YEARS.  
?70,175,37

YOUR IDENTICAL TWIN FLIES PAST IN A ROCKET SHIP. CHOOSE  
HIS SPEED AS A % OF THE SPEED OF LIGHT (BETWEEN 0 AND 100).  
?100

YOUR IDENTICAL TWIN FLIES PAST IN A ROCKET SHIP. CHOOSE  
HIS SPEED AS A % OF THE SPEED OF LIGHT (BETWEEN 0 AND 100).  
?99

FOR A SPEED OF 99 % OF LIGHT, WHICH IS 296.794 MILLION  
METERS/SEC AND 652.41 MILLION MPH,

| YOU           | TWIN'S APPEARANCE |        |  |                        |
|---------------|-------------------|--------|--|------------------------|
| 70 INCHES     | 9.87471           | INCHES |  | - LENGTH CONTRACTION   |
| 79.5455 KGMS. | 563.883           | KGMS.  |  | - MASS-ENERGY INCREASE |
| 37 YEARS      | 5.21949           | YEARS  |  | - TIME DILATION        |

YOUR TWIN IS ALSO TILTED BY 44.6373 DEGREES, DUE TO DEPTH-  
OF-FIELD ROTATION

FOR EARTH'S GRAVITY FIELD TO PRODUCE AN EQUIVALENT SPACE-TIME DISTORTION WOULD REQUIRE THE EARTH'S DIAMETER TO BE 709.365 MILLION TIMES SMALLER THAN IT IS, OR THE MASS 709.365 MILLION TIMES BIGGER THAN ACTUAL.

YOUR ANTI-MATTER TWIN COULD BE CREATED BY THE COLLISION OF 2 GAMMA-RAYS EACH HAVING 7.15909 BILLION BILLION JOULES OF ENERGY, WHICH EQUALS 1883.97 MILLION TONS OF TNT OR 37.6794 H-BOMBS (PAIR PRODUCTION).

IF YOU FLY OFF IN THE ROCKET'S OPPOSITE DIRECTION AT THE SAME SPEED, 99 % OF C, YOU BOTH WILL SEPARATE AT 99.9949 % OF C (RELATIVISTIC VELOCITY ADDITION).

WHEN THE PURPLE ROCKET IS MOVING AWAY, IT APPEARS INVISIBLE-INFRARED! (LARGE RED SHIFT)  
WHEN THE PURPLE ROCKET IS PASSING YOU, IT APPEARS INVISIBLE-INFRARED! (LARGE RED SHIFT)  
OF COURSE YOU APPEAR THE SAME WAY TO YOUR TWIN; AFTER ALL, HE IS A RELATIVE !!

DONE





CONTRIBUTED PROGRAM **BASIC**

## TITLE:

DRILL ON SYMBOLS FOR CHEMICAL ELEMENTS

ELEMENT  
36267

## DESCRIPTION:

This program provides drill and practice in the naming of chemical symbols for a given chemical element. The user is allotted 5 seconds for a correct response to a given element name. The cycle is repeated ten times followed by a summary of his performance.

## INSTRUCTIONS:

User types in his name. He is asked to input the symbols for the elements. Example: CR for CHROMIUM. Five seconds are provided to answer. The cycle repeats ten times.

SPECIAL  
CONSIDERATIONS:

X $\emptyset$ , which is set in line 2 $\emptyset$ , is how many elements are stored in the DATA statements. N $\emptyset$ , assigned in line 25, assigns the number of problems, and T $\emptyset$  in line 30 sets the time limit for the responses. To add more elements, use DATA statements, with the format  
XXXX DATA "ELEMENT", "SYMBOL", "ELEMENT", ETC....

FOR INSTRUCTIONAL PURPOSES:  
Suitable Courses: Chemistry

Student Background Required: Knowledge of elements and their symbols.

## ACKNOWLEDGEMENTS:

Phillip Short  
Burnsville Senior High School

RUN

RUN  
ELMENT

NAMING ELEMENTS

WHAT IS YOUR NAME?PHILLIP SHORT

WHAT IS THE SYMBOL FOR LITHIUM ?  
LN  
NO. YOU ARE WRONG  
THE ANSWER IS LI ..

WHAT IS THE SYMBOQ FOR NEON ?  
NE  
CORRECT!!

WHAT IS THE SYMBOL FOR IRIDIUM ?  
IR  
CORRECT!!

WHAT IS THE SYMBOL FOR HYDROGEN ?  
H  
CORRECT!!

WHAT IS THE SYMBOL FOR GERMANIUM ?  
GE  
CORRECT!!

WHAT IS THE SYMBOL FOR NICKEL ?  
NI  
CORRECT!!

WHAT IS THE SYMBOL FOR KRYPTON ?  
KR  
CORRECT!!

WHAT IS THE SYMBOL FOR TIN ?  
T  
YOU ARE TOO SLOW.  
THE ANSWER IS SN ..

WHAT IS THE SYMBOL FOR BORON ?  
B  
YOU ARE TOO SLOW.  
THE ANSWER IS B ..

WHAT IS THE SYMBOL FOR BROMINE ?  
BR  
CORRECT!!

-----  
PHILLIP SHORT

YOU GOT 7 RIGHT.

YOU WERE TOO SLOW 2 TIMES.

YOU WERE WRONG 1 TIMES.

-----  
DONE

## TITLE:

CALCULATES EMPIRICAL FORMULAS

## DESCRIPTION:

A classroom demonstration designed to calculate the empirical formulae from atomic mass (atomic weight) and percent composition.

OBJECTIVES:

- A. To distinguish between molecular and empirical formulae.
- B. To illustrate the law of multiple proportions.
- C. To emphasize the unity of the atom when writing chemical formulae.
- D. To demonstrate the importance of accurate calculation with empirical formulae problems.

## INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - The student should have some experience in writing chemical formulae and calculating percent composition from chemical formulae. An understanding of significant figures would also add to the value of the lesson.
- B. Materials - None

DISCUSSION:

In this program the atomic number is used for identification only and has no part in the actual calculations.

The student generally has difficulty understanding the function of the ratio in calculating empirical formulae. This program is designed to emphasize that function.

The importance of significant figures could also be illustrated. The students' tendency to approximate generally results in numbers of questionable value. In this program, by using a series of calculations for the same compound with figures of progressively greater accuracy, an empirical formulae closer to whole numbers will be obtained.

## ACKNOWLEDGEMENTS:

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
EMPIR

THIS PROGRAM WILL FIND THE EMPIRICAL FORMULA FOR  
ANY COMPOUND CONTAINING UP TO FIVE DIFFERENT ELEMENTS

WHEN INFORMATION IS REQUESTED, TYPE IN THE ATOMIC  
NUMBER, THE ATOMIC WEIGHT, AND THE PCT COMPOSITION BY  
WEIGHT IN THAT ORDER; FOR EXAMPLE, IN THE COMPOUND  $S_2O_2$ ,  
THE DATA WOULD BE ENTERED AS FOLLOWS: 16,32,50 FOR  
SULFUR AND 8,16,50 FOR OXYGEN.

HOW MANY ELEMENTS DOES YOUR UNKNOWN COMPOUND CONTAIN?2  
ENTER THE ATOMIC NUMBER, THE ATOMIC WEIGHT, AND THE  
PCT COMPOSITION FOR EACH OF THE ELEMENTS IN YOUR COMPOUND.  
BE SURE TO ENTER ONE SET OF NUMBERS FOR EACH QUESTION MARK.

1 . ?26,55.9,69.96  
2 . ?8,16,30.04

| ATOMIC<br>NUMBER | PCT.<br>COMP. | INITIAL<br>RATIO | RATIO*2 | RATIO*3 |
|------------------|---------------|------------------|---------|---------|
| 26               | 69.96         | 1                | 2       | 3       |
| 8                | 30.04         | 1.5              | 3       | 4.5     |

TO FIND THE EMPIRICAL FORMULA LOCATE THE FIRST RATIO  
COLUMN IN WHICH ALL OF THE NUMBERS MOST CLOSELY APPROXIMATE  
A WHOLE NUMBER.

IF YOU WOULD LIKE TO TRY AGAIN TYPE 1, IF NOT TYPE 0.?1

HOW MANY ELEMENTS DOES YOUR UNKNOWN COMPOUND CONTAIN?3  
ENTER THE ATOMIC NUMBER, THE ATOMIC WEIGHT, AND THE  
PCT COMPOSITION FOR EACH OF THE ELEMENTS IN YOUR COMPOUND.  
BE SURE TO ENTER ONE SET OF NUMBERS FOR EACH QUESTION MARK.

1 . ?1,1,2  
2 . ?16,32,32.7  
3 . ?8,16,65.3

| ATOMIC<br>NUMBER | PCT.<br>COMP. | INITIAL<br>RATIO | RATIO*2 | RATIO*3 |
|------------------|---------------|------------------|---------|---------|
| 1                | 2             | 2                | 3.9     | 5.9     |
| 16               | 32.7          | 1                | 2       | 3       |
| 8                | 65.3          | 4                | 8       | 12      |

IF YOU WOULD LIKE TO TRY AGAIN TYPE 1, IF NOT TYPE 0.?1

HOW MANY ELEMENTS DOES YOUR UNKNOWN COMPOUND CONTAIN?1  
THE EMPIRICAL FORMULA FOR A COMPOUND THAT CONTAINS ONLY  
A SINGLE ELEMENT IS STRAIGHTFORWARD.

IF YOU WOULD LIKE TO TRY AGAIN TYPE 1, IF NOT TYPE 0.?0

DONE

**TITLE:**

EQUIL1/EQUIL2: Equilibrium Systems

**DESCRIPTION:**

This program calculates the effects of concentration changes in the equilibrium systems  $2\text{HI} \rightleftharpoons \text{H}_2 + \text{I}_2$  and  $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$ .

OBJECTIVES:

- A. To show that an equilibrium system is a dynamic one.
- B. To illustrate and reinforce Le Chateliers principle.
- C. An exercise in the interpretation of experimental data.
- D. The significance of the Equilibrium constants.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - The student should have been made aware of "reversible" reactions, equilibrium systems and Le Chateliers principle.
- B. Materials - none

DISCUSSION:

These two programs can be used as classroom demonstrations to illustrate the effect of varying the concentration of one of the products of a system at Equilibrium. The results are given not only as a table, but also graphically, since it was found that students have less trouble recognizing trends when they can be illustrated.

The equilibrium constant can also be changed to show its effect on the equilibrium system.

As always, the teacher should have run the program he wishes to use prior to its classroom presentation since the choice of constants will determine the slope of the curves.

NOTE: The vertical axis (horizontal on the output) is labeled in percent of maximum y value.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN

EQUIL1

THIS PROGRAM WILL INVESTIGATE THE EQUILIBRIUM SYSTEM



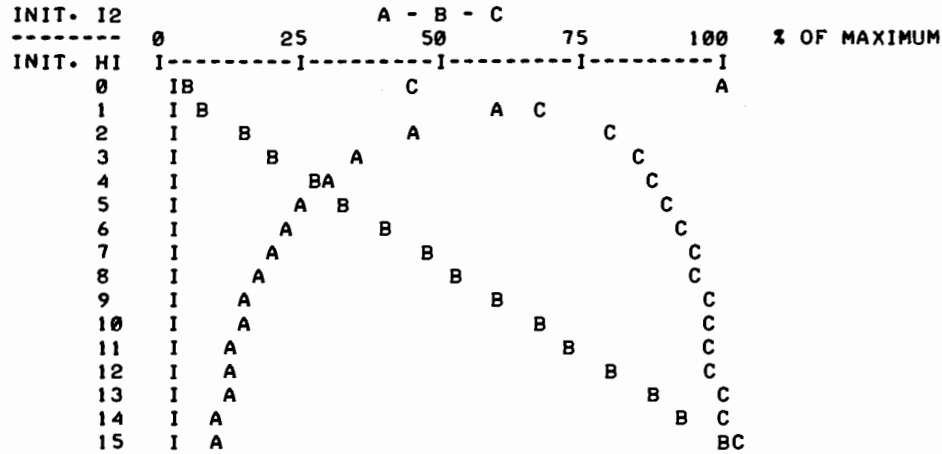
WHAT IS THE EQUILIBRIUM CONSTANT?.5

WHAT IS THE INITIAL CONCENTRATION OF HI?2

WOULD YOU LIKE THE RESULTS PLOTTED (1), TABULATED (2)  
OR BOTH (3) (TYPE THE APPROPRIATE NUMBER)?3

| INIT. I2 | EQUIL. H2   | EQUIL. I2 | EQUIL. HI |
|----------|-------------|-----------|-----------|
| -----    | -----       | -----     | -----     |
| INIT. HI | INIT. HI    | INIT. HI  | INIT. HI  |
| 0        | .292893     | .292893   | .414214   |
| 1        | .177124     | 1.17712   | .645751   |
| 2        | .129171     | 2.12917   | .741658   |
| 3        | .102084     | 3.10208   | .795832   |
| 4        | 8.45242E-02 | 4.08452   | .830952   |
| 5        | 7.21726E-02 | 5.07217   | .855655   |
| 6        | 6.29959E-02 | 6.063     | .874008   |
| 7        | 5.59025E-02 | 7.0559    | .888195   |
| 8        | .050252     | 8.05025   | .899496   |
| 9        | 4.56438E-02 | 9.04564   | .908712   |
| 10       | 4.18119E-02 | 10.0418   | .916376   |
| 11       | 3.85761E-02 | 11.0386   | .922848   |
| 12       | 3.58057E-02 | 12.0358   | .928389   |
| 13       | 3.34072E-02 | 13.0334   | .933186   |
| 14       | .031311     | 14.0313   | .937378   |
| 15       | 2.94628E-02 | 15.0295   | .941074   |

A: (EQUIL. H2)/(INIT. HI)      MAXIMUM IS .292893  
 B: (EQUIL. I2)/(INIT. HI)      MAXIMUM IS 15.0295  
 C: (EQUIL. HI)/(INIT. HI)      MAXIMUM IS .941074



\*\*\*\*\*

WOULD YOU LIKE ANOTHER RUN (1=YES, 0=NO)?0

DONE

RUN  
 RUN  
 EQUIL2

THIS PROGRAM WILL INVESTIGATE THE EQUILIBRIUM SYSTEM

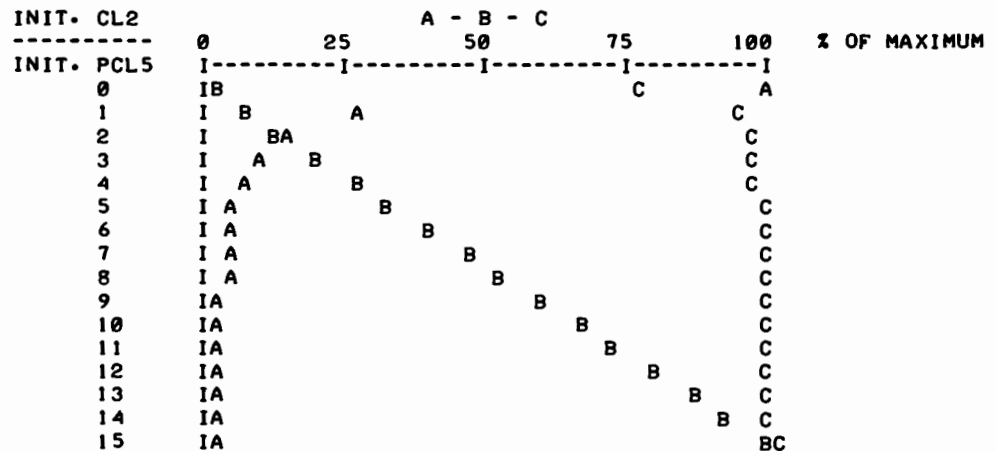
$$PCL5 = PCL3 + CL2$$

WHAT IS THE EQUILIBRIUM CONSTANT?.74  
 WHAT IS THE INITIAL CONCENTRATION OF PCL5?10

WOULD YOU LIKE THE RESULTS PLOTTED (1), TABULATED (2)  
 OR BOTH (3) (TYPE THE APPROPRIATE NUMBER)?3

| INIT. CL2  | EQUIL. PCL3 | EQUIL. CL2 | EQUIL. PCL5 |
|------------|-------------|------------|-------------|
| -----      | -----       | -----      | -----       |
| INIT. PCL5 | INIT. PCL5  | INIT. PCL5 | INIT. PCL5  |
| 0          | .237534     | .237534    | .762466     |
| 1          | .064971     | 1.06497    | .935029     |
| 2          | 3.50864E-02 | 2.03509    | .964914     |
| 3          | 2.38872E-02 | 3.02389    | .976113     |
| 4          | 1.80836E-02 | 4.01808    | .981916     |
| 5          | 1.45426E-02 | 5.01454    | .985457     |
| 6          | 1.21589E-02 | 6.01216    | .987841     |
| 7          | 1.04456E-02 | 7.01045    | .989554     |
| 8          | 9.15527E-03 | 8.00916    | .990845     |
| 9          | 8.14819E-03 | 9.00815    | .991852     |
| 10         | 7.34043E-03 | 10.0073    | .99266      |
| 11         | 6.67858E-03 | 11.0067    | .993321     |
| 12         | 6.12545E-03 | 12.0061    | .993875     |
| 13         | 5.65815E-03 | 13.0057    | .994342     |
| 14         | 5.25570E-03 | 14.0053    | .994744     |
| 15         | 4.90761E-03 | 15.0049    | .995092     |

A: (EQUIL. PCL3)/(INIT. PCL5)      MAXIMUM IS .237534  
 B: (EQUIL. CL2)/(INIT. PCL5)      MAXIMUM IS 15.0049  
 C: (EQUIL. PCL5)/(INIT. PCL5)      MAXIMUM IS .995092



\*\*\*\*\*

WOULD YOU LIKE ANOTHER RUN (1=YES, 0=NO)?0

DONE





**TITLE:**

EVOLU: Natural Selection Experiment

**DESCRIPTION:**

A population of dark and light pepper moths are studied over a period of 30 years. The student selects the year and direction of environmental changes which favors one or the other. The concept of natural selection in evolution is developed.

OBJECTIVES:

To show the student that:

- A. The mutation rate within a population for a specific trait can be stable for a period of time, or can change. The success of the progeny exhibiting this variation is dependent upon environmental conditions.
- B. Progeny exhibiting an hereditary trait do not necessarily reach maturity, because of the influence of environment.
- C. Evolution depends upon mutation, heredity, and environmental pressures.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - An understanding of the following terms: 1) mutation rate, 2) species, 3) environmental change, 4) population.
- B. Materials - 1) Specimens showing color variations within any species (optional); and 2) Ditto of the list of assumptions presented in this program (optional). Assumptions are listed below.

DISCUSSION: See following page.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

DISCUSSION:

A. Operational Suggestions

1. Student level - average
2. Group size - Work in small groups of five or less. Remaining students may be engaged in a related activity.
3. Assumptions - Prior to running the program, the students should be told to assume the following:
  - a) The environment initially favors the light moths.
  - b) At first, brown moths are produced, but because of environmental pressures they do not reach maturity.
  - c) The total population in the area cannot exceed the initial number of moths, because this is the maximum number of moths the environment can support.
4. Each group of students should run the program at least two times, varying the environmental pressure; once favoring the dark moths and once favoring the light.
5. You might have the runs of different groups of students reflect different mutation rates.
6. Supervision of the number of program runs per group is necessary since they are not automatically cut off.

B. Suggested Follow-up

These questions may be used to initiate discussion:

1. Why does the mutation rate remain constant? Does it always remain constant under natural conditions? Explain your reasons.
2. Assuming constant environmental conditions, how does changing the mutation rate affect the population? Why?
3. How does changing the mutation rate affect the dark moth population when environmental pressures favor these moths? Why?
4. What environmental pressures could favor the dark moths? (industrial expansion, predators which favor the light or dark moths) (The classic case of the pepper moths and the industrial revolution in England could be discussed at this point.)
5. What possible role might pollutants play in altering a mutation rate? What other factors could affect a mutation rate?
6. Is evolution a slow or fast process? Explain your answer.
7. Why do a few white moths always remain in the population, even though the environment favors the dark moths?
8. What is natural selection? What is its role in evolution?
9. Make a list of all factors important to evolution.

RUN

RUN  
EVOLU

**EVOLUTION STUDY**

**WITHIN A LARGE POPULATION OF PEPPER MOTHS, THERE ARE A FEW INDIVIDUALS WHICH SHOW UP DARKER IN COLOR THAN THE NORMAL LIGHT COLORED MOTHS BECAUSE OF MUTATIONS.**

**YOU ARE GOING TO STUDY THIS POPULATION OF PEPPER MOTHS FOR 30 YEARS AND SEE WHAT HAPPENS TO THE NUMBER OF DARK MOTHS WHEN YOU ALTER ENVIRONMENTAL CONDITIONS.**

**SELECT A MUTATION RATE VALUE BETWEEN 1 AND 10. THE HIGHER THE NUMBER, THE HIGHER THE MUTATION RATE IS, AND THUS THERE ARE MORE DARK MOTHS IN OUR POPULATION.  
?9**

**HOW MANY LIGHT COLORED MOTHS ARE THERE IN THE AREA?  
SELECT A NUMBER BETWEEN 1000 AND 1000000 ?65789**

**YOU HAVE THE POWER TO CHANGE THE ENVIRONMENT.  
AT WHAT POINT IN OUR THIRTY YEAR PERIOD DO YOU WANT TO IMPLEMENT YOUR POWER? SELECT A YEAR FROM 3 THROUGH 10.  
?5**

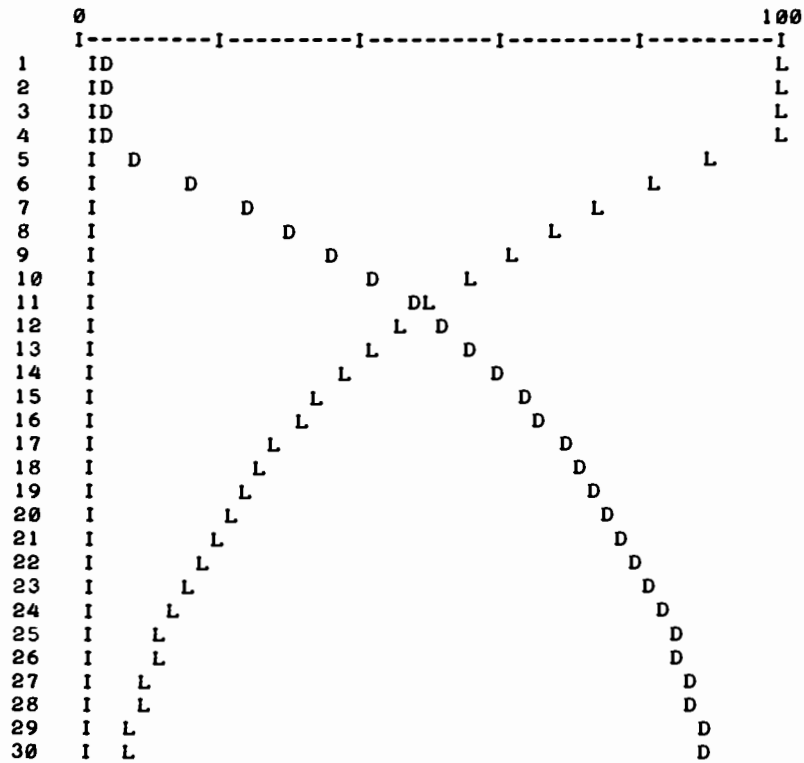
**IS THE ENVIRONMENTAL CHANGE GOING TO FAVOR LIGHT MOTHS (TYPE 1) OR DARK MOTHS (TYPE 2)?2**

**HOW DO YOU WISH TO SEE THE RESULTS?  
1=TABLE ONLY, 2=GRAPH ONLY, 0=BOTH?0**

**FOR A MUTATION RATE OF 9**

| YEAR | DARK MOTHS | LIGHT MOTHS |
|------|------------|-------------|
| 1    | 0          | 65789.      |
| 2    | 0          | 65789.      |
| 3    | 0          | 65789.      |
| 4    | 0          | 65789.      |
| 5    | 5921       | 59868.      |
| 6    | 11309      | 54480.      |
| 7    | 16212      | 49577.      |
| 8    | 20674      | 45115.      |
| 9    | 24734      | 41055.      |
| 10   | 28429      | 37360.      |
| 11   | 31791      | 33998.      |
| 12   | 34851.     | 30938       |
| 13   | 37635.     | 28154       |
| 14   | 40169.     | 25620       |
| 15   | 42475.     | 23314       |
| 16   | 44573.     | 21216       |
| 17   | 46482.     | 19307       |
| 18   | 48220.     | 17569       |
| 19   | 49801.     | 15988       |
| 20   | 51240.     | 14549       |
| 21   | 52549.     | 13240       |
| 22   | 53741.     | 12048       |
| 23   | 54825.     | 10964       |
| 24   | 55812.     | 9977        |
| 25   | 56710.     | 9079        |
| 26   | 57527.     | 8262        |
| 27   | 58271.     | 7518        |
| 28   | 58948.     | 6841        |
| 29   | 59564.     | 6225        |
| 30   | 60124.     | 5665        |

L=LIGHT MOTHS, D=DARK MOTHS  
VALUES GRAPHED AS PERCENTAGE OF POPULATION.



DO YOU WANT TO RUN THIS PROGRAM AGAIN (1=YES,0=NO)?0

DONE



|                          |                                                                                                                                                                                                                        |                          |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>TITLE:</b>            | GAMGN: Process of Gametogenesis                                                                                                                                                                                        | GAMGN<br>36302           |
| <b>DESCRIPTION:</b>      | A review of the process of gametogenesis, applying it to the concept of dominant-recessive traits.                                                                                                                     |                          |
|                          | <u>OBJECTIVES:</u>                                                                                                                                                                                                     |                          |
|                          | A. To reinforce the meaning of the terms random assortment, meiotic divisions, monoploid, and diploid.                                                                                                                 |                          |
|                          | B. To allow the student to make decisions based upon knowledge gained in the program, thus causing the students to think.                                                                                              |                          |
|                          | C. To review and reinforce both spermatogenesis and oogenesis.                                                                                                                                                         |                          |
| <b>INSTRUCTIONS:</b>     | <u>PRELIMINARY PREPARATION:</u>                                                                                                                                                                                        |                          |
|                          | A. Student                                                                                                                                                                                                             |                          |
|                          | 1. Students should be familiar with all phases of meiosis.                                                                                                                                                             |                          |
|                          | 2. Genetics should have been introduced so that the student understands the implications of gene action, dominance and recessiveness, homologous and non-homologous chromosomes.                                       |                          |
|                          | 3. Programming and machine knowledge. Keep in mind that for this program the students should be given time to try to determine what genetic traits are represented by the chromosome designation shown in the program. |                          |
|                          | normal wing - red eye                                                                                                                                                                                                  | = A1A2, B1B2, C1C2, D1D2 |
|                          | normal wing - white eye                                                                                                                                                                                                | = A1A2, B2B2, C1C2, D1D2 |
|                          | vestigial wing                                                                                                                                                                                                         | = A1A1, B1B2, C1C2, D1D2 |
|                          | lethal gene                                                                                                                                                                                                            | = A1A2, B1B2, C1C1, D1D2 |
|                          | red eye                                                                                                                                                                                                                | = B1B2 or B1B1           |
|                          | white eye                                                                                                                                                                                                              | = B2B2 (recessive)       |
|                          | normal wing                                                                                                                                                                                                            | = A1A2 or A2A2           |
|                          | vestigial wing                                                                                                                                                                                                         | = A1A1 (recessive)       |
|                          | non lethal gene                                                                                                                                                                                                        | = C2C2                   |
|                          | lethal gene carrier                                                                                                                                                                                                    | = C1C2                   |
|                          | lethal (dies)                                                                                                                                                                                                          | = C1C1 (recessive)       |
|                          | B. Materials - none necessary                                                                                                                                                                                          |                          |
|                          | Continued on following page.                                                                                                                                                                                           |                          |
| <b>ACKNOWLEDGEMENTS:</b> | Huntington Project<br>Polytechnic Institute of Brooklyn                                                                                                                                                                |                          |

DISCUSSION:

A. Operational Suggestions

1. Student level - average to above average ability
2. If the student is confused alert him to the fact that chromosomes are letters and the number following the letter represents genes. Similar letters indicate homologous chromosomes. (see program)
3. Read the program ahead of time to make sure your students are familiar with the terms used in the program.
4. If the students are thrown off the machine see that they review with the teacher the concept of gametogenesis before continuing with the program.
5. Ideally, students should work individually. If this is not possible, then work in groups of 5 or less. Allow one group at a time at the computer while the remaining groups are engaged in a related activity.

B. Suggested Follow-up

To maximize the value of this program, it is strongly suggested that the teacher:

1. Elicit from the students:

What are the gene locations for the various genetic traits (eye color, wing normalcy, lethality)? Which is recessive? Which is dominant? Why is there no chance that the offspring will have the exact chromosomal composition of the father?

2. Ask the following questions, based on the information given, as lead-ins to discussion or as a homework assignment.

- (a) What is a polar body? How does the formation of polar bodies increase the survival chance of the egg cell?
- (b) How is random assortment responsible for genetic trait variations?
- (c) Why is it possible for all offspring to have the same traits without variations?

ARTICULATION INTO NEXT AREA TO BE COVERED:

This program can lead directly into the topic of genetics. A second program, DRQS A833-36300, appearing in the manual, should follow. It demonstrates, with a game, the random recombinations of the chromosomes in offspring, showing all possible combinations and, if repeated often enough, Mendelian ratios.

RUN

RUN  
GAMGN

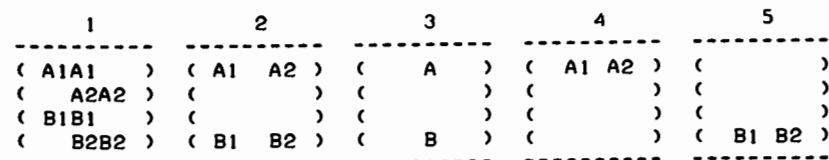
THE FOLLOWING DIAGRAMS ARE REPRESENTATIONS OF PRIMARY SEX CELLS. CHROMOSOMES ARE REPRESENTED BY LETTERS.



BY TYPING IN A NUMBER, WHAT IS THE DIPLOID NUMBER OF CHROMOSOMES FOR THIS ORGANISM?4

SO YOU SEE THAT A1 + A2, FOR EXAMPLE, ARE PAIRS OF HOMOLOGOUS CHROMOSOMES. IT IS ESSENTIAL THAT AFTER FERTILIZATION, IF THE DIPLOID CONDITION IS TO BE RETAINED THAT WE HAVE SOME MEANS OF PLACING ONLY ONE A AND ONE B CHROMOSOME IN THE SPERM AND ONLY ONE A AND ONE B CHROMOSOME IN THE EGG. THIS INVOLVES MEIOSIS.

LOOK AT THE PRIMARY SPERMATOCYTE ABOVE. DURING THE FIRST STAGE OF MEIOSIS, THE MALE SEX CELL SHOULD APPEAR AS IT IS IN ONE OF THE FOLLOWING DIAGRAMS.



WHICH DIAGRAM MOST CLOSELY REPRESENTS THIS MEIOTIC STAGE ?1

O.K., NOW WE CAN MOVE ALONG. MEIOTIC DIVISION OCCURS AND WE GET TWO SECONDARY SPERMATOCYTES FROM EACH PRIMARY SPERMATOCYTE AND ONE SECONDARY OOCYTE FROM EACH PRIMARY OOCYTE. EACH SPERMATOCYTE CONTAINS THE FOLLOWING CHROMOSOMES: A1 A2, B1 B2. EACH OOCYTE HAS A3 A4, B3 B4.

THE REASON WHY ONLY ONE OOCYTE IS PRODUCED IS:

- 1)THE OOCYTE DOES NOT UNDERGO DIVISION.
- 2)THE OOCYTE DIVIDES AFTER FERTILIZATION.
- 3)A POLAR BODY IS FORMED.
- 4)THERE IS AN ERROR IN THE COMPUTER.



WHICH NUMBER WOULD REPRESENT THE CORRECT ANSWER?3

CORRECT. NOW LET'S MOVE TO THE FINAL STAGE IN WHICH WE WILL END UP WITH 4 MONOPLIOD(HAPLOID) SPERM--1)A1B1 2)A2B2 3)A1B2 4)A2B1 AND ONE OVUM--1)A3B3 OR 2)A4B4 OR 3)A3B4 OR 4)A4B3

WHAT IS THE POSSIBILITY THAT THE OFFSPRING WILL HAVE THE SAME CHROMOSOMAL COMPOSITION AS THE FATHER? PRINT ONE OF THE FOLLOWING NUMBERS.

- 1)50 CHANCE
- 2)NO CHANCE
- 3)100 CHANCE
- 4)YOU CAN'T TELL FROM THE INFORMATION GIVEN

?2

GOOD THINKING.

I HOPE YOU HAVE A FAIRLY GOOD IDEA OF SEVERAL PRINCIPLES INVOLVED, PARTICULARLY RANDOM ASSORTMENT.

NOW LET'S SEE IF WE CAN USE THESE IDEAS TO DETERMINE WHAT OCCURS IN A POPULATION. WE WILL USE AS OUR ORGANISM THE FRUIT FLY, DROSOPHILA, WHICH HAS 8 AS THE DIPLOID NUMBER OF CHROMOSOMES. THE FOLLOWING WILL REPRESENT CERTAIN CONDITIONS IN FRUIT FLIES :

NORMAL WING-RED EYE=A1A2, B1B2, C1C2, D1D2  
 NORMAL WING-WHITE EYE=A1A2, B2B2, C1C2, D1D2  
 VESTIGIAL WING=A1A1, B1B2, C1C2, D1D2  
 LETHAL GENE=A1A2, B1B2, C1C1, D1D2

SUPPOSE WE CROSS THE NORMAL RED EYED WITH THE NORMAL EYED FRUIT FLY. WHAT COULD THE OFFSPRING LOOK LIKE? LOOK AT THE GENOTYPES CAREFULLY AND SEE IF YOU CAN PICK OUT THE DIFFERENT GENE COMBINATIONS. THEN MAKE ALL POSSIBLE CROSSES. AT A LATER DATE, WE WILL SEE HOW I, THE COMPUTER, CAN SOLVE THIS PROBLEM FOR YOU. BUT FIRST, TAKE THIS SHEET BACK TO YOUR SEATS AND WORK ON IT.

DONE





GENE1  
36642**TITLE:** GENETICS SIMULATION**DESCRIPTION:** GENE1 is a simulation of the inheritance of genetic traits demonstrating the statistical nature of the Mendelian Laws.

GENE1 was developed by the Huntington II Project at the Polytechnic Institute of Brooklyn under the direction of L. Braun. This work was partially supported by the National Science Foundation, Grant GW-5883.

**INSTRUCTIONS:** The user specifies the dominant and recessive traits to be studied. The user is then asked to enter the genotypes of the female parent and the male parent (the genotype of each parent is entered on 2 separate lines). After specifying the number of offspring to be studied, the simulation takes place and a detailed report of the offspring may be generated.**SPECIAL CONSIDERATIONS:** The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                   |        |
|-------------------|--------|
| Student Workbook  | \$ .30 |
| Teachers Guide    | .30    |
| Resource Handbook | .50    |

**ACKNOWLEDGEMENTS:** Huntington II Project  
State University of New York

RUN

RUN  
GENE1

WHAT ARE THE TWO TRAITS TO BE STUDIED?  
DOMINANT TRAIT?BROWN  
RECESSIVE TRAIT?BLUE

\*\*\*\*\*

GENOTYPE OF FEMALE PARENT?BROWN  
??BLUE

GENOTYPE OF MALE PARENT?BLUE  
??BLE-UE

HOW MANY OFFSPRING DO YOU WANT TO STUDY?25

DETAILED REPORT (YES OR NO)?YES

| OFFSPRING NO. | -----GENOTYPE----- |        | PHENOTYPE |
|---------------|--------------------|--------|-----------|
|               | GENE 1             | GENE 2 |           |
| 1             | BROWN              | BLUE   | BROWN     |
| 2             | BROWN              | BLUE   | BROWN     |
| 3             | BROWN              | BLUE   | BROWN     |
| 4             | BLUE               | BLUE   | BLUE      |
| 5             | BROWN              | BLUE   | BROWN     |
| 6             | BLUE               | BLUE   | BLUE      |
| 7             | BLUE               | BLUE   | BLUE      |
| 8             | BLUE               | BLUE   | BLUE      |
| 9             | BROWN              | BLUE   | BROWN     |
| 10            | BROWN              | BLUE   | BROWN     |
| 11            | BROWN              | BLUE   | BROWN     |
| 12            | BLUE               | BLUE   | BLUE      |
| 13            | BROWN              | BLUE   | BROWN     |
| 14            | BROWN              | BLUE   | BROWN     |
| 15            | BROWN              | BLUE   | BROWN     |
| 16            | BROWN              | BLUE   | BROWN     |
| 17            | BROWN              | BLUE   | BROWN     |
| 18            | BLUE               | BLUE   | BLUE      |
| 19            | BROWN              | BLUE   | BROWN     |
| 20            | BROWN              | BLUE   | BROWN     |
| 21            | BROWN              | BLUE   | BROWN     |
| 22            | BLUE               | BLUE   | BLUE      |
| 23            | BROWN              | BLUE   | BROWN     |
| 24            | BLUE               | BLUE   | BLUE      |
| 25            | BROWN              | BLUE   | BROWN     |

\*\*\*\*\*

GENOTYPE RATIO     0 : 2.125     : 1  
PHENOTYPE RATIO   2.125     : 1

\*\*\*\*\*

WANT ANOTHER RUN (YES OR NO)?YES

\*\*\*\*\*

GENOTYPE OF FEMALE PARENT?BROWN  
??BLUE

GENOTYPE OF MALE PARENT?BROWN  
??BLUE

HOW MANY OFFSPRING DO YOU WANT TO STUDY?15

DETAILED REPORT (YES OR NO)?YES

| OFFSPRING NO. | -----GENOTYPE----- |        | PHENOTYPE |
|---------------|--------------------|--------|-----------|
|               | GENE 1             | GENE 2 |           |
| 1             | BLUE               | BLUE   | BLUE      |
| 2             | BLUE               | BROWN  | BROWN     |
| 3             | BROWN              | BLUE   | BROWN     |
| 4             | BROWN              | BLUE   | BROWN     |
| 5             | BROWN              | BROWN  | BROWN     |
| 6             | BROWN              | BROWN  | BROWN     |
| 7             | BLUE               | BLUE   | BLUE      |
| 8             | BLUE               | BLUE   | BLUE      |
| 9             | BROWN              | BROWN  | BROWN     |
| 10            | BROWN              | BROWN  | BROWN     |
| 11            | BROWN              | BROWN  | BROWN     |
| 12            | BLUE               | BROWN  | BROWN     |
| 13            | BROWN              | BROWN  | BROWN     |
| 14            | BLUE               | BLUE   | BLUE      |
| 15            | BROWN              | BLUE   | BROWN     |

\*\*\*\*\*

GENOTYPE RATIO    1 : .833333    : .666667  
 PHENOTYPE RATIO    2.75                : 1

\*\*\*\*\*

WANT ANOTHER RUN (YES OR NO)?YES

\*\*\*\*\*

GENOTYPE OF FEMALE PARENT?BROWN  
 ??BLUE

GENOTYPE OF MALE PARENT?BROWN  
 ??BLUE

HOW MANY OFFSPRING DO YOU WANT TO STUDY?15

DETAILED REPORT (YES OR NO)?NO

\*\*\*\*\*

GENOTYPE RATIO    1 : 1.6                : .4  
 PHENOTYPE RATIO    6.5                : 1

\*\*\*\*\*

WANT ANOTHER RUN (YES OR NO)?NO

DONE



GRAZE  
36746**TITLE:**

GRASSLANDS ECOLOGY SIMULATION

**DESCRIPTION:**

This program deals with the ecology of a grasslands region and allows the student to vary animal population in order to attain an ecological balance. The populations of cattle, songbirds, hawks, rodents and grasshoppers are considered. The user is referred to the supplementary materials that describe detailed operation of the program in the curriculum material listed below.

**INSTRUCTIONS:**

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5653 Student Manual  
HP 5951-5654 Teacher's Guide  
HP 5951-5655 Classroom Set (30 Student Manuals and 1 Teacher's Guide)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project  
Scientific Press  
1629 Channing Ave.  
Palo Alto, California 94303

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES  
Suitable Course(s): General Science, Biology, Environmental Studies

Student Background Required: None (Grades 7-12)

**ACKNOWLEDGEMENTS:**

Michael Chester/Irv Brenner

RUN

WHAT'S YOUR NAME? IRV BRENNER

HOW MANY CATTLE? 300  
 HOW MANY SONGBIRDS? 5000  
 HOW MANY HAWKS? 5

| YEAR | CATTLE | SONGBIRDS | HAWKS | RODENTS/ACRE | G'HOPPERS/ACRE |
|------|--------|-----------|-------|--------------|----------------|
| 0.0  | 300    | 5000      | 5.0   | 200          | 10000          |
| 0.5  | 288    | 5273      | 5.0   | 306          | 14528          |
| 1.0  | 276    | 5691      | 5.6   | 478          | 9251           |
| 1.5  | 277    | 5503      | 6.0   | 455          | 12134          |
| 2.0  | 291    | 3998      | 5.7   | 419          | 9541           |

YOUR SCORE IS 60.7

COMPLETE SUMMARY? NO

|      |     |      |      |     |      |
|------|-----|------|------|-----|------|
| 15.0 | 295 | 4856 | 12.2 | 195 | 9867 |
|------|-----|------|------|-----|------|

HOW MANY CATTLE? 0

DONE

RUN  
 GRAZE

WHAT'S YOUR NAME? IRV BRENNER

HOW MANY CATTLE? 400  
 HOW MANY SONGBIRDS? 8000  
 HOW MANY HAWKS? 10

| YEAR | CATTLE | SONGBIRDS | HAWKS | RODENTS/ACRE | G'HOPPERS/ACRE |
|------|--------|-----------|-------|--------------|----------------|
| 0.0  | 400    | 8000      | 10.0  | 200          | 10000          |
| 0.5  | 440    | 7313      | 9.5   | 243          | 11183          |
| 1.0  | 402    | 6038      | 10.3  | 254          | 10786          |
| 1.5  | 421    | 5370      | 11.0  | 252          | 12884          |
| 2.0  | 435    | 5538      | 12.6  | 225          | 10615          |

YOUR SCORE IS 90.8

COMPLETE SUMMARY? YES

|      |     |      |      |     |       |
|------|-----|------|------|-----|-------|
| 2.5  | 420 | 5275 | 11.9 | 210 | 13103 |
| 3.0  | 420 | 5495 | 13.4 | 211 | 10247 |
| 3.5  | 431 | 5796 | 12.5 | 212 | 11959 |
| 4.0  | 392 | 5334 | 13.6 | 184 | 11008 |
| 4.5  | 383 | 5472 | 13.7 | 206 | 11810 |
| 5.0  | 396 | 5780 | 12.7 | 201 | 11164 |
| 5.5  | 386 | 5417 | 12.8 | 184 | 13996 |
| 6.0  | 377 | 5363 | 13.1 | 174 | 10133 |
| 6.5  | 409 | 5203 | 11.8 | 200 | 13472 |
| 7.0  | 377 | 4791 | 12.1 | 218 | 10150 |
| 7.5  | 411 | 4993 | 14.4 | 217 | 13109 |
| 8.0  | 365 | 4888 | 11.8 | 188 | 10685 |
| 8.5  | 398 | 4736 | 11.0 | 239 | 13850 |
| 9.0  | 425 | 5601 | 12.0 | 229 | 9225  |
| 9.5  | 396 | 5698 | 12.4 | 192 | 14088 |
| 10.0 | 366 | 5215 | 12.4 | 204 | 11106 |
| 10.5 | 364 | 5532 | 13.3 | 201 | 13478 |
| 11.0 | 363 | 5103 | 12.1 | 219 | 10396 |
| 11.5 | 377 | 5637 | 14.1 | 199 | 14167 |
| 12.0 | 369 | 4982 | 11.5 | 210 | 9731  |
| 12.5 | 411 | 5265 | 11.7 | 202 | 12752 |
| 13.0 | 381 | 5234 | 12.3 | 219 | 10959 |
| 13.5 | 436 | 4970 | 15.0 | 184 | 14175 |
| 14.0 | 374 | 5561 | 12.2 | 198 | 10268 |
| 14.5 | 366 | 5474 | 12.3 | 233 | 12946 |
| 15.0 | 361 | 5467 | 13.2 | 218 | 9913  |

HOW MANY CATTLE? 0

DONE

**TITLE:**

HALF-LIFE SIMULATION

**DESCRIPTION:**

The program simulates the decay of 1000 radioactive nuclei by simulating the tossing of 1000 20-sided dice. One side of each dice is assumed to be marked, so that if that side is up after the toss, the nucleus that it represents is considered to have decayed. After each toss, those dice which have decayed are removed from the experiment, since they cannot decay a second time. Output includes a table of number of toss, number of decays, number remaining, a graph of decays as a function of time, a table of number of toss, number of decays, logarithm of number of decays, a graph of logarithm of decays as a function of time, and calculation of decay constant using least squares, plus a calculation of the percent error of this calculation.

**INSTRUCTIONS:**

Answer any questions either Yes or No.

Total execution time if the entire program is run will be about 12 minutes.

**SPECIAL  
CONSIDERATIONS:****FOR INSTRUCTIONAL PURPOSES**

Suitable Courses: Physics, Physical Science, General Science, Chemistry.

Student Background Required: Appropriate to study of radioactive decay and/or half-life in typical junior or senior high school.

The program could be used to supplement or replace laboratory experiments in the courses noted. Teachers may wish to omit the logarithm and decay constant portions for junior high or for general science classes.

**ACKNOWLEDGEMENTS:**

Donald E. Gettinger  
Stillwater Senior High School



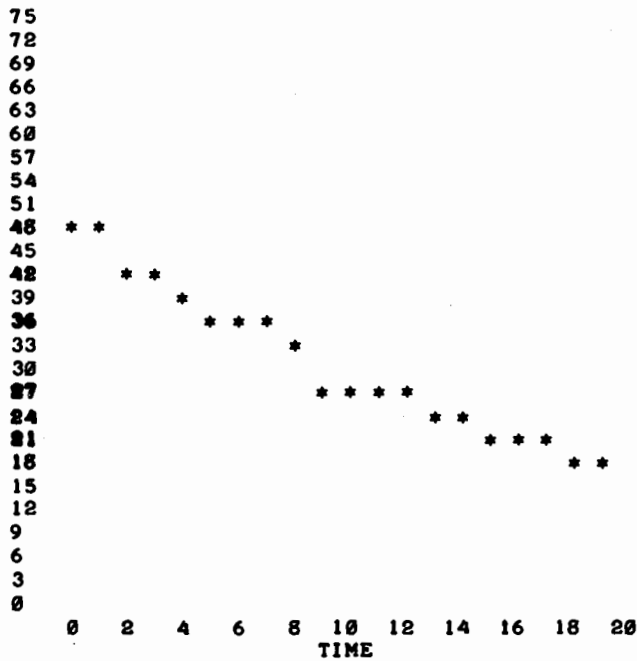
**RUN**

RUN  
HZLIFE

**DO YOU NEED EXPLANATION?NO  
IT WILL TAKE ABOUT 3 MINUTES TO TOSS THE DICE  
20 PIMES BEFORE ANY FURTHER PRINTING WILL OCCUR.**

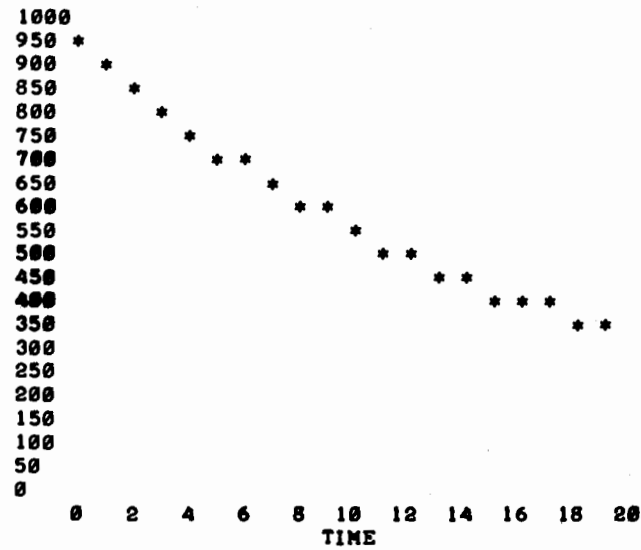
| NO. OF TOSS | NO OF DECAYS | NO. REMAINING |
|-------------|--------------|---------------|
| 1           | 50           | 950           |
| 2           | 49           | 901           |
| 3           | 44           | 857           |
| 4           | 43           | 814           |
| 5           | 40           | 774           |
| 6           | 37           | 737           |
| 7           | 36           | 701           |
| 8           | 36           | 665           |
| 9           | 33           | 632           |
| 10          | 29           | 603           |
| 11          | 29           | 574           |
| 12          | 28           | 546           |
| 13          | 28           | 518           |
| 14          | 25           | 493           |
| 15          | 24           | 469           |
| 16          | 23           | 446           |
| 17          | 22           | 424           |
| 18          | 21           | 403           |
| 19          | 20           | 383           |
| 20          | 19           | 364           |

**DECAYS AS A FUNCTION OF TIME (TOSSES)**



**NOTE: TIME=0 IS TOSS NO. 1, TIME=1 IS TOSS NO. 2, ETC.**

NUMBER REMAINING AS A FUNCTION OF TIME (TOSSES)

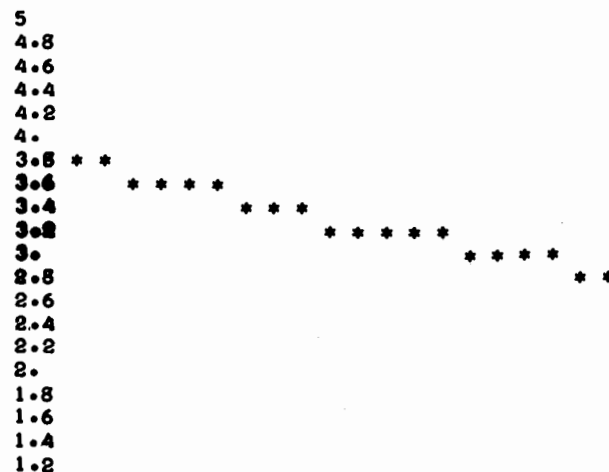


NOTE: TIME=0 IS TOSS NO. 1, TIME=1 IS TOSS NO. 2, ETC.

DO YOU WISH TO HAVE TABLE OF LN OF DECAYS, GRAPH OF LN DECAYS VS. TIME, AND DECAY CONSTANT? YES

| NO. OF TOSS | NO. OF DECAYS | LN OF NO. OF DECAYS |
|-------------|---------------|---------------------|
| 1           | 50            | 3.91202             |
| 2           | 49            | 3.89182             |
| 3           | 44            | 3.78419             |
| 4           | 43            | 3.7612              |
| 5           | 40            | 3.68888             |
| 6           | 37            | 3.61092             |
| 7           | 36            | 3.58352             |
| 8           | 36            | 3.58352             |
| 9           | 33            | 3.49651             |
| 10          | 29            | 3.3673              |
| 11          | 29            | 3.3673              |
| 12          | 28            | 3.3322              |
| 13          | 28            | 3.3322              |
| 14          | 25            | 3.21888             |
| 15          | 24            | 3.17805             |
| 16          | 23            | 3.13549             |
| 17          | 22            | 3.09104             |
| 18          | 21            | 3.04452             |
| 19          | 20            | 2.99573             |
| 20          | 19            | 2.94444             |

LN OF DECAYS AS A FUNCTION OF TIME (TOSSES)



1.  
.800003  
.600003  
.400003  
.200003  
2.80142E-06  
0 2 4 6 8 10 12 14 16 18 20  
TIME

NOTE: TIME=0 IS TOSS NO. 1, TIME=1 IS TOSS NO. 2, ETC.

SLOPE OF THE LINE JUST PLOTTED IS -5.09096E-02  
THIS SLOPE IS THE DECAY CONSTANT  
ACCEPTED VALUE FOR THE DECAY CONSTANT IS -0.05000  
PER CENT ERROR IN DECAY CONSTANT IS 1.81913

DONE

CONTRIBUTED PROGRAM **BASIC**

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>TITLE:</b>                      | DRILL ON FORMULAS AND CHARGES OF IONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | IONIC<br>36260 |
| <b>DESCRIPTION:</b>                | This program randomly generates a total of 10 ions. The student is given five seconds to input the formula, and five seconds to input the charge. If he is too slow, or incorrect, the correct answer is printed. A summary is given at the end of the drill.                                                                                                                                                                                                                                                                |                |
| <b>INSTRUCTIONS:</b>               | The user is asked to input his name. The program prompts the student to give the correct answers on formulas and charges.                                                                                                                                                                                                                                                                                                                                                                                                    |                |
| <b>SPECIAL<br/>CONSIDERATIONS:</b> | The value of T0 set in line 5 governs the amount of time given to respond, N in line 30 governs how many ions are stored in the DATA lines, AO controls how many ions are given as questions, and is set in line 32. Any of these can be changed by altering the appropriate line. Use the DATA statements (lines 88-1010) as a model for adding more ions, if desired.<br><br>FOR INSTRUCTIONAL PURPOSES:<br>Suitable Courses: Chemistry<br><br>Student Background Required: Knowledge of ions, their formulas and charges. |                |
| <b>ACKNOWLEDGEMENTS:</b>           | Phillip Short<br>Burnsville Senior High School                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                |

RUN

RUN  
IONIC

WHAT IS YOUR NAME?PHILLIP SHORT

IONS AND THEIR CHARGES.

WHAT IS THE FORMULA OF THE NICKEL ION?

NI

RIGHT!!

WHAT IS THE CHARGE ON THE NICKEL ION?

2

CORRECT!!

WHAT IS THE FORMULA OF THE CUPROUS ION?

CU

RIGHT!!

WHAT IS THE CHARGE ON THE CUPROUS ION?

1

CORRECT!!

WHAT IS THE FORMULA OF THE MERCUROUS ION?

HG

RIGHT!!

WHAT IS THE CHARGE ON THE MERCUROUS ION?

1

CORRECT!!

WHAT IS THE FORMULA OF THE BARIUM ION?

BA

RIGHT!!

WHAT IS THE CHARGE ON THE BARIUM ION?

2

CORRECT!!

WHAT IS THE FORMULA OF THE IODIDE ION?

I

RIGHT!!

WHAT IS THE CHARGE ON THE IODIDE ION?

-1

CORRECT!!

WHAT IS THE FORMULA OF THE CHROMATE ION?

TOO SLOW!!

THE ANSWER IS  $\text{CrO}_4$  !!!!

MAYBE YOU KNOW ITS CHARGE...

WHAT IS THE CHARGE ON THE CHROMATE ION?

-2

CORRECT!!

WHAT IS THE FORMULA OF THE LITHIUM ION?

LI

RIGHT!!

WHAT IS THE CHARGE ON THE LITHIUM ION?

1

CORRECT!!

WHAT IS THE FORMULA OF THE CARBONATE ION?

$\text{CO}_3$

RIGHT!!

WHAT IS THE CHARGE ON THE CARBONATE ION?

-2

CORRECT!!

WHAT IS THE FORMULA OF THE NITRATE ION?

NO

TOO SLOW!!

THE ANSWER IS  $\text{NO}_3$  !!!!

MAYBE YOU KNOW ITS CHARGE...

WHAT IS THE CHARGE ON THE NITRATE ION?

-1

CORRECT!!

WHAT IS THE FORMULA OF THE MAGNESIUM ION?

Mg

RIGHT!!

WHAT IS THE CHARGE ON THE MAGNESIUM ION?

2

CORRECT!!

-----

PHILLIP SHORT

YOU GOT BOTH PARTS RIGHT FOR 8 IONS.

YOU GOT ONE PART RIGHT FOR 2 IONS.

YOU GOT BOTH PARTS WRONG FOR 0 IONS.

-----

DONE



IONIC1  
36266**TITLE:**

DRILL ON FORMULAS OF IONIC COMPOUNDS

**DESCRIPTION:**

This program randomly selects a positive and negative ion, and asks the user for the chemical formula of the simplest resulting compound.

**INSTRUCTIONS:**

Conventions used in formula input.

1. If there is more than one molecule of an ion, the number of molecules of this ion follows the ion's formula.
2. Put parenthesis around the formula if the ion is multiatomic and it occurs more than once in the compound.
3. The cation is given first, then the negative ion. (anion)
4. Give the simplest form of the compound.

i.e. give  $H_4O_2$  as  $H_2O$ .

but leave  $Cu_2CO_4$  as is.

Ten pairs of ions are given. The response time is 15 seconds to input the name of each compound.

**SPECIAL  
CONSIDERATIONS:**

23 common cations and 18 common anions are stored in the data lines at the end of the program. The cations are given first, the anions last. The format used is name, formula, charge. If the user adds any more, change lines 40 and 70 to the appropriate values, and change the dimensions of matrices A and C, if necessary. To add more multiatomic cations, add the line(s) after 400 that read the same as 400 except they have the formula of the added multiatomic cation(s) in the quotes. To add multiatomic anions which have only two letters (like OH) add lines after 530 paralleling the construction of 530. If a user wants the question to give the formula of the ions, change the A\$ and C\$ in line 700 to B\$ and D\$. Line 30 controls how many problems are given. To vary the time given to respond, change line 710 to ENTER n, Z, G\$, where n is an integer between 1 and 255.

For INSTRUCTIONAL PURPOSES  
Suitable Courses: Chemistry

Student Background Required: Memorization of ion names, formulas, charges, and of how to combine them to get compounds.

**ACKNOWLEDGEMENTS:**

Phillip Short  
Burnsville Senior High School



**RUN**

RUN  
IONIC1

IONIC BONDS

WHAT IS THE COMPOUND FORMED FROM SODIUM AND HYDROXIDE .

NAOH

THAT IS CORRECT... VERY GOOD!!!!!!

YOU HAVE ANSWERED 1 CORRECTLY OUT OF 1 .

WHAT IS THE COMPOUND FORMED FROM LITHIUM AND PERMANGANATE .

TOO SLOW!!! THE ANSWER IS LIMNO4.

YOU HAVE ANSWERED 1 CORRECTLY OUT OF 2 .

WHAT IS THE COMPOUND FORMED FROM MERCURIC AND PHOSPHATE .

HG

TOO SLOW!!! THE ANSWER IS HG3(PO4)2.

YOU HAVE ANSWERED 1 CORRECTLY OUT OF 3 .

WHAT IS THE COMPOUND FORMED FROM CALCIUM AND IODIDE .

CAI4

NO THE ANSWER IS CAI2.

YOU HAVE ANSWERED 1 CORRECTLY OUT OF 4 .

WHAT IS THE COMPOUND FORMED FROM HYDROGEN AND CHLORIDE .

HOCL

NO THE ANSWER IS HCL.

YOU HAVE ANSWERED 1 CORRECTLY OUT OF 5 .

WHAT IS THE COMPOUND FORMED FROM STANNOUS AND DICHROMATE .

STCH2

NO THE ANSWER IS SNCR2O7.

YOU HAVE ANSWERED 1 CORRECTLY OUT OF 6 .

WHAT IS THE COMPOUND FORMED FROM CHROMOUS AND FLUORIDE .

CRFL03

NO THE ANSWER IS CRF2.

YOU HAVE ANSWERED 1 CORRECTLY OUT OF 7 .

WHAT IS THE COMPOUND FORMED FROM MERCUROUS AND NITRATE .

HGN03

NO THE ANSWER IS HGN03.

YOU HAVE ANSWERED 1 CORRECTLY OUT OF 8 .

AGCH3COO

THAT IS CORRECT... VERY GOOD!!!!!!

YOU HAVE ANSWERED 2 CORRECTLY OUT OF 10

WHAT IS THE COMPOUND FORMED FROM LEAD AND CARBONATE .

PB(CO2)2

NO THE ANSWER IS PBCO3.

YOU HAVE ANSWERED 1 CORRECTLY OUT OF 9 .

YOU WERE WRONG 6 TIMES.

YOU WERE TOO SLOW 2 TIMES.

DONE

WHAT IS THE COMPOUND FORMED FROM SILVER AND ACETATE .

CONTRIBUTED PROGRAM **BASIC**ISOMER  
36261

## TITLE:

DRILL ON NAMING ALKANES

## DESCRIPTION:

This program generates names of up to ten alkanes randomly, and prints out representations of them on the teletype, then names them. The number of alkanes (of lengths up to ten carbons in the main chain) is controllable (via input), as is the total number of carbons in the alkyl side chains (by altering a line). In a given run there are no duplications.

## INSTRUCTIONS:

The only input required is the number of hydrocarbons to be printed. One file, (ISO-1), is required. It should have a length of about 512 words, or eight records on the HP 2000B. This file serves as a temporary storage for strings used in naming the alkanes. If the name of the first two alkanes are 2,3-dimethylpentane and 3,4-dimethyl-5,6-diethyl-4,5-dibutyldecane respectively the strings stored in the file will be "2,3-DIMETHYLPENTANE", "3,4-DIMETHYL", "5,6-DIETHYL", "-4,5-DIBUTYLDECANEN".

SPECIAL  
CONSIDERATIONS:

The length of the largest number of carbon atoms in all the side chains may be altered by changing line 9 to 9 LET MO=n, where n is this number. This is just an upper limit, not a lower, and the actual number is limited also by the number (randomly-generated) of carbons in the main chain.

## FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Organic Chemistry

Student Background Required: Knowledge of how to name simple alkanes (with side chains). This program is written with the intention that the student run the program and take the output back to his desk. He conceals the answers from his view, and names the chemicals, checking his answers when he is done.

## ACKNOWLEDGEMENTS:

Phillip Short  
Burnsville Senior High School

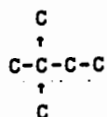
RUN

RUN  
ISOMER

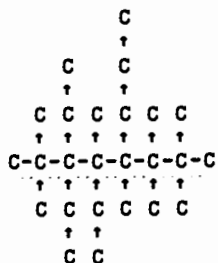
ALKANES WITH SIMPLE ALKYL SIDECHAINS

HOW MANY HYDROCARBONS DO YOU WANT PRINTED?5

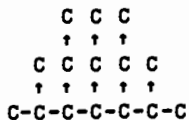
( 1 )



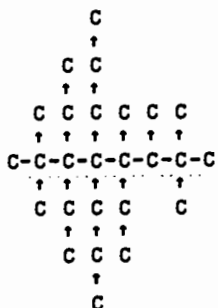
( 2 )



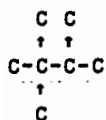
( 3 )



( 4 )



( 5 )



- ( 1 ) 2,2-DIMETHYLBUTANE
- ( 2 ) 2,2,4,5,6,6,7,7-OCTAMETHYL-3,3,4-TRIETHYL-5-PROPYLOCTANE
- ( 3 ) 2,6-DIMETHYL-3,4,5-TRIETHYLHEPTANE
- ( 4 ) 2,2,5,6,7,7-HEXAMETHYL-3,3,5-TRIETHYL-4,4-DIPROPYLOCTANE
- ( 5 ) 2,2,3-TRIMETHYLBUTANE

\*\*\*\*\*

DONE

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b>            | KINERV: Review of Kinematics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>DESCRIPTION:</b>      | <p>Questions are asked concerning the motion of a ball thrown vertically upwards at various velocities. Neglecting air resistance, the student is to determine such quantities as 1) maximum obtainable height; 2) time of flight; and 3) the height reached at different times.</p> <p><u>OBJECTIVES:</u></p> <p>To develop and review basic skills in solving projectile motion problems.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>INSTRUCTIONS:</b>     | <p><u>PRELIMINARY PREPARATION:</u></p> <p>A. Student - previous classroom instruction and a working knowledge of algebra.</p> <p>B. Materials - none</p> <p><u>DISCUSSION:</u></p> <p>The student is presented with various problems concerning the motion of the ball. In each case, the initial velocity <math>V_0</math> of the ball is given. There are five basic questions asked:</p> <ol style="list-style-type: none"><li>1. Determine maximum height reached;</li><li>2. Find the height after <math>t</math> seconds;</li><li>3. Find the velocity when the ball is at height <math>h</math>;</li><li>4. Determine the time of flight; and</li><li>5. Find the velocity after <math>t</math> seconds.</li></ol> <p>The quantities <math>V_0</math>, <math>h</math>, and <math>t</math> are randomly determined for each question asked and the correct answers are given following the student response.</p> <p>The program is designed to serve as a review of typical motion problems discussed in class and to aid in overcoming student "uncertainty" in the solution of numerical problems.</p> <p>The program may be modified to cover other areas of review by entering new questions in place of those presently offered (see listing).</p> |
| <b>ACKNOWLEDGEMENTS:</b> | Huntington Project<br>Polytechnic Institute of Brooklyn                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

RUN  
RUN  
KINERV

---REVIEW OF KINEMATICS---

A BALL IS THROWN STRAIGHT UP AT VARIOUS VELOCITIES.  
AIR FRICTION IS NEGLIGIBLE. THE UPWARD DIRECTION IS TAKEN  
AS POSITIVE, AND THE DOWNWARD DIRECTION AS NEGATIVE.

THE LOCAL ACCELERATION DUE TO GRAVITY IS -10 METERS/SECOND/SEC  
ALL VALUES ARE IN M.K.S. METRIC UNITS.

FOR VARIOUS THROWING SPEEDS, YOU MUST ANSWER CERTAIN  
QUESTIONS ABOUT THE BALL IN FLIGHT.

1 . THE UPWARD THROWING SPEED IS 15 METERS/SECOND.  
WHAT IS THE VELOCITY AFTER 1.9 SECONDS OF FLIGHT?-4  
YOU'RE CORRECT WITHIN 5 PERCENT. THE CORRECT ANSWER IS -4 .

2 . THE UPWARD THROWING SPEED IS 38 METERS/SECOND.  
HOW HIGH ABOVE THE GROUND WILL THE BALL GO?28  
YOU'RE OFF MORE THAN 5 PERCENT. THE CORRECT ANSWER IS 72.2 .

3 . THE UPWARD THROWING SPEED IS 30 METERS/SECOND.  
HOW LONG WILL IT TAKE THE BALL TO RETURN TO THE GROUND?6.0  
YOU'RE CORRECT WITHIN 5 PERCENT. THE CORRECT ANSWER IS 6 .

4 . THE UPWARD THROWING SPEED IS 22 METERS/SECOND.  
WHAT IS THE VELOCITY WHEN IT REACHES A HEIGHT OF 12.2  
METERS ABOVE THE GROUND ?16  
YOU'RE CORRECT WITHIN 5 PERCENT. THE CORRECT ANSWER IS 15.4919 .

5 . THE UPWARD THROWING SPEED IS 17 METERS/SECOND.  
WHAT IS THE VELOCITY AFTER 2.2 SECONDS OF FLIGHT?-4  
YOU'RE OFF MORE THAN 5 PERCENT. THE CORRECT ANSWER IS -5. .

OUT OF 5 QUESTIONS, YOU GOT 3 RIGHT.  
DON'T YOU KNOW ANYTHING ABOUT THROWING THINGS UP???

WANT TO TRY ANOTHER 5 PROBLEMS (1=YES, 0=NO) : ?0

DONE

**TITLE:**

KINET: Kinetic Reaction

KINET  
36309**DESCRIPTION:**

A class room presentation designed to calculate equilibrium concentrations and graph the progress (concentration vs. time) from initiation to equilibrium for the general reaction  $A \rightleftharpoons P$ .

OBJECTIVES:

- A. An understanding of Equilibrium
- B. The significance of the magnitude of the Equilibrium constant.
- C. The relationship of the rate constant to the point of equilibrium.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student
  - 1. The distinction between initial and equilibrium concentration should be made very clear.
  - 2. The meaning of the terms "Rate constant" and "Equilibrium constant".
- B. Materials - none

DISCUSSION:

To insure the success of this program in a teaching situation, the teacher should run the program prior to its use in the classroom. This is necessary to insure that the choice of constants illustrates the point to be made and the amount of classroom time be kept to a minimum.

By varying the equilibrium constant it is possible to move the point of equilibrium on the concentration axis, and show the relative concentrations of product and reactant as a function of the value of the equilibrium constant.

The effect of different rate constants on the time it takes to attain equilibrium can also be shown. The point at which the two curves approach a straight line is the point of equilibrium (if the two curves intersect a dot is used as the point).

In this program, time is plotted in ten equal steps from initiation of the reaction to equilibrium. The time to attain equilibrium is different depending on the constant used. It should be pointed out that while the point of equilibrium on the graph may appear to be at the same spot, the units of time are changing, thus the point on the graph is different.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
KINET

FOR THE EQUILIBRIUM PROBLEMS YOU ARE ABOUT TO DO, THE  
DATA MAY BE PRESENTED IN THE FOLLOWING MANNER:  
(INDICATE YOUR CHOICE BY NUMBER)

- CHOICE 1 = TABLE OF DATA
- CHOICE 2 = GRAPH OF DATA
- CHOICE 3 = TABLE AND GRAPH OF DATA
- CHOICE 4 = END PROGRAM

WHAT IS YOUR CHOICE?3

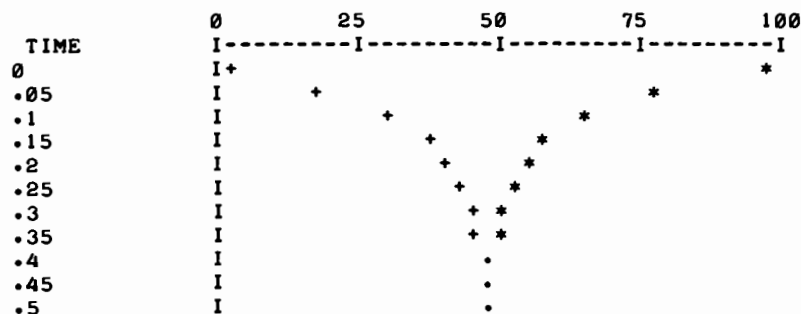
LET F = THE FORWARD RATE CONSTANT  
LET K = THE EQUILIBRIUM CONSTANT FOR THE REACTION A =P  
TYPE IN THE CONSTANTS F AND K IN THAT ORDER.  
?5,1

\*\*\*\*\*

LET A1 = ORIGINAL CONCENTRATION OF A  
LET A = PERCENT CONCENTRATION OF A (A/A1\*100)  
LET P = PERCENT CONCENTRATION OF P (P/A1\*100)

| TIME | A       | P       |
|------|---------|---------|
| 0    | 100     | 0       |
| .05  | 80.3265 | 19.6735 |
| .1   | 68.394  | 31.606  |
| .15  | 61.1565 | 38.8435 |
| .2   | 56.7668 | 43.2332 |
| .25  | 54.1043 | 45.8958 |
| .3   | 52.4893 | 47.5107 |
| .35  | 51.5099 | 48.4901 |
| .4   | 50.9158 | 49.0842 |
| .45  | 50.5555 | 49.4445 |
| .5   | 50.3369 | 49.6631 |

PERCENT CONCENTRATION OF A(\*) AND P(+)



WHAT IS YOUR CHOICE?2

LET F = THE FORWARD RATE CONSTANT  
LET K = THE EQUILIBRIUM CONSTANT FOR THE REACTION A =P  
TYPE IN THE CONSTANTS F AND K IN THAT ORDER.  
?5,0.1

\*\*\*\*\*

PERCENT CONCENTRATION OF A(\*) AND P(+)

| TIME | 0   | 25 | 50 | 75 | 100 |
|------|-----|----|----|----|-----|
| 0    | I+  |    |    |    | *   |
| .05  | I + |    |    |    | *   |
| .1   | I + |    |    |    | *   |
| .15  | I + |    |    |    | *   |
| .2   | I + |    |    |    | *   |
| .25  | I + |    |    |    | *   |
| .3   | I + |    |    |    | *   |
| .35  | I + |    |    |    | *   |
| .4   | I + |    |    |    | *   |
| .45  | I + |    |    |    | *   |
| .5   | I + |    |    |    | *   |

WHAT IS YOUR CHOICE?0

YOUR CHOICE MUST BE A NUMBER BETWEEN 1 AND 4, TRY AGAIN.

WHAT IS YOUR CHOICE?4

DONE





**TITLE:**

COMPUTER-AUGMENTED PHYSICS TOPICS (NEWTON)

**DESCRIPTION:**

This program, written by a high school student at Project Solo, calculates the stopping distance for a simulated aircraft landing on an airfield or aircraft carrier. Two types of output are available:

1. A listing of landing distances for progressively large aircraft mass and landing speed.
2. A single calculation for one value each of mass and speed.

**INSTRUCTIONS:**

The program asks the user to choose the type of output (see above).

If option 1 has been chosen, the user enters:

- a. Landing speeds - smallest value, greatest value, step size
- b. Mass - smallest value, greatest value, step size
- c. Runway - length and width

continued on following page

**SPECIAL  
CONSIDERATIONS:**

This program accompanies the Project Solo Module "Computer-Augmented Physics Topics" of the Hewlett Packard Curriculum Series.

This program is a sample answer to a student problem presented in Computer-Augmented Physics Topics, a Physics module from the Project Solo Series.

Information on actual aircraft (lines 500-590) may need to be updated from time to time, and as desired by the teacher.

FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Physics

Student Background Required: Newtonian laws of motion (concurrent)

This is a sample solution to a problem for the student. It may be desired to provide access to this program only after the student has attacked the problem in his or her own way.

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5648 Computer-Augmented Physics Topics (student text)  
HP 5951-5649 Computer-Augmented Physics Topics (problem solutions)  
HP 5951-5650 Computer-Augmented Physics Topics (classroom set - 30  
student books and 1 problem solutions)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project  
Scientific Press  
1629 Channing Ave.  
Palo Alto, California 94303

**ACKNOWLEDGEMENTS:**

Project Solo  
University of Pittsburgh

Instructions - continued

- d. Braking strength of the retaining barrier
- e. A value determining the accuracy (roundoff) of the calculations.

If option 2 has been chosen, the user enters:

- a. Mass and landing speed (one value for each)

followed by c., d., and e. as given above.

The program contains information on the range of mass and landing speed in representative civilian aircraft, which the student can request.

**RUN**

PLEASE USE THE METRIC SYSTEM THROUGHOUT.  
 WOULD YOU LIKE SOME ACTUAL FIGURES FOR  
 AIRCRAFT CARRIERS (0=NO, 1=YES)?

?1

ON AN AIRCRAFT CARRIER, THE RUNOUT DISTANCE IS  
 ABOUT 305 METERS.  
 THE MASS AND LANDING SPEED OF REAL AIRPLANES RANGE  
 FROM ABOUT 419 KG AND 72.5 KM/HR FOR THE BOWERS  
 FLY BABY I-4, TO ABOUT 157,500 KG AND 230 KM/HR FOR  
 THE LONG-RANGE RUSSIAN AIRLINER, ILYUSHIN II-62.  
 THE MASS OF THE BOEING 747-21 IS ABOUT 238,815 KG.

DO YOU WANT A LISTING WITH PROGRESSIVELY LARGER  
 MASS AND SPEED (0=NO, 1=YES)?

?1

INPUT THE SMALLEST AND GREATEST VALUE OF THE LANDING  
 SPEEDS AND THE STEP SIZE IN KM/HR.

?80,240,40

NOW, DO THE SAME FOR THE AIRPLANE'S MASS IN KG.

?400,4400,400

INPUT THE RUNOUT DISTANCE AND THE RUNWAY WIDTH  
 IN METERS.

?1000,200

INPUT THE BRAKING STRENGTH (NEGATIVE) IN NEWTONS.

?-5000

MY CALCULATIONS ARE ACCURATE TO THE NEAREST N METERS.  
 INPUT A VALUE FOR N.

?10

400 KG

|     |                    |       |
|-----|--------------------|-------|
| 80  | KM/HR              |       |
|     | LANDING DISTANCE = | 70 M  |
| 120 | KM/HR              |       |
|     | LANDING DISTANCE = | 100 M |
| 160 | KM/HR              |       |
|     | LANDING DISTANCE = | 140 M |
| 200 | KM/HR              |       |
|     | LANDING DISTANCE = | 170 M |
| 240 | KM/HR              |       |
|     | LANDING DISTANCE = | 210 M |

800 KG

|     |                    |       |
|-----|--------------------|-------|
| 80  | KM/HR              |       |
|     | LANDING DISTANCE = | 100 M |
| 120 | KM/HR              |       |
|     | LANDING DISTANCE = | 150 M |
| 160 | KM/HR              |       |
|     | LANDING DISTANCE = | 200 M |
| 200 | KM/HR              |       |
|     | LANDING DISTANCE = | 260 M |
| 240 | KM/HR              |       |
|     | LANDING DISTANCE = | 330 M |

1200 KG

|     |                    |       |
|-----|--------------------|-------|
| 80  | KM/HR              |       |
|     | LANDING DISTANCE = | 120 M |
| 120 | KM/HR              |       |
|     | LANDING DISTANCE = | 180 M |
| 160 | KM/HR              |       |
|     | LANDING DISTANCE = | 250 M |
| 200 | KM/HR              |       |
|     | LANDING DISTANCE = | 330 M |
| 240 | KM/HR              |       |
|     | LANDING DISTANCE = | 430 M |

|      |     |                                 |
|------|-----|---------------------------------|
| 1600 | KG  |                                 |
|      | 80  | KM/HR                           |
|      |     | LANDING DISTANCE = 140 M        |
|      | 120 | KM/HR                           |
|      |     | LANDING DISTANCE = 210 M        |
|      | 160 | KM/HR                           |
|      |     | LANDING DISTANCE = 300 M        |
|      | 200 | KM/HR                           |
|      |     | LANDING DISTANCE = 400 M        |
|      | 240 | KM/HR                           |
|      |     | LANDING DISTANCE = 520 M        |
| 2000 | KG  |                                 |
|      | 80  | KM/HR                           |
|      |     | LANDING DISTANCE = 150 M        |
|      | 120 | KM/HR                           |
|      |     | LANDING DISTANCE = 240 M        |
|      | 160 | KM/HR                           |
|      |     | LANDING DISTANCE = 350 M        |
|      | 200 | KM/HR                           |
|      |     | LANDING DISTANCE = 470 M        |
|      | 240 | KM/HR                           |
|      |     | LANDING DISTANCE = 620 M        |
| 2400 | KG  |                                 |
|      | 80  | KM/HR                           |
|      |     | LANDING DISTANCE = 170 M        |
|      | 120 | KM/HR                           |
|      |     | LANDING DISTANCE = 270 M        |
|      | 160 | KM/HR                           |
|      |     | LANDING DISTANCE = 390 M        |
|      | 200 | KM/HR                           |
|      |     | LANDING DISTANCE = 540 M        |
|      | 240 | KM/HR                           |
|      |     | LANDING DISTANCE = 710 M        |
| 2800 | KG  |                                 |
|      | 80  | KM/HR                           |
|      |     | LANDING DISTANCE = 190 M        |
|      | 120 | KM/HR                           |
|      |     | LANDING DISTANCE = 300 M        |
|      | 160 | KM/HR                           |
|      |     | LANDING DISTANCE = 440 M        |
|      | 200 | KM/HR                           |
|      |     | LANDING DISTANCE = 600 M        |
|      | 240 | KM/HR                           |
|      |     | LANDING DISTANCE = 800 M        |
| 3200 | KG  |                                 |
|      | 80  | KM/HR                           |
|      |     | LANDING DISTANCE = 200 M        |
|      | 120 | KM/HR                           |
|      |     | LANDING DISTANCE = 330 M        |
|      | 160 | KM/HR                           |
|      |     | LANDING DISTANCE = 480 M        |
|      | 200 | KM/HR                           |
|      |     | LANDING DISTANCE = 670 M        |
|      | 240 | KM/HR                           |
|      |     | LANDING DISTANCE = 890 M        |
| 3600 | KG  |                                 |
|      | 80  | KM/HR                           |
|      |     | LANDING DISTANCE = 210 M        |
|      | 120 | KM/HR                           |
|      |     | LANDING DISTANCE = 350 M        |
|      | 160 | KM/HR                           |
|      |     | LANDING DISTANCE = 520 M        |
|      | 200 | KM/HR                           |
|      |     | LANDING DISTANCE = 730 M        |
|      | 240 | KM/HR                           |
|      |     | LANDING DISTANCE = 980 M        |
| 4000 | KG  |                                 |
|      | 80  | KM/HR                           |
|      |     | LANDING DISTANCE = 230 M        |
|      | 120 | KM/HR                           |
|      |     | LANDING DISTANCE = 380 M        |
|      | 160 | KM/HR                           |
|      |     | LANDING DISTANCE = 570 M        |
|      | 200 | KM/HR                           |
|      |     | LANDING DISTANCE = 800 M        |
|      | 240 | KM/HR                           |
|      |     | LANDING DISTANCE = 1000 METERS. |
| 4400 | KG  |                                 |

80 KM/HR  
LANDING DISTANCE = 240 M  
120 KM/HR  
LANDING DISTANCE = 400 M  
160 KM/HR  
LANDING DISTANCE = 610 M  
200 KM/HR  
LANDING DISTANCE = 860 M  
240 KM/HR

THE PLANE COULD NOT BE STOPPED IN 1000 METERS.  
WELL, I'M FINALLY FINISHED NOW. GOODBYE !

DONE

RUN  
LANDIN

PLEASE USE THE METRIC SYSTEM THROUGHOUT.  
WOULD YOU LIKE SOME ACTUAL FIGURES FOR  
AIRCRAFT CARRIERS (0=NO, 1=YES)?  
?0

DO YOU WANT A LISTING WITH PROGRESSIVELY LARGER  
MASS AND SPEED (0=NO, 1=YES)?  
?0

INPUT THE MASS IN KG, AND THE LANDING SPEED IN KM/HR.  
?157500,230

INPUT THE RUNOUT DISTANCE AND THE RUNWAY WIDTH  
IN METERS.

?1000,250

INPUT THE BRAKING STRENGTH (NEGATIVE) IN NEWTONS.  
?-5000

MY CALCULATIONS ARE ACCURATE TO THE NEAREST N METERS.  
INPUT A VALUE FOR N.

?10

THE PLANE COULD NOT BE STOPPED IN 1000 METERS.  
LIKE TO TRY AGAIN, WITH DIFFERENT VALUES (0=NO, 1=YES)

?1

INPUT THE MASS IN KG, AND THE LANDING SPEED IN KM/HR.  
?157500,230

INPUT THE RUNOUT DISTANCE AND THE RUNWAY WIDTH  
IN METERS.

?7500,250

INPUT THE BRAKING STRENGTH (NEGATIVE) IN NEWTONS.  
?-10000

MY CALCULATIONS ARE ACCURATE TO THE NEAREST N METERS.  
INPUT A VALUE FOR N.

?50

THE PLANE COULD NOT BE STOPPED IN 7500 METERS.  
LIKE TO TRY AGAIN, WITH DIFFERENT VALUES (0=NO, 1=YES)

?1

INPUT THE MASS IN KG, AND THE LANDING SPEED IN KM/HR.  
?150000,230

INPUT THE RUNOUT DISTANCE AND THE RUNWAY WIDTH  
IN METERS.

?5000,200

INPUT THE BRAKING STRENGTH (NEGATIVE) IN NEWTONS.  
?-100000

MY CALCULATIONS ARE ACCURATE TO THE NEAREST N METERS.  
INPUT A VALUE FOR N.

?100

THE PLANE WAS SUCCESSFULLY STOPPED.  
ITS LANDING DISTANCE WAS 1800 M

LIKE TO TRY AGAIN, WITH DIFFERENT VALUES (0=NO, 1=YES)

?0

DONE

**TITLE:** SOLVES LENS PROBLEMS

**DESCRIPTION:** The focal length, object distance, image distance, image size, or object size, may be calculated if sufficient information is entered by the student.

OBJECTIVES:

- A. To solve for focal length of a lens from laboratory data.
- B. To check image position and size from lab data.
- C. To solve lens problems.

**INSTRUCTIONS:**

PRELIMINARY PREPARATION:

- A. Student - Data from a lens experiment.
- B. Materials - None

DISCUSSION:

If this program is used in conjunction with a lens laboratory, the student may check his calculations of focal length.

He may also check his image size and position from known object size and position.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
LENSES

THIS PROGRAM MAY BE USED TO SOLVE LENS PROBLEMS.  
 IN THE ORDER GIVEN ENTER THE VALUES FOR THE FOLLOWING:  
 FOCAL LENGTH, OBJECT DISTANCE, IMAGE DISTANCE, OBJECT  
 SIZE, IMAGE SIZE. INPUT 0 (ZERO) FOR UNKNOWN VALUES.  
 EVERY TIME THE COMPUTER ASKS 'READY?', ENTER 1 IF YOU HAVE  
 MORE PROBLEMS TO DO, OR 0 TO END THE PROGRAM.

\*\*\* READY ?1

WHAT ARE YOUR VALUES FOR F, P, Q, O, I?1,2,3,4,5

YOUR Q IS NOT CORRECT FOR THE F AND P YOU HAVE ENTERED  
 NOTE CHANGED Q. THE PERCENT ERROR ON YOUR Q IS:  
 50 PERCENT.  
 YOUR I IS NOT CORRECT FOR THE O YOU HAVE ENTERED  
 NOTE CHANGED I. THE PERCENT ERROR ON YOUR I IS:  
 25 PERCENT.

F= 1                    P= 2                    Q= 2                    O= 4                    I= 4

\*\*\* READY ?1

WHAT ARE YOUR VALUES FOR F, P, Q, O, I?1,2,2.04,4,3.9

YOUR Q IS CORRECT TO WITHIN 2.                    %  
 NOTE CORRECTED Q.  
 YOUR I IS CORRECT TO WITHIN 2.5                    %  
 NOTE CORRECTED I.

F= 1                    P= 2                    Q= 2                    O= 4                    I= 4

\*\*\* READY ?1

WHAT ARE YOUR VALUES FOR F, P, Q, O, I?0.5,8,4,4

YOUR I IS NOT CORRECT FOR THE O YOU HAVE ENTERED  
 NOTE CHANGED I. THE PERCENT ERROR ON YOUR I IS:  
 37.5 PERCENT.

F= 3.07692            P= 5                    Q= 8                    O= 4                    I= 6.4

\*\*\* READY ?1

WHAT ARE YOUR VALUES FOR F, P, Q, O, I?46,53,0,34,32

YOUR I IS NOT CORRECT FOR THE O YOU HAVE ENTERED  
 NOTE CHANGED I. THE PERCENT ERROR ON YOUR I IS:  
 85.6777 PERCENT.

F= 46                    P= 53                    Q= 348.286            O= 34                    I= 223.429

\*\*\* READY ?1

WHAT ARE YOUR VALUES FOR F, P, Q, O, I?4857,2,6,0,0

YOUR Q IS NOT CORRECT FOR THE F AND P YOU HAVE ENTERED  
 NOTE CHANGED Q. THE PERCENT ERROR ON YOUR Q IS:  
 399.876 PERCENT.

F= 4857                    P= 2                    Q=-2.00082

\*\*\* READY ?0

DONE

**TITLE:** LOCK & KEY MODEL OF ENZYME ACTION**DESCRIPTION:** This exercise allows the user to conduct a simulated experiment in competitive inhibition of the enzyme acetylcholinesterase.**INSTRUCTIONS:** The goal in this experiment is to determine which inhibitor chemical is most effective. In the computer simulation you can control: (1) amount of acetylcholine, (2) type of inhibitor chemical, and (3) amount of inhibitor.

Before running the program, the user should map out the experimental design and enter it on a Computer Input Sheet. Output may be in either table or graph form. The table prints out the amount of acetylcholine remaining at the end of each tenth of a minute and the total acetic acid produced up to that time. The graph yields a plot of the amount of acetic acid produced versus the time (in tenths of a minute) since the onset of the reaction, with the amount of acetic acid produced (in millimoles) printed next to the appropriate point.

**SPECIAL  
CONSIDERATIONS:**

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                   |        |
|-------------------|--------|
| Student Workbook  | \$ .30 |
| Teachers Guide    | .30    |
| Resource Handbook | .50    |

**ACKNOWLEDGEMENTS:** Huntington II Project  
State University of New York



RUN

RUN  
LOCKEY

LOCKEY- A COMPETITIVE INHIBITION STUDY OF THE ENZYME  
ACETYLCHOLINESTERASE FEATURING THE LOCK AND KEY HYPOTHESIS

DO YOU WISH INSTRUCTIONS? (1=YES, 0=NO)?1

YOU ARE CONDUCTING AN INVESTIGATION OF THE ENZYME  
ACETYLCHOLINESTERASE. FROM THE NAME YOU CAN TELL  
THAT THIS ENZYME WORKS ON THE CHEMICAL ACETYLCHOLINE.  
IT BREAKS ACETYLCHOLINE INTO ACETIC ACID AND CHOLINE.

WE WANT TO INVESTIGATE WHICH INHIBITOR IS THE MOST  
EFFECTIVE IN SLOWING THE NORMAL ACTION OF THE ENZYME.  
THIS WILL GIVE US VALUABLE INFORMATION ON ITS ACTION.

THE CODE FOR THE INHIBITORS IS:

- 1= AMMONIUM
- 2= DIMETHYLAMINE           BE SURE TO CONSULT
- 3= METHYLAMINE            THE IMPORTANT STRUCTURAL
- 4= PROSTIGMINE            FORMULAE LISTED IN THE
- 5= TRIMETHYLAMINE        INFORMATION PACKET
- 0= NO INHIBITOR

IN THIS STUDY YOU CAN CONTROL:  
THE AMOUNT OF ACETYLCHOLINE  
THE TYPE OF INHIBITOR  
AND THE AMOUNT OF INHIBITOR

BY COMPARING THE STRUCTURE OF ACETYLCHOLINE WITH  
THE STRUCTURE OF THE FIVE INHIBITORS YOU SHOULD  
BE ABLE TO MAKE A HYPOTHESIS AS TO WHICH OF THE  
FIVE INHIBITORS WILL BE THE MOST EFFECTIVE

REMEMBER: INCLUDE YOUR KNOWLEDGE OF THE  
LOCK AND KEY MODEL OF ENZYME ACTION.

\*\*\*\*\*

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLE?2  
TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?0  
DATA FORMAT: 1=TABLE, 2=GRAPH   TYPE NUMBER OF CHOICE?1

| MINUTES<br>ELAPSED | ACETYLCHOLINE<br>REMAINING | TOTAL ACETIC<br>ACID PRODUCED |
|--------------------|----------------------------|-------------------------------|
| 0                  | 2                          | 0                             |
| .1                 | 1.72                       | .28                           |
| .2                 | 1.43                       | .57                           |
| .3                 | 1.15                       | .85                           |
| .4                 | .88                        | 1.12                          |
| .5                 | .61                        | 1.39                          |
| .6                 | .36                        | 1.64                          |
| .7                 | .14                        | 1.86                          |
| .8                 | .02                        | 1.98                          |
| .9                 | 0                          | 2                             |

THE REACTION HAS RUN TO COMPLETION

CONCENTRATION OF INHIBITOR REMAINING: 0   MILLIMOLE

ANOTHER EXPERIMENT? (1=YES, 0=NO)?1

\*\*\*\*\*

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLE?2  
TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?1  
AMOUNT OF INHIBITOR IN MILLIMOLE?100  
DATA FORMAT: 1=TABLE, 2=GRAPH?1

| MINUTES ELAPSED | ACETYLCHOLINE REMAINING | TOTAL ACETIC ACID PRODUCED |
|-----------------|-------------------------|----------------------------|
| 0               | 2                       | 0                          |
| .1              | 1.72                    | .28                        |
| .2              | 1.44                    | .56                        |
| .3              | 1.16                    | .84                        |
| .4              | .88                     | 1.12                       |
| .5              | .62                     | 1.38                       |
| .6              | .37                     | 1.63                       |
| .7              | .16                     | 1.84                       |
| .8              | .03                     | 1.97                       |
| .9              | 0                       | 2                          |

THE REACTION HAS RUN TO COMPLETION

CONCENTRATION OF INHIBITOR REMAINING: 100 MILLIMOLES

ANOTHER EXPERIMENT? (1=YES, 0=NO)?1

\*\*\*\*\*

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLES?2  
 TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?2  
 AMOUNT OF INHIBITOR IN MILLIMOLES?100  
 DATA FORMAT: 1=TABLE, 2=GRAPH?2

| MIN. | MILLIMOLES ACETIC ACID PRODUCED |   |
|------|---------------------------------|---|
|      | 0                               | 1 |
| 0    | I* 0                            | I |
| .1   | I* .23                          | I |
| .2   | I * .46                         | I |
| .3   | I * .68                         | I |
| .4   | I * .89                         | I |
| .5   | I * 1.09                        | I |
| .6   | I * 1.27                        | I |
| .7   | I * 1.44                        | I |
| .8   | I * 1.58                        | I |
| .9   | I * 1.71                        | I |
| 1    | I * 1.8                         | I |
| 1.1  | I * 1.87                        | I |
| 1.2  | I * 1.92                        | I |
| 1.3  | I * 1.95                        | I |
| 1.4  | I * 1.97                        | I |
| 1.5  | I * 1.98                        | I |
| 1.6  | I * 1.99                        | I |
| 1.7  | I * 2                           | I |

THE REACTION HAS RUN TO COMPLETION

CONCENTRATION OF INHIBITOR REMAINING: 100 MILLIMOLES

ANOTHER EXPERIMENT? (1=YES, 0=NO)?1

\*\*\*\*\*

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLES?2  
 TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?3  
 AMOUNT OF INHIBITOR IN MILLIMOLES?100  
 DATA FORMAT: 1=TABLE, 2=GRAPH?2

| MIN. | MILLIMOLES ACETIC ACID PRODUCED |   |
|------|---------------------------------|---|
|      | 0                               | 1 |
| 0    | I* 0                            | I |
| .1   | I* .27                          | I |
| .2   | I * .54                         | I |
| .3   | I * .81                         | I |
| .4   | I * 1.07                        | I |
| .5   | I * 1.32                        | I |
| .6   | I * 1.55                        | I |
| .7   | I * 1.75                        | I |
| .8   | I * 1.9                         | I |
| .9   | I * 1.98                        | I |
| 1    | I * 2                           | I |

THE REACTION HAS RUN TO COMPLETION

CONCENTRATION OF INHIBITOR REMAINING: 100 MILLIMOLES

ANOTHER EXPERIMENT? (1=YES, 0=NO)?1

\*\*\*\*\*

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLES?2

TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?4

AMOUNT OF INHIBITOR IN MILLIMOLES?100

DATA FORMAT: 1=TABLE, 2=GRAPH?2

| MIN. | MILLIMOLES ACETIC ACID PRODUCED                |   |
|------|------------------------------------------------|---|
|      | 0                                              | 1 |
|      | I....I....I....I....I....I....I....I....I....I | 2 |
| 0    | I* 0                                           |   |
| .1   | I* 0                                           |   |
| .2   | I* 0                                           |   |
| .3   | I* 0                                           |   |
| .4   | I* 0                                           |   |
| .5   | I* .01                                         |   |
| .6   | I* .01                                         |   |
| .7   | I* .01                                         |   |
| .8   | I* .01                                         |   |
| .9   | I* .01                                         |   |
| 1    | I* .01                                         |   |
| 1.1  | I* .01                                         |   |
| 1.2  | I* .01                                         |   |
| 1.3  | I* .01                                         |   |
| 1.4  | I* .01                                         |   |
| 1.5  | I* .02                                         |   |
| 1.6  | I* .02                                         |   |
| 1.7  | I* .02                                         |   |
| 1.8  | I* .02                                         |   |
| 1.9  | I* .02                                         |   |
| 2    | I* .02                                         |   |

DO YOU WANT TO CONTINUE THE ASSAY? (1=YES, 0=NO)?0

CONCENTRATION OF INHIBITOR REMAINING: 100 MILLIMOLES

ANOTHER EXPERIMENT? (1=YES, 0=NO)?1

\*\*\*\*\*

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLES?2

TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?5

AMOUNT OF INHIBITOR IN MILLIMOLES?100

DATA FORMAT: 1=TABLE, 2=GRAPH?2

```

MIN.          MILLIMOLES ACETIC ACID PRODUCED
0             1             2
I.....I.....I.....I.....I.....I.....I.....I.....I.....I
0             I* 0
.1            I* .11
.2            I* .21
.3            I * .31
.4            I  * .4
.5            I  * .49
.6            I   * .58
.7            I    * .66
.8            I     * .74
.9            I      * .82
1             I       * .89
1.1           I        * .96
1.2           I         * 1.03
1.3           I          * 1.09
1.4           I           * 1.15
1.5           I            * 1.21
1.6           I             * 1.26
1.7           I              * 1.31
1.8           I               * 1.36
1.9           I                * 1.4
2             I                 * 1.45
DO YOU WANT TO CONTINUE THE ASSAY? (1=YES, 0=NO)?1
2.1           I                  * 1.48
2.2           I                   * 1.52
2.3           I                    * 1.56
2.4           I                     * 1.59
2.5           I                      * 1.62
2.6           I                       * 1.65
2.7           I                        * 1.67
2.8           I                         * 1.7
2.9           I                          * 1.72
3             I                           * 1.74
DO YOU WANT TO CONTINUE THE ASSAY? (1=YES, 0=NO)?0

CONCENTRATION OF INHIBITOR REMAINING: 100 MILLIMOLES
ANOTHER EXPERIMENT? (1=YES, 0=NO)?0

```

DONE



CONTRIBUTED PROGRAM **BASIC**

MALAR  
36797

**TITLE:**

MALARIA ERADICATION PROGRAM

**DESCRIPTION:**

The MALAR unit provides a context within which to explore the economic, biological, political, and ecological ramifications of a classic example of a serious health problem. Often the problems of public health are viewed only as medical ones, when in fact they are also very much economic, political, and even ecological. A unit of study such as that suggested by MALAR can be of great assistance in helping students learn about, and gain an appreciation of these other factors related to health problems.

Many school programs are beginning to recognize the importance of the study of health at all levels and in the broad sense of the term. A unit like MALAR provides a novel, interesting core for a related unit of study. Since MALAR treats a classic health problem, it provides a springboard to considerations of other health problems.

At a more specific level, MALAR helps a student to learn something about epidemiology and the health problem of malaria. He can determine basic principles of dealing with an epidemic disease. The computer program allows the student to become the decision-maker in a situation involving public health, and requires him to balance economic considerations with biological and medical ones. Using the computer simulation, the student has an opportunity to explore a public health situation from new perspectives and at the same time to develop some important inquiry and problem-solving skills.

**INSTRUCTIONS:**

This program simulates the attack phase of a malaria eradication plan. It allows the user to attempt to eradicate malaria from a given area within five years. The user can try to do this with or without a budget limitation.

**SPECIAL  
CONSIDERATIONS:**

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                   |        |
|-------------------|--------|
| Student Workbook  | \$ .30 |
| Teachers Guide    | .30    |
| Resource Handbook | .50    |

**ACKNOWLEDGEMENTS:**

Huntington II Project  
State University of New York

**RUN**

RUN  
MALAR

DO YOU REQUIRE INSTRUCTIONS FOR MALAR (1=YES, 0=NO)?1  
CURRENT CONDITIONS:

APPROX. POP. OF AREA:100000  
APPROX. NO. ILL WITH MALARIA:25000  
APPROX. NO. DEATHS/YR DUE TO MALARIA:1000

TO CORRECT THIS SITUATION YOU CAN:  
ISOLATE THOSE ILL IN QUARANTINE HOSPITALS  
ADMINISTER DRUGS TO THOSE ILL  
APPLY PESTICIDES TO KILL MOSQUITOES  
GIVE PREVENTIVE DRUGS TO THOSE STILL HEALTHY

THESE ARE THE APPROX. COSTS:  
FIELD HOSPITAL OF 20 BEDS: \$2000 PER YEAR  
DRUG TREATMENT FOR ILL: \$2 PER PERSON FOR 1 YR.  
FULL ANTI-MOSQUITO SPRAY:\$ 75000 FOR 1 YEAR  
WHEN USING DDT, OTHER SPRAYS HIGHER COST  
PREVENTIVE DRUG EFFECTIVE 1 YR.:72 CENTS PER PERSON

CONSULT YO UR STUDENT MANUAL FOR FURTHER INFORMATION  
YOU MAY USE MALAR EITHER WITH A BUDGET (VERSION 1)  
OR WITHOUT A BUDGET (VERSION 2). VERSION NUMBER?2

YOUR OBJECTIVE IS TO MINIMIZE MALARIA FOR THE NEXT  
FIVE YEARS.

----- (HOSPITALS)

HOW MANY FIELD HOSPITALS DO YOU INTEND TO USE?200

FOR THIS TREATMENT:  
INDICATE YEARS TO BE USED BY TYPING, AFTER THE YEAR,  
1=YES OR 0=NO

YEAR 1 ?1  
YEAR 2 ?1  
YEAR 3 ?1  
YEAR 4 ?1  
YEAR 5 ?1

COST OF THIS TREATMENT: \$ 2.00000E+06  
TOTAL MONEY ALREADY ALLOCATED FOR 5 YEARS \$ 2.00000E+06

----- (DRUGS FOR SICK)

HOW MANY FULL TREATMENTS OF DRUGS  
FOR THE ILL, SHOULD BE ORDERED PER YEAR?1000

FOR THIS TREATMENT:

YEAR 1 ?1  
YEAR 2 ?1  
YEAR 3 ?1  
YEAR 4 ?1  
YEAR 5 ?1

COST OF THIS TREATMENT: \$ 10000  
TOTAL MONEY ALREADY ALLOCATED FOR 5 YEARS \$ 2.01000E+06

----- (MOSQUITOES)

WHAT PERCENTAGE OF MOSQUITOES DO YOU WANT TO ELIMINATE?0

----- (PREVENTIVE DRUGS)

HOW MANY DOSES OF PREVENTIVE DRUGS, FOR THOSE  
HEALTHY, DO YOU WANT TO ORDER PER YEAR?1000

FOR THIS TREATMENT:

YEAR 1 ?1  
YEAR 2 ?1  
YEAR 3 ?1  
YEAR 4 ?1  
YEAR 5 ?1

COST OF THIS TREATMENT: \$ 3600  
TOTAL MONEY ALREADY ALLOCATED FOR 5 YEARS \$ 2.01360E+06

USING YOUR PLAN:

| YEAR | NO. SICK | NO. DEATHS DUE TO MALARIA |
|------|----------|---------------------------|
| 0    | 24963    | 981                       |
| 1    | 23658    | 905                       |
| 2    | 23721    | 935                       |
| 3    | 23761    | 955                       |
| 4    | 23586    | 869                       |
| 5    | 23625    | 888                       |

OVER YOUR 5 YEAR TREATMENT PROGRAM  
4552 DEATHS DUE TO MALARIA HAVE BEEN RECORDED

DO YOU WISH AN EVALUATION (1=YES, 0=NO)?0

DO YOU WANT TO (1) TAKE THE NEXT FIVE YEARS  
OR (2) START OVER OR (3) END. TYPE NUMBER?3

DONE

RUN  
MALAR

DO YOU REQUIRE INSTRUCTIONS FOR MALAR (1=YES, 0=NO)?0  
YOU MAY USE MALAR EITHER WITH A BUDGET (VERSION 1)  
OR WITHOUT A BUDGET (VERSION 2). VERSION NUMBER?2

YOUR OBJECTIVE IS TO MINIMIZE MALARIA FOR THE NEXT  
FIVE YEARS.

----- (HOSPITALS)

HOW MANY FIELD HOSPITALS DO YOU INTEND TO USE?200

FOR THIS TREATMENT:  
INDICATE YEARS TO BE USED BY TYPING, AFTER THE YEAR,  
1=YES OR 0=NO  
YEAR 1 ?1  
YEAR 2 ?1  
YEAR 3 ?1  
YEAR 4 ?0  
YEAR 5 ?0

COST OF THIS TREATMENT: \$ 1.20000E+06  
TOTAL MONEY ALREADY ALLOCATED FOR 5 YEARS \$ 1.20000E+06

----- (DRUGS FOR SICK)

HOW MANY FULL TREATMENTS OF DRUGS  
FOR THE ILL, SHOULD BE ORDERED PER YEAR?1000

FOR THIS TREATMENT:  
YEAR 1 ?1  
YEAR 2 ?1  
YEAR 3 ?1  
YEAR 4 ?0  
YEAR 5 ?0  
COST OF THIS TREATMENT: \$ 6000  
TOTAL MONEY ALREADY ALLOCATED FOR 5 YEARS \$ 1.20600E+06

----- (MOSQUITOES)

WHAT PERCENTAGE OF MOSQUITOES DO YOU WANT TO ELIMINATE?60  
WHAT PESTICIDE WILL YOU USE  
1=DDT 2=MALATHION 3=PROPOXUR  
?1

FOR THIS TREATMENT:  
YEAR 1 ?1  
YEAR 2 ?1  
YEAR 3 ?1  
YEAR 4 ?0  
YEAR 5 ?0  
COST OF THIS TREATMENT: \$ 135000.  
TOTAL MONEY ALREADY ALLOCATED FOR 5 YEARS \$ 1.34100E+06

----- (PREVENTIVE DRUGS)



HOW MANY DOSES OF PREVENTIVE DRUGS, FOR THOSE HEALTHY, DO YOU WANT TO ORDER PER YEAR ? 1000

FOR THIS TREATMENT:

YEAR 1 ?1  
 YEAR 2 ?1  
 YEAR 3 ?1  
 YEAR 4 ?0  
 YEAR 5 ?0

COST OF THIS TREATMENT: \$ 2160

TOTAL MONEY ALREADY ALLOCATED FOR 5 YEARS \$ 1.34316E+06

USING YOUR PLAN:

| YEAR | NO. SICK | NO. DEATHS DUE TO MALARIA |
|------|----------|---------------------------|
| 0    | 24963    | 981                       |
| 1    | 11730    | 433                       |
| 2    | 11793    | 455                       |
| 3    | 11833    | 469                       |
| 4    | 24900    | 949                       |
| 5    | 24939    | 969                       |

OVER YOUR 5 YEAR TREATMENT PROGRAM  
 3275 DEATHS DUE TO MALARIA HAVE BEEN RECORDED

DO YOU WISH AN EVALUATION (1=YES, 0=NO)?0

DO YOU WANT TO (1) TAKE THE NEXT FIVE YEARS  
 OR (2) START OVER OR (3) END. TYPE NUMBER?3

DONE

RUN  
 MALAR

DO YOU REQUIRE INSTRUCTIONS FOR MALAR (1=YES, 0=NO)?0  
 YOU MAY USE MALAR EITHER WITH A BUDGET (VERSION 1)  
 OR WITHOUT A BUDGET (VERSION 2). VERSION NUMBER?1

YOUR OBJECTIVE IS TO MINIMIZE MALARIA FOR THE NEXT  
 5 YEARS, WITH A TOTAL FUND OF 500 THOUSAND DOLLARS

----- (HOSPITALS)

HOW MANY FIELD HOSPITALS DO YOU INTEND TO USE?0

----- (DRUGS FOR SICK)

HOW MANY FULL TREATMENTS OF DRUGS  
 FOR THE ILL, SHOULD BE ORDERED PER YEAR?7500

FOR THIS TREATMENT:

INDICATE YEARS TO BE USED BY TYPING, AFTER THE YEAR,  
 1=YES OR 0=NO

YEAR 1 ?1  
 YEAR 2 ?1  
 YEAR 3 ?1  
 YEAR 4 ?1  
 YEAR 5 ?1

COST OF THIS TREATMENT: \$ 75000.

THIS LEAVES A BALANCE OF 425000. DOLLARS

----- (MOSQUITOES)

WHAT PERCENTAGE OF MOSQUITOES DO YOU WANT TO ELIMINATE?100

WHAT PESTICIDE WILL YOU USE

1=DDT 2=MALATHION 3=PROPOXUR

?3

FOR THIS TREATMENT:

YEAR 1 ?1  
 YEAR 2 ?1  
 YEAR 3 ?1  
 YEAR 4 ?1  
 YEAR 5 ?1

COST OF THIS TREATMENT: \$ 3.18750E+06

YOUR LAST ITEM OVERSPENT YOUR BUDGET  
 RESET THIS EXPENDITURE SO IT'S WITHIN THE \$ 425000.      REMAINING  
 WHAT PERCENTAGE OF MOSQUITOES DO YOU WANT TO ELIMINATE?100  
 WHAT PESTICIDE WILL YOU USE  
 1=DDT            2=MALATHION            3=PROPOXUR  
 ?1

FOR THIS TREATMENT:  
 YEAR 1    ?1  
 YEAR 2    ?1  
 YEAR 3    ?1  
 YEAR 4    ?1  
 YEAR 5    ?1  
 COST OF THIS TREATMENT: \$ 375000.  
 THIS LEAVES A BALANCE OF 50000.            DOLLARS

----- (PREVENTIVE DRUGS)

HOW MANY DOSES OF PREVENTIVE DRUGS, FOR THOSE  
 HEALTHY, DO YOU WANT TO ORDER PER YEAR?12000

FOR THIS TREATMENT:  
 YEAR 1    ?1  
 YEAR 2    ?1  
 YEAR 3    ?1  
 YEAR 4    ?1  
 YEAR 5    ?1  
 COST OF THIS TREATMENT: \$ 43200.  
 THIS LEAVES A BALANCE OF 6800            DOLLARS

USING YOUR PLAN:

| YEAR | NO. SICK | NO. DEATHS DUE TO MALARIA |
|------|----------|---------------------------|
| 0    | 25047    | 1024                      |
| 1    | 700      | 8                         |
| 2    | 706      | 9                         |
| 3    | 694      | 6                         |
| 4    | 691      | 5                         |
| 5    | 703      | 8                         |

OVER YOUR 5 YEAR TREATMENT PROGRAM  
 36 DEATHS DUE TO MALARIA HAVE BEEN RECORDED

DO YOU WISH AN EVALUATION (1=YES, 0=NO)?1

| PROGRAM      | TOTAL COST | DOLLARS | YEARS | EFFECTIVENESS (PCT.) |
|--------------|------------|---------|-------|----------------------|
| DRUG TREAT   | 75000.     |         | 5     | 85                   |
| MOSQ SPRAY   | 375000.    |         | 5     | 80                   |
| PREVENT DRUG | 43200.     |         | 5     | 7.2                  |

SURPLUS ORDERING:  
 14205 TREATMENTS OF DRUGS FOR SICK UNUSED  
 OF THESE 6505 DOSES ARE STILL USABLE

DO YOU WANT TO (1) TAKE THE NEXT FIVE YEARS  
 OR (2) START OVER OR (3) END. TYPE NUMBER?3

DONE



**TITLE:**

MASSD: Mass Defect

**DESCRIPTION:**

A classroom presentation that could be used to calculate mass defect, and give the answer in terms of usable energy (kw-hr. of electricity).

OBJECTIVES:

- A. To calculate and explain mass defect.
- B. To introduce the concept of binding energy.
- C. Conversion of mass to energy. (atomic power)

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - The student should have an understanding of nuclear particles, and the law of conservation of mass and energy.
- B. Materials - The teacher should make available a table of isotopes that lists the actual mass. (Handbook of Chemistry and Physics, Chemical Rubber Company)

DISCUSSION:

It should be noted that the masses used here include the electrons. The very small difference which would be obtained if the bare nuclear mass were known is negligible for the purpose of this calculation.

Time permitting, it would be beneficial to have the student investigate the conversion of atomic mass units (AMU) to calories and kilowatt-hours in order to recognize the significance of the units and the magnitude of the numbers involved.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
MASSD

THIS PROGRAM IS DESIGNED TO INVESTIGATE MASS DEFECT

WHICH OF THE ELEMENTS WOULD YOU LIKE TO CONSIDER?  
REMEMBER WE ARE DEALING WITH A SINGLE ATOM, THEREFORE  
IN ADDITION TO THE ATOMIC NUMBER WE ARE GOING TO NEED THE  
ACTUAL MASS (IN AMU) AND THE MASS NUMBER OF THE ISOTOPE  
YOU WANT TO WORK WITH.

WHEN THE MACHINE TYPES A QUESTION MARK (?) TYPE IN  
YOUR ANSWER THEN HIT RETURN KEY. USE NUMBERS OF UP TO  
SIX SIGNIFICANT FIGURES. ROUND IF NECESSARY TO 6 DIGITS.  
IN THE VALUES FOR MASS DEFECT.

THE ATOMIC NUMBER IS ?8  
THE ACTUAL MASS IS ?15.9949  
THE MASS NUMBER IS ?16

THE SUM OF THE MASS OF THE 8 PROTONS AND THE 8 NEUTRONS  
PLUS THE WEIGHT OF THE 8 ELECTRONS IS THE CALCULATED  
MASS.

CALCULATED MASS - ACTUAL MASS = MASS DEFECT  
16.132 - 15.9949 = .1371

THE MASS DEFECT IN TERMS OF ENERGY IS THE EQUIVALENT OF  
2936 X 10<sup>9</sup> CAL. PER MOLE OF THIS SUBSTANCE,  
OR 184 X 10<sup>9</sup> CAL. PER GRAM.

IF WE DIVIDE THIS BINDING ENERGY BY THE NUMBER OF  
PARTICLES IN THE NUCLEUS, WE GET A RATIO KNOWN AS THE  
BINDING ENERGY PER NUCLEON, WHICH IS A MEASURE OF THE  
STABILITY OF THE NUCLEUS. THE MORE 'BINDING'  
PER NUCLEON, THE MORE STABLE IS THE NUCLEUS.  
THE BINDING ENERGY PER NUCLEON IS : 1.27674E-05 ERGS. PER NUCLEON, OR  
3.04712E-13 CAL. PER NUC.,  
WHICH IS MORE COMMONLY EXPRESSED AS 800 MEV.

THE AMOUNT OF ENERGY (BINDING ENERGY) CONTAINED IN ONE  
GRAM OF THIS SUBSTANCE WOULD BE SUFFICIENT TO SUPPLY ALL  
THE ELECTRICAL NEEDS IN AN AVERAGE ONE FAMILY HOUSE USING  
15 KW-HRS. PER DAY FOR A PERIOD OF 14245 DAYS OR  
39 YEARS.

IF YOU WOULD LIKE TO RUN ANOTHER PROBLEM TYPE IN 1,  
IF NOT TYPE IN 0.  
?0

\*\*\*\*\*

DONE

**TITLE:**

DIFFUSION EXPERIMENT

**DESCRIPTION:**

This program simulates an experiment on diffusion. Membrane characteristics are "observed" by the student, and means of transport across membranes identified.

OBJECTIVES:

- A. To provide background for understanding of transport of materials across living membranes.
- B. To evaluate and reinforce an understanding of conditions under which diffusion, osmosis, and active transport take place.
- C. To help in the understanding of solution concentrations.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - exposed to the meaning of diffusion, osmosis, active transport, and semipermeable; should understand the need for energy expenditure in active transport; and have observed or performed the iodine test for starch.
- B. Materials - a prepared ditto of questions to be answered by students as a homework assignment or for classroom discussion.

DISCUSSION:

- A. Operational Suggestions
  1. Student level - this program has been effective with average and above average students.
  2. An incorrect answer results in the students being instructed to return to their seats, correct their answer, and give a reason for its correctness. A correct answer is immediately reinforced.

Continued on following page.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

DISCUSSION: continued

3. The class is grouped. A maximum of 5 per group is recommended. The groups sequentially run the program until completion, or they are sent away from the machine by an incorrect answer. The other groups may be engaged in performance of the same experiment being "done" by the computer, or in a related activity. Interruption of an actual experiment, as a group goes to the computer, should not affect the results.
4. When the program is to be used with more than one class, it is suggested that the data line in the program (see list) be changed. Since this is a simple change to make, it can be made between groups within a class. This prevents their memorization and/or transmission to other groups and classes. Examples follow:

```
140 DATA10,11,12,13,14 may be changed to:  
140 DATA1,2,3,4,5  
or 140 DATA4,2,6,9,1  
or 140 DATA20,30,40,50,60
```

Any combination of numbers may be inserted. There must be a total of five, however, since the student is asked to respond to five questions.

It has been found that extensive discussion precedes the answering of each question on the computer, and in the writing of the rationalizations. This is certainly desirable.

B. Suggested Follow-up

Questions which may be used for discussion, or given as a homework assignment:

1. What happens to the concentration of water within the membrane as the glucose diffuses out? Why?
2. What observations indicated that the iodine has moved into the "cell"?
3. Why couldn't the same observations be made outside of the membrane?
4. What changes in observations would you expect if the cellophane had not been permeable?
5. Can materials diffuse through a semipermeable membrane in both directions at the same time?
6. What is meant by equilibrium?
7. Under what conditions is a cell in complete equilibrium with its environment? (When it is dead.)

RUN

RUN  
MEMBR

CELL MEMBRANES

AN IMPORTANT FUNCTION OF CELL MEMBRANES IS TO CONTROL THE PASSAGE OF MATERIAL INTO AND OUT OF CELLS. THIS PROGRAM GOES INTO THE MEANS BY WHICH THIS PROCESS TAKES PLACE.

IN THIS EXPERIMENT A STARCH AND GLUCOSE SOLUTION WAS PLACED WITHIN A PIECE OF CELLOPHANE TUBING. CELLOPHANE IS POROUS ENOUGH TO PERMIT THE PASSAGE OF SOME SMALLER MOLECULES THROUGH IT. THEREFORE, A CLOSED OFF PIECE OF TUBING CAN REPRESENT A CELL.

AFTER THE STARCH AND GLUCOSE SOLUTION WAS PLACED INTO THE TUBING, THE END WAS TIED OFF AND THE 'CELL' PLACED IN A BEAKER OF WATER TO WHICH A FEW DROPS OF IODINE HAD BEEN ADDED.

LET 10 REPRESENT THE OUTSIDE OF THE MEMBRANE  
LET 11 REPRESENT THE INSIDE OF THE MEMBRANE

WHERE IS THE CONCENTRATION OF GLUCOSE THE GREATEST?11

THAT IS CORRECT. WHERE IS THE CONCENTRATION OF STARCH THE GREATEST?11

RIGHT. WHERE IS THE CONCENTRATION OF IODINE THE GREATEST?10

WOW! WHAT A SUPERIOR MIND YOU HAVE, OR IS IT JUST LUCKY GUESSING? WHERE IS THE CONCENTRATION OF WATER THE GREATEST?10

YES. IF THE MEMBRANE WERE THE OUTER LIMITS OF A LIVING CELL, WHICH OF THE PROCESSES BELOW WOULD ACCOUNT FOR THE MOVEMENT OF GLUCOSE OUT OF THE CELL?

LET OSMOSIS = 12  
LET ACTIVE TRANSPORT = 13  
LET DIFFUSION = 14

?14

CORRECT. THE GLUCOSE DIFFUSED FROM AN AREA OF HIGHER CONCENTRATION TO ONE OF LOWER CONCENTRATION. WHICH PROCESS WOULD ACCOUNT FOR THE MOVEMENT OF THE WATER OUT OF THE CELL?13

RIGHT. THE CONCENTRATION OF WATER IS GREATER OUTSIDE OF THE CELL THAN INSIDE. ACTIVE TRANSPORT WOULD ACCOUNT FOR MOVEMENT AGAINST DIFFUSION. WHICH PROCESS WOULD EXPLAIN THE TRANSPORT OF WATER INTO THE CELL?12

YES, OSMOSIS IS DIFFUSION OF WATER THROUGH A SEMIPERMEABLE MEMBRANE. IF THE IODINE OUTSIDE OF THE CELL HAD TURNED BLACK, WHAT PROCESS WOULD HAVE CAUSED IT?13

YES. SINCE STARCH MOLECULES ARE RELATIVELY LARGE, THE CELL WOULD HAVE TO EXPEND ENERGY TO MOVE THEM ACROSS THE MEMBRANE, EVEN WHEN THE STARCH CONCENTRATION IS GREATER INSIDE THE CELL.

CONGRATULATIONS. YOU HAVE SCORED 100. KEEP UP THE GOOD WORK.

\*\*\* END OF PROGRAM \*\*\*

DONE





**TITLE:** COMPUTER-AUGMENTED PHYSICS TOPICS (MKS UNITS) MKS1  
36671

**DESCRIPTION:** This program provides practice in converting from English units to MKS units of physical measurement. The student is asked to answer questions, and perform one conversion calculation, using Desk Calculator mode if desired.

**INSTRUCTIONS:** To access the calculator mode, the student types 999999 in answer to question(s) requiring calculation. For all other questions, factual data (self-explanatory) is requested, and the program calculates the conversions. See DESCAL (HP 36674) in Volume IV for instructions for using the Calculator Mode.  
APPEND - DESCAL before RUNning program.

**SPECIAL CONSIDERATIONS:** This program accompanies the Project Solo Module "Computer-Augmented Physics Topics" of the Hewlett Packard Curriculum Series.

FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Physics (Secondary level)

Student Background Required: MKS units of measurements (may be concurrent)

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5648 Computer-Augmented Physics Topics (student text)  
HP 5951-5649 Computer-Augmented Physics Topics (problem solutions)  
HP 5951-5650 Computer-Augmented Physics Topics (classroom set - 30 student books and 1 problem solutions)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project  
Scientific Press  
1629 Channing Ave.  
Palo Alto, California 94303

**ACKNOWLEDGEMENTS:** Project Solo  
University of Pittsburgh

RUN

APPEND-DESCAL  
RUN  
MKS1

IN THIS LESSON YOU WILL GAIN SOME FAMILIARITY  
WITH THE MKS SYSTEM OF UNITS.  
TO USE THE CALCULATOR MODE (LATER ON) TYPE 999999.

WHAT IS YOUR WEIGHT IN POUNDS?125  
THEREFORE YOUR WEIGHT IS 556.818 NEWTONS.  
YOUR MASS IS 56.8182 KILOGRAMS.  
WHILE I'M STILL BEING PERSONAL,  
HOW LONG DOES IT TAKE YOU TO GET TO SCHOOL?  
GIVE YOUR TIME IN MINUTES.

?25  
THAT IS 1500 SECONDS.  
WELL, I GUESS THAT ISN'T TOO BAD!  
NOW LET'S CONSIDER DISTANCES  
HOW FAR DO YOU LIVE FROM SCHOOL?  
ALLOW 10 BLOCKS PER MILE AND PRINT YOUR  
ANSWER IN BLOCKS!

?35  
THAT IS A DISTANCE OF 5632.7 METERS!  
YOUR AVERAGE SPEED ON THE WAY TO SCHOOL IS 3.75514 M/SEC.  
HOW DO YOU GET TO SCHOOL?  
INDICATE BY 1 FOR WALKING, 2 FOR BUS, 3 FOR CAR, 4 FOR BICYCLE  
AND 5 FOR OTHER?3  
THE SPEED LIMIT IN THE CITY IS 25 MPH.  
WHAT IS THIS SPEED EXPRESSED IN METERS PER SECOND?

?999999  
CALCULATOR MODE.  
CLEARED TO ZERO  
1ST NUMBER?25  
FUNCTION?MUL  
2ND NUMBER?5280  
MUL= 132000.

FUNCTION?DIV  
2ND NUMBER?3600  
DIV= 36.6667

FUNCTION?DIV  
2ND NUMBER?3.281  
DIV= 11.1755

FUNCTION?EXT  
EXIT.  
?11.1755  
YOU HAVE JUST CALCULATED WHAT YOUR MAXIMUM  
SPEED SHOULD HAVE BEEN. DO YOU EXCEED  
ANY SPEED LIMITS (1=YES, 0=NO)?0  
RIGHT! HOPE YOU HAD A GOOD TIME WITH THIS LITTLE  
PROGRAM. YOU HAVE COOPERATED TO THE FULLEST (I THINK).  
TRY THE NEXT LESSON (MKS2).  
PEACE AND FAREWELL.

DONE

**TITLE:**

COMPUTER-AUGMENTED PHYSICS TOPICS (MKS UNITS)

MKS2  
36673**DESCRIPTION:**

This program follows MKS1 in learning sequence, and provides further practice in conversion from English units to MKS units of physical measurement, using the Desk Calculator mode if desired.

**INSTRUCTIONS:**

There are two kinds of problems in this tutorial:

1. Convert mass in Kg. to weight in Newtons.
2. Convert distance in miles to distance in meters.

The student may attempt as many of each kind as he or she desires. To access the Calculator mode (which allows the student to perform the necessary calculations, then return to the INPUT (answer) line in the program), the student enters 999999 as the answer.

See DESCAL (HP 36674) in Volume IV for instructions in using the calculator mode.

APPEND - DESCAL before RUNNING the program.

**SPECIAL  
CONSIDERATIONS:**

This program accompanies the Project Solo Module "Computer-Augmented Physics Topics" of the Hewlett Packard Curriculum Series.

**FOR INSTRUCTIONAL PURPOSES**

Suitable Courses: Physics (secondary)

Student Background Required: MKS units of measurement (may be concurrent)

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5648 Computer-Augmented Physics Topics (student text)  
 HP 5951-5649 Computer-Augmented Physics Topics (problem solutions)  
 HP 5951-5650 Computer-Augmented Physics Topics (classroom set - 30  
 student books and 1 problem solutions)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project  
 Scientific Press  
 1629 Channing Ave.  
 Palo Alto, California 94303

**ACKNOWLEDGEMENTS:**

Project Solo  
 University of Pittsburgh

RUN

APPEND-DESCAL  
RUN  
MKS2

AND SO WE CONTINUE WITH THE MKS SYSTEM OF UNITS.  
REMEMBER-- 999999 FOR CALCULATOR MODE.  
IF A CAR HAS A MASS OF 1000 KILOGRAMS, WHAT IS ITS  
WEIGHT IN NEWTONS?9800  
VERY GOOD.

NOW TRY THIS ONE. WHAT IS THE WEIGHT OF AN OBJECT  
WHICH HAS A MASS OF 7085 KILOGRAMS?

?999999  
CALCULATOR MODE.  
CLEARED TO ZERO  
1ST NUMBER?7085  
FUNCTION?MUL  
2ND NUMBER?9.8  
MUL= 69433.

FUNCTION?EXT  
EXIT.  
?69433.

GOOD. SOON YOU'LL BE AN EXPERT.  
WOULD YOU LIKE TO TRY ANOTHER CONVERSION OF MASS  
TO WEIGHT? (1=YES, 0=NO)?0

OK, THEN, TRY SOME DISTANCES:  
HOW MANY METERS ARE THERE IN A MILE?  
?999999

CALCULATOR MODE.  
CLEARED TO ZERO  
1ST NUMBER?5280  
FUNCTION?DIV  
2ND NUMBER?3.281  
DIV= 1609.27

FUNCTION?EXT  
EXIT.  
HOW MANY METERS ARE THERE IN A MILE?  
?1609.27

O.K. YOU ARE GETTING THE IDEA. GO TO THE DESK CALCULATOR MODE  
AND CALCULATE EACH OF THE FOLLOWING DISTANCES IN METERS

6700 MILES  
8000 MILES  
4400 MILES  
7200 MILES

CALCULATOR MODE.  
CLEARED TO ZERO  
1ST NUMBER?6700  
FUNCTION?MUL  
2ND NUMBER?1609.27  
MUL= 1.07821E+07

FUNCTION?CLR  
CLEARED TO ZERO  
1ST NUMBER?8000  
FUNCTION?MUL  
2ND NUMBER?1609.27  
MUL= 1.28742E+07

FUNCTION?CLR  
CLEARED TO ZERO  
1ST NUMBER?4400  
FUNCTION?MUL  
2ND NUMBER?1609.27  
MUL= 7.08079E+06

FUNCTION?CLR  
CLEARED TO ZERO  
1ST NUMBER?7200  
FUNCTION?MUL  
2ND NUMBER?1609.27  
MUL= 1.15867E+07

FUNCTION?EXT  
EXIT.

INPUT YOUR FOUR ANSWERS:  
?1.07821E+07,1.28742E+07,7.08079E+06,1.15867E+07  
CONGRATULATIONS! SEE YOU LATER.

DONE





**TITLE:**

ACID-BASE TITRATION

**DESCRIPTION:**

This program will calculate molarity by using data obtained from an acid-base titration.

OBJECTIVES:

To provide the teacher and the student with a molarity calculator to be used where either finds it applicable.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

A. Student - This program can be used with students who have had no preliminary preparation or those with extensive preparation.

B. Materials - None

DISCUSSION:

It should be noted that normality is no longer in the New York State syllabus. It thus becomes necessary to teach titration calculations in the molarity systems by way of moles of  $H^+$  reacted vs. moles of  $OH^-$  reacted, a much preferred method. This program does just that.

This program may be used in lab, as check on homework problems, and for tutorial work.

The teacher may also wish to show the logic of programs in general by using this very elementary program. The teacher need only take the list and explain it line by line to enhance the students' understanding. The equation used to solve the problems is:

$$\text{Moles } H^+ = \text{Moles } OH^-$$

$$(M_A)(V_A)(n) = (M)(V_B)(n)$$

V = volume in liters  
n = subscript of the  $H^+$   
or  $OH^-$

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn



RUN

GET-MOLAR  
RUN  
MOLAR

THIS PROGRAM IS DESIGNED TO CALCULATE THE UNKNOWN MOLARITY  
IN AN ACID-BASE TITRATION.

WHAT IS THE SUBSCRIPT OF THE H+ IN THE ACID FORMULA,  
AND THE SUBSCRIPT OF THE OH- IN THE BASE FORMULA?2,1

HOW MANY ML OF ACID, AND HOW MANY ML OF BASE  
WERE USED?19.7,10.0

IS THE KNOWN MOLARITY FOR THE ACID OR THE BASE?  
ANSWER 1 FOR ACID OR 2 FOR BASE?1

WHAT IS THE MOLARITY OF THE ACID?5.5

ANSWER: THE BASE IS 21.67 M.

DO YOU WANT TO WORK ANOTHER PROBLEM? ANSWER 1 FOR YES  
OR 0 FOR NO?1

\*\*\*\*\*

WHAT IS THE SUBSCRIPT OF THE H+ IN THE ACID FORMULA,  
AND THE SUBSCRIPT OF THE OH- IN THE BASE FORMULA?3,1

HOW MANY ML OF ACID, AND HOW MANY ML OF BASE  
WERE USED?0,29.3

IS THE KNOWN MOLARITY FOR THE ACID OR THE BASE?  
ANSWER 1 FOR ACID OR 2 FOR BASE?1

WHAT IS THE MOLARITY OF THE ACID?2.0

ANSWER: THE BASE IS 0 M.

DO YOU WANT TO WORK ANOTHER PROBLEM? ANSWER 1 FOR YES  
OR 0 FOR NO?1

\*\*\*\*\*

WHAT IS THE SUBSCRIPT OF THE H+ IN THE ACID FORMULA,  
AND THE SUBSCRIPT OF THE OH- IN THE BASE FORMULA?2,1

HOW MANY ML OF ACID, AND HOW MANY ML OF BASE  
WERE USED?15.0,24.7

IS THE KNOWN MOLARITY FOR THE ACID OR THE BASE?  
ANSWER 1 FOR ACID OR 2 FOR BASE?2

WHAT IS THE MOLARITY OF THE BASE?1.5

ANSWER: THE ACID IS 1.24 M.

DO YOU WANT TO WORK ANOTHER PROBLEM? ANSWER 1 FOR YES  
OR 0 FOR NO?0

\*\*\*\*\*

DONE  
BYE  
051 MINUTES OF TERMINAL TIME

CONTRIBUTED PROGRAM **BASIC**NEWTN2  
36316

## TITLE:

NEWTN2: Newtons 2nd Law

## DESCRIPTION:

A problematic situation is presented to the student which requires repeated applications of Newton's 2nd law. By selecting various angles and forces, the operator can observe the resulting motion produced. To successfully complete the program, the student must complete a specified displacement within ten attempts.

OBJECTIVES:

To aid in the development of skills in applying the equations of motion.

## INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - An awareness of Newton's 2nd law is required. In addition, some familiarity of force components (resolution of vectors) is necessary.
- B. Materials - Graph paper is helpful to students with below-to-average ability.

DISCUSSION:A. Operational Suggestions

This program was designed for operation by individual students or small groups, but the program may be used with a class as a "lead-in" demonstration of forces and vectors. The presentation is also helpful in describing two dimensional motion under the influence of a constant external force.

When executed by small groups of average students, it has been noted that programs of this type stimulate discussions and involvement for those participating.

B. Suggested Follow-up

The student is confronted with a situation which requires that he overcome a given force (the wind), in moving a boat across a channel 10 Km. wide. The magnitude of the force produced by the wind on the boat varies with each "run", but the direction of the vector is always southwest, i.e. 45 deg. with respect to the direction EAST. The student may vary his paddling force (limited to values less than 200 Newtons), and direction at intervals during his displacement. After each choice of variables, he is given his position, as well as the resulting speed and direction of the boat. A certificate is presented for successful completion of the task.

## ACKNOWLEDGEMENTS:

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
NEWTN2

HINT: GRAPH PAPER IS HELPFUL IN RUNNING THIS PROGRAM.

F' MA SPEED,...

-----

YOU'RE TRYING TO ESCAPE FROM DEVIL'S ISLAND ON A SMALL BOAT.  
DEVIL'S ISLAND IS LOCATED AT COORDINATES (0,0).  
TO SUCCEED, YOU MUST REACH A CHANNEL 50 METERS WIDE AND  
10000 METERS DUE EAST, AT ABOUT (10000,0).

IN ADDITION, YOU MUST GET THERE IN FIVE MINUTES OR LESS OR  
SUFFER RECAPTURE --- (HEH,HEH,HEH--)

WHAT DO YOU WEIGH (IN POUNDS)?170

YOUR SITUATION IS AS FOLLOWS:

THE WIND IS BLOWING FROM THE NORTHEAST (45 DEGREES) EXERTING  
A FORCE OF 120 NEWTONS ON YOUR BOAT. YOU MAY PADDLE WITH  
ANY FORCE IN THE EASTWARD DIRECTION (ZERO DEGREES IS EAST)  
TO ACCELERATE YOUR BOAT ACROSS THE BAY AND THUS  
REACH THE OPPOSITE SHORE (AND FREEDOM).  
(NOTE: THE MASS OF THE BOAT WITH YOU ABOARD IS 177 KILOGRAMS).

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL  
YOU PADDLE?150,25

T= .5            X= 127            Y=-57            V(X)= 8            V(Y)=-4

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?0

T= 1            X= 507            Y=-229            V(X)= 17            V(Y)=-8

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?1

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL  
YOU PADDLE?150,15

T= 1.5            X= 1163            Y=-577            V(X)= 27            V(Y)=-16

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?1

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL  
YOU PADDLE?150,8

T= 2            X= 2128            Y=-1211            V(X)= 37            V(Y)=-27

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?0

T= 2.5            X= 3410            Y=-2176            V(X)= 48            V(Y)=-38

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?0

T= 3            X= 5011            Y=-3472            V(X)= 59            V(Y)=-49

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?1

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL  
YOU PADDLE?150,3

T= 3.5            X= 6932            Y=-5132            V(X)= 69            V(Y)=-62

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?1

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL  
YOU PADDLE?150,30

T= 4            X= 9126            Y=-7018            V(X)= 77            V(Y)=-64

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?1

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL  
YOU PADDLE?150,25

T= 4.5            X= 11559            Y=-8990            V(X)= 85            V(Y)=-68

YOU HAVE REACHED THE OPPOSITE SHORE,  
BUT ARE-8990 METERS OFF COURSE.

ALL THAT WORK FOR NOTHING!

YOU'RE LOST IN THE SWAMPS FOREVER; GOODBYE.

SEE IF YOU CAN IMPROVE YOUR ABILITY LATER.

DONE

NZY2  
36304**TITLE:**

NZY2: Enzyme Reaction Rate

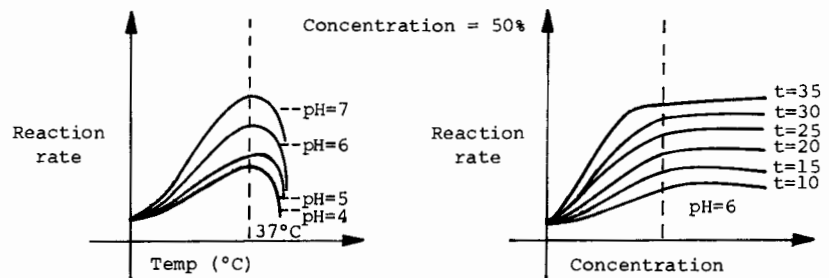
**DESCRIPTION:**

An extension of NZYM A833-36303 which permits the student to examine the effect on reaction rate with continuous changes in environmental factors.

OBJECTIVES:

In addition to reinforcing the concept that reaction rate is governed by pH, temperature, and enzyme concentration; the program can be used to:

- A. Introduce the idea of controlled experimentation where two factors are kept constant and a third is permitted to vary.
- B. Develop the idea of plotting experimental data to generate a family of curves as illustrated below.

**INSTRUCTIONS:**

See following page.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - Same as NZYMC. It might also be helpful if the student has been exposed previously to an actual experimental demonstration in which the change of reaction rate with one or more factors is visually displayed. The rate of bubble formation when one of the reactant products is a gas for example, might serve as one practical illustration of variation of reaction rate with temperature.
- B. Materials - none

DISCUSSION:

A. Operational Suggestions

- 1. Average students should work as part of a group; above-average students could be permitted to work alone.
- 2. For group effort activity, it would be instructive to use three different groups, each of which holds a different factor constant while the other two factors are allowed to vary.

B. Suggested Follow-up

- 1. Each group should be required to plot their data, on a board, if possible, so the whole class can see the results. Families of curves should be discussed.
- 2. Equivalent points on each data set should be compared; e.g. is reaction rate the same when pH is 4, temperature is 25°C and concentration is 50%, regardless of which factor is held constant and the others allowed to vary?
- 3. Introduce the concepts of interpolation between curves and again check comparable points on each set.
- 4. Indicate that the maximum reaction rate obtained is the same regardless of the technique used to reach maximum.

RUN

RUN  
NZYM2

THIS PROGRAM WILL ENABLE YOU TO SEE THE EFFECTS ON THE RATE OF REACTION WITHIN A SYSTEM CONTROLLED BY ENZYMES. THE REACTION RATE WILL VARY AS THE ENVIRONMENTAL CONDITIONS VARY. THESE CONDITIONS, PH, CONCENTRATION OF ENZYMES, AND TEMPERATURE, IN A NATURAL SITUATION ARE NEVER CONSTANT. LET'S SEE WHAT CONTROLS THIS RATE IN THESE SYSTEMS.

THE FOLLOWING ARE THE LIMITS WITHIN WHICH EACH OF OUR ENVIRONMENTAL CONDITIONS CAN VARY.

- 1)PH-----BETWEEN 4 AND 10
- 2)ENZ. CONC.--BETWEEN 10 AND 100 PERCENT
- 3)TEMP.-----BETWEEN 5 AND 47 DEGREES C.

I AM GOING TO PRINT A '?. YOU MUST THEN TYPE A NUMBER FOR PH, CONC., AND TEMP. (IN THAT ORDER), WHICH FALLS WITHIN EACH LIMIT STATED (SEE ABOVE.)

?4,10,5

| PH | CONC. | TEMP. | REACTION RATE |
|----|-------|-------|---------------|
| 4  | 10    | 5     | .05           |

NOTE THE REACTION RATE WITH THE THREE VALUES WHICH YOU SELECTED TO PROVIDE A BASIS FOR JUDGEMENT OF REACTION RATE, CHOOSE ANOTHER SET OF VALUES FOR PH, CONC., AND TEMP. (SEE LIMITS ABOVE).

?7,10,5

| PH | CONC. | TEMP. | REACTION RATE |
|----|-------|-------|---------------|
| 7  | 10    | 5     | 4.5           |

IS THE RESULT A HIGHER OR LOWER REACTION RATE? IS THE HIGHEST VALUE OBTAINED A MAXIMUM VALUE? DO YOU WANT TO TRY ANOTHER SET OF VALUES (TYPE '1') OR WOULD YOU PREFER A MORE ORGANIZED APPROACH TO DETERMINE MAXIMUM REACTION RATE (TYPE '2')

?2

WE ARE NOW GOING TO PERFORM AN EXPERIMENT IN WHICH YOU ARE TO TYPE IN THE VALUES FOR PH, CONC. AND TEMP. AS YOU DID BEFORE. HOWEVER, NOW YOU ARE GOING TO BE ABLE TO CHOOSE THE FACTOR WHICH WILL VARY. THE OTHER TWO FACTORS WILL REMAIN CONSTANT. (USE DIFFERENT NUMERICAL VALUES FOR EACH FACTOR.) TO OBTAIN THE MOST SIGNIFICANT DATA, START THE EXPERIMENT USING LOW NUMERICAL VALUES FOR EACH FACTOR.

I AM GOING TO PRINT A '?'. YOU MUST THEN TYPE A NUMBER FOR PH, CONC., AND TEMP. (IN THAT ORDER), WHICH FALLS WITHIN EACH LIMIT STATED (SEE ABOVE.)

?2

??20,5

AT LEAST ONE OF THE VARIABLES DOES NOT LIE WITHIN THE PRESCRIBED LIMITS. SEE LIMITS ABOVE AND TRY AGAIN.

?4,20,5

TYPE THE NUMBER WHICH IS TO BE VARIED.

?20

| PH | CONC. | TEMP. | REACTION RATE |
|----|-------|-------|---------------|
| -- | ----- | ----- | -----         |
| 4  | 20    | 5     | .1            |
| 4  | 30    | 5     | .13           |
| 4  | 40    | 5     | .16           |
| 4  | 50    | 5     | .17           |
| 4  | 60    | 5     | .19           |
| 4  | 70    | 5     | .19           |
| 4  | 80    | 5     | .2            |
| 4  | 90    | 5     | .2            |
| 4  | 100   | 5     | .2            |

YOU NOW HAVE A SET OF VALUES FOR REACTION RATE AS ONE OF THE GOVERNING FACTORS IS VARIED AND THE OTHER TWO ARE HELD CONSTANT. DOES THE REACTION RATE HAVE A MAXIMUM VALUE? IS THIS THE MAXIMUM POSSIBLE REACTION RATE? TO DETERMINE THIS, USE THE SAME INITIAL VALUE FOR THE VARYING FACTOR, BUT THIS TIME TYPE IN DIFFERENT VALUES FOR THE CONSTANT FACTORS.

IF YOU WANT ANOTHER SET OF VALUES FOR REACTION RATE, TYPE '1'  
IF YOU ARE SATISFIED THAT YOU KNOW THE VALUES FOR EACH FACTOR'S MAXIMUM REACTION RATE THEN TYPE '2'.

?2

DONE



NZYMC  
36303**TITLE:**

NZYMC: Enzymatic Reaction Rates

**DESCRIPTION:**

This program covers enzymatic reaction rates, and conveys the idea that enzyme reactions are dependent upon environmental factors such as pH, temperature, and the concentration of the enzymes. A simulated experimental situation is created, whereby the student works with one parameter at a time and can vary the degree of the enzyme reactivity.

OBJECTIVES:

The program presents the students with the following concepts:

- A. Enzymatic reaction rates are dependent upon environmental factors; (these include pH, temperature, concentration of enzymes, and substrate)
- B. The value of graphing to help in the interpretation of data;
- C. The meaning of the term "limiting factor";
- D. Different enzymes may vary in degree of reactivity and thereby affect reaction rates;
- E. Enzymes are not used up, but can take part in additional reactions.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

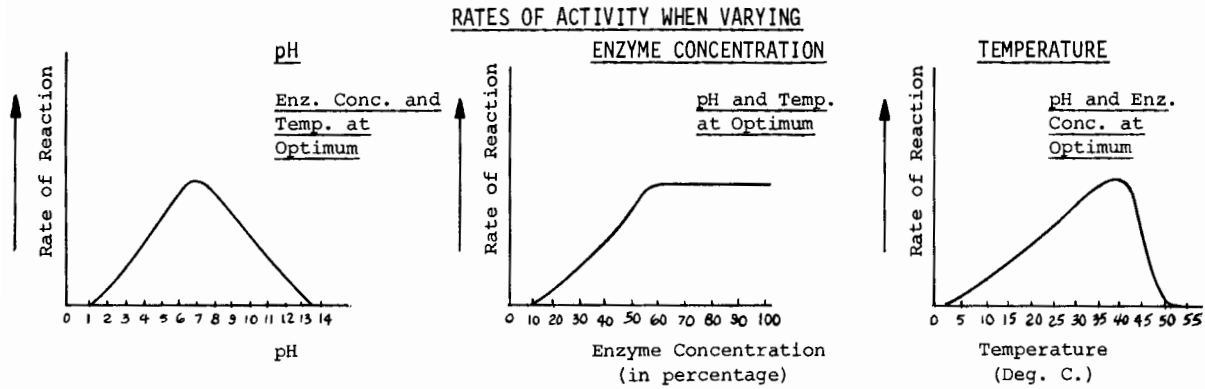
- A. Student - The student should have some understanding of these terms: pH, substrate, enzyme, and chemical reaction. He should know that there is a substrate-enzyme interaction, and that enzymes act as catalytic agents, therefore, more than one reaction can take place with one molecule of the enzyme over a period of time.
- B. Materials - graph paper, transparencies of the following plots, and one of the three together for simultaneous viewing. (optional)

Continued on following page.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn





DISCUSSION:

A. Operational Suggestions

1. Student level - Average to above average ability
2. The student should use all three limiting factors presented in the computer program.
3. Students' graphs should be checked before proceeding with the follow-up question.
4. Students work in groups of 5 or less. Allow one group at a time at the computer while the remaining groups are engaged in a related activity. For Example: Food testing with hydrogen peroxide for catalase activity.

B. Suggested Follow-up

To maximize the value of this program, it is strongly suggested that the teacher:

1. Elicit from the students:  
What represents maximum and minimum reaction rate for pH, temperature, and enzyme concentration? (Use appropriate transparencies or chalkboard)
2. Ask the following questions, based on the plotted graphs, as lead-ins to discussion or as a homework assignment.
  - (a) At what point do most reactions take place with regard to pH, enzyme concentration, and temperature? (This and subsequent questions are intended to bring up the ideas of optimal pH, temperature, and enzyme concentration.)
  - (b) Why is death caused when pH rises or falls beyond a certain point in a system?
  - (c) Why does the concentration of enzymes reach a point and then no increase in reactions take place?
  - (d) What is normal body temperature? What relationship is there between reaction rate and body temperature? High fever? Freezing temperature? (Note: 40 deg. C. is 104 deg. F., which is higher than normal.)
  - (e) Suppose the pH of a system is 7, enzyme concentration is 90, and temperature is 0 degrees. What is the reaction rate? Why? \*
  - (f) Suppose the temperature is 37 deg. C., enzyme concentration is 30, and pH is 14. What is the reaction rate? Why? \*
  - (g) What is meant by limiting factors?

\* Student must examine all three graphs before reaching a conclusion.

RUN  
 RUN  
 NZYMC

THIS PROGRAM IS DESIGNED TO SHOW THAT ENZYME ACTION IS RELATED TO CERTAIN LIMITING FACTORS. THESE FACTORS INCLUDE PH, THE CONCENTRATION OF ENZYMES, AND TEMPERATURE. IN THIS PROGRAM WE ASSUME THAT TWO OF THE THREE FACTORS ARE CONSTANTS AND WILL CHANGE ONLY ONE AT A TIME. WE ALSO ASSUME THAT EACH FACTOR WORKS INDEPENDENTLY, ALTHOUGH THIS IS NOT TRUE IN NATURE.

YOU HAVE A CHOICE OF THE FOLLOWING LIMITING FACTORS:

1)PH                    2)CONCENTRATION OF ENZYMES                    3)TEMPERATURE

WHICH NUMBER DO YOU WISH ?1

\*\*\* PH \*\*\*

HOW REACTIVE AN ENZYME ARE YOU WORKING WITH? USE A VALUE OF FROM 1 (NOT VERY REACTIVE) TO 10 (VERY REACTIVE). ?7.5

| PH VALUE | REACTION RATE | 0  | 50 | 100 | 150 | 200 |
|----------|---------------|----|----|-----|-----|-----|
| 1        | 0             | I* |    |     |     |     |
| 2        | 11.25         | I* |    |     |     |     |
| 3        | 30            | I  | *  |     |     |     |
| 4        | 56.25         | I  | *  |     |     |     |
| 5        | 90            | I  |    | *   |     |     |
| 6        | 138.75        | I  |    |     | *   |     |
| 7        | 157.5         | I  |    |     |     | *   |
| 8        | 138.75        | I  |    |     | *   |     |
| 9        | 90            | I  |    | *   |     |     |
| 10       | 56.25         | I  | *  |     |     |     |
| 11       | 30            | I  | *  |     |     |     |
| 12       | 11.25         | I* |    |     |     |     |
| 13       | 3.75          | I* |    |     |     |     |
| 14       | 0             | I* |    |     |     |     |

DO YOU WISH ANOTHER RUN? IF YES, PRINT 1; IF NO, PRINT 0. ?1

YOU HAVE A CHOICE OF THE FOLLOWING LIMITING FACTORS:

1)PH                    2)CONCENTRATION OF ENZYMES                    3)TEMPERATURE

WHICH NUMBER DO YOU WISH ?2

\*\*\* CONCENTRATION OF ENZYMES \*\*\*

HERE WE MUST ASSUME THAT THE SUBSTRATE IS ALWAYS SUFFICIENT.

HOW REACTIVE AN ENZYME ARE YOU WORKING WITH? USE A VALUE OF FROM 1 (NOT VERY REACTIVE) TO 10 (VERY REACTIVE). ?7.5

| ENZYME CONC. | REACTION RATE | 0  | 50 | 100 | 150 | 200 |
|--------------|---------------|----|----|-----|-----|-----|
| 10           | 0             | I* |    |     |     |     |
| 20           | 33.75         | I  | *  |     |     |     |
| 30           | 67.5          | I  | *  |     |     |     |
| 40           | 101.25        | I  |    | *   |     |     |
| 50           | 135           | I  |    |     | *   |     |
| 60           | 157.5         | I  |    |     |     | *   |
| 70           | 157.5         | I  |    |     |     | *   |
| 80           | 157.5         | I  |    |     |     | *   |
| 90           | 157.5         | I  |    |     |     | *   |
| 100          | 157.5         | I  |    |     |     | *   |

DO YOU WISH ANOTHER RUN? IF YES, PRINT 1; IF NO, PRINT 0. ?1

YOU HAVE A CHOICE OF THE FOLLOWING LIMITING FACTORS:

1)PH                    2)CONCENTRATION OF ENZYMES                    3)TEMPERATURE

WHICH NUMBER DO YOU WISH ?3

\*\*\* TEMPERATURE \*\*\*

HOW REACTIVE AN ENZYME ARE YOU WORKING WITH? USE A VALUE OF FROM 1 (NOT VERY REACTIVE) TO 10 (VERY REACTIVE). ?7.5

| DEGREES C. | REACTION RATE | 0   | 50 | 100 | 150 | 200 |
|------------|---------------|-----|----|-----|-----|-----|
| 0          | 0             | I*  |    |     |     |     |
| 5          | 11.25         | I*  |    |     |     |     |
| 10         | 22.5          | I * |    |     |     |     |
| 15         | 41.25         | I   | *  |     |     |     |
| 20         | 63.75         | I   | *  |     |     |     |
| 25         | 86.25         | I   |    | *   |     |     |
| 30         | 112.5         | I   |    |     | *   |     |
| 35         | 146.25        | I   |    |     |     | *   |
| 40         | 127.5         | I   |    |     | *   |     |
| 45         | 37.5          | I   | *  |     |     |     |
| 50         | 0             | I*  |    |     |     |     |

DO YOU WISH ANOTHER RUN? IF YES, PRINT 1; IF NO, PRINT 0. ?0

STUDY THE GRAPHS AND TABLES, AND TRY TO FIGURE OUT WHAT'S HAPPENING HERE.

DONE

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b>                  | INTEGRATES EQUATIONS OF MOTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>DESCRIPTION:</b>            | This program integrates the equations of motion for an object moving under the influence of a force that varies as $\frac{1}{r^n}$ .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>INSTRUCTIONS:</b>           | <p>Initial conditions are put in the DATA statement in line 1410. The data is in the order in which it occurs:</p> <ul style="list-style-type: none"> <li>(a) Exponent N in the force law</li> <li>(b) Initial X position</li> <li>(c) Initial Y position</li> <li>(d) Initial X velocity</li> <li>(e) Initial Y velocity</li> <li>(f) Computing time increment</li> <li>(g) Time limit</li> </ul> <p>Typical values are shown in the listing. The program gives relative information only. It is intended to show the shapes of orbits.</p>                                                                                                                         |
| <b>SPECIAL CONSIDERATIONS:</b> | <p>FOR INSTRUCTIONAL PURPOSES</p> <p>Suitable Courses: Any Physics courses, high school level up.</p> <p>Student Background Required: The program can be used by high school physics students without becoming involved in the mathematical description. College physics students would probably be interested in the method used.</p> <p>The program should be used to teach students about two dimensional motion under various force laws. Certainly inverse square law (n=2) examples should be studied. Let the students experiment with other exponents.</p> <p>If a plotter is available, the program can be easily modified to produce a graphic output.</p> |
| <b>ACKNOWLEDGEMENTS:</b>       | Herbert D. Peckham<br>Gavilan Junior College                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

RUN

RUN  
ORBIT

|              |              |         |
|--------------|--------------|---------|
| 1            | 0            | 1       |
| .995004      | 9.98334E-02  | 1       |
| .980067      | .198669      | 1       |
| .955336      | .29552       | 1       |
| .921061      | .389418      | 1.      |
| .877583      | .479425      | 1.      |
| .825336      | .564642      | 1.      |
| .764842      | .644217      | 1.      |
| .696707      | .717356      | 1.      |
| .62161       | .783326      | 1.      |
| .540302      | .84147       | 1.      |
| .453596      | .891207      | .999999 |
| .362358      | .932038      | .999999 |
| .267499      | .963557      | .999999 |
| .169967      | .985449      | .999999 |
| .070737      | .997494      | .999999 |
| -2.91997E-02 | .999572      | .999999 |
| -.128845     | .991663      | .999999 |
| -.227202     | .973846      | .999998 |
| -.32329      | .946298      | .999998 |
| -.416147     | .909295      | .999998 |
| -.504846     | .863207      | .999998 |
| -.588501     | .808494      | .999998 |
| -.666276     | .745702      | .999998 |
| -.737394     | .67546       | .999998 |
| -.801143     | .598468      | .999997 |
| -.856888     | .515497      | .999997 |
| -.904071     | .427375      | .999997 |
| -.942221     | .334983      | .999997 |
| -.970956     | .239244      | .999997 |
| -.98999      | .141114      | .999997 |
| -.999132     | 4.15747E-02  | .999997 |
| -.998291     | -5.83803E-02 | .999997 |
| -.987476     | -.157752     | .999997 |
| -.966793     | -.255547     | .999997 |
| -.936451     | -.35079      | .999997 |
| -.896752     | -.442527     | .999997 |
| -.848093     | -.529842     | .999997 |
| -.790959     | -.611863     | .999997 |
| -.725923     | -.687771     | .999997 |
| -.653634     | -.756807     | .999997 |

DONE

**TITLE:** TEACHES STRAIGHT ALKANE NOMENCLATURE AND NAMING OF ORGANIC ALKANES ORG1  
36826

**DESCRIPTION:** There are 2 programs in this package: ORG1 and ORG2. ORG1 teaches a student how to recognize a hydrocarbon, find carbon to hydrogen ratio, and name straight chain alkanes of up to 20 carbons in length. ORG2 is a sequel to ORG1, and teaches a student how to name branched chain alkanes of up to 20 carbons. Should be followed by ISOMER (HP 36261) for practice drill.

**INSTRUCTIONS:** Program is inter-active. Just GET and RUN program.

**SPECIAL CONSIDERATIONS:** FOR INSTRUCTIONAL PURPOSES.  
Suitable Courses: Advanced or organic chemistry.  
Student Background Required: Knowledge of chemical symbols, pre-algebra.

**ACKNOWLEDGEMENTS:** Richard C. Adams  
Pleasant Hill High School

RUN

RUN  
ORG1

THIS IS A PROGRAM FOR TEACHING YOU HOW TO NAME ORGANIC CHEMICALS OF VARIOUS TYPES. NOW SINCE I'VE TOLD YOU WHAT THIS PROGRAM IS ABOUT, WHAT IS YOUR NAME?

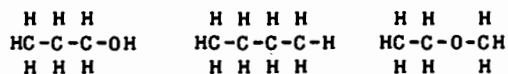
?RICHARD

HELLO, RICHARD. LET'S GET STARTED THEN.

CARBON COMPOUNDS MAKE UP QUITE A LARGE PART OF OUR WORLD. I (A COMPUTER) AM NOT MADE OF CARBON BUT YOU ARE, RICHARD. THE CHEMISTRY OF CARBON COMPOUNDS IS CALLED 'ORGANIC CHEMISTRY'. ONE FACET OF THIS LARGE AREA OF STUDY IS 'HYDROCARBONS.' HYDROCARBONS ARE CHEMICAL COMPOUNDS WHICH CONTAIN CARBON AND HYDROGEN ATOMS ONLY.

WHICH OF THE COMPOUNDS BELOW DO YOU THINK IS A HYDROCARBON? (USE THE NUMBER OF YOUR CHOICE)

1.                    2.                    3.



?1

NO THAT'S NOT CORRECT. TRY AGAIN. REMEMBER, HYDROCARBONS ARE CHEMICAL COMPOUNDS WHICH CONTAIN CARBON AND HYDROGEN ATOMS ONLY. WHICH OF THE COMPOUNDS BELOW DO YOU THINK IS A HYDROCARBON? (USE THE NUMBER OF YOUR CHOICE)

?2

THAT'S THE ONE. YOU SAW THE OTHER TWO HAD OXYGEN IN THEM. HOW MANY CARBONS ARE THERE IN #1, #2, & #3?4,4,4  
NO, THAT'S NOT RIGHT. YOU MISSED #1 #3 COUNT AGAIN!  
HOW MANY CARBONS ARE THERE IN #1, #2, & #3?4,4,3  
NO, THAT'S NOT RIGHT. YOU MISSED #1 COUNT AGAIN!  
HOW MANY CARBONS ARE THERE IN #1, #2, & #3?3,4,3  
THAT'S RIGHT. GOOD FOR YOU, RICHARD!

A CERTAIN CLASS OF HYDROCARBONS IS CALLED 'THE ALKANE FAMILY.' THEY ALL HAVE A CERTAIN RATIO OF CARBON TO HYDROGEN SUCH THAT IF THERE ARE 'N' CARBONS, THERE WILL BE 2N+2 HYDROGENS.

HOW MANY HYDROGENS WOULD AN ALKANE OF 1 CARBONS HAVE?6  
NO, THAT'S NOT RIGHT. TRY AGAIN. REMEMBER: HYDROGENS=2N+2  
HOW MANY HYDROGENS WOULD AN ALKANE OF 1 CARBONS HAVE?4  
THAT'S THE ANSWER. LET'S DO ANOTHER ONE. NOW  
HOW MANY HYDROGENS WOULD AN ALKANE OF 3 CARBONS HAVE?8  
THAT'S THE ANSWER. LET'S DO ANOTHER ONE. NOW  
HOW MANY HYDROGENS WOULD AN ALKANE OF 4 CARBONS HAVE?10  
THAT'S THE ANSWER. LET'S DO ANOTHER ONE. NOW  
HOW MANY HYDROGENS WOULD AN ALKANE OF 4 CARBONS HAVE?10  
THAT'S THE ANSWER.

NOW YOU SHOULD LEARN HOW TO NAME HYDROCARBONS. ALL THE ALKANES END IN '-ANE.' THE PREFIXES ARE AS FOLLOWS:

|                                      |         |
|--------------------------------------|---------|
| FOR ONE CARBON THE PREFIX IS 'METH-' |         |
| TWO                                  | 'ETH-'  |
| THREE                                | 'PROP-' |
| FOUR                                 | 'BUT-'  |
| FIVE                                 | 'PENT-' |
| SIX                                  | 'HEX-'  |

FOR EXAMPLE



IS ETHANE.

WHAT DO YOU THINK THIS COMPOUND IS:

```

  H H H H
HC-C-C-CH
  H H H H

```

1. PROPANE? 2. BUTANE? 3. PENTANE?  
 (TYPE NUMBER OF YOUR ANSWER)?3  
 PENTANE HAS FIVE CARBONS. TRY AGAIN.  
 (TYPE NUMBER OF YOUR ANSWER)?1  
 PROPANE HAS THREE CARBONS. COUNT AGAIN.  
 (TYPE NUMBER OF YOUR ANSWER)?2  
 RIGHT! BUTANE HAS FOUR CARBONS.

HERE ARE SOME MORE NAMES FOR NUMBERS OF CARBONS.  
 MOST OF THEM ARE GREEK SO THEY'RE A LITTLE WEIRD.

```

  7 HEPT  10 DEC   13 TRISKEDEC  16 HEXADEC
  8 OCT   11 UNDEC 14 TETRADEC  .....
  9 NON   12 DODEC 15 PENTADEC  20 EICOS

```

HOW MANY CARBONS DO YOU THINK THERE ARE IN  
 HEPTADECANE, OCTADECANE, AND NONADECANE? (USE COMMAS)?16,17,18

THAT'S NOT RIGHT. BUT HERE'S A CLUE\* 'OCTADECANE'  
 HAS 18 CARBONS. TRY AGAIN.

HOW MANY CARBONS DO YOU THINK THERE ARE IN  
 HEPTADECANE, OCTADECANE, AND NONADECANE? (USE COMMAS)?17,18,19  
 THAT'S RIGHT, RICHARD.

WHEN YOU'RE READY FOR THE  
 NEXT LESSON, TYPE 'GET-ORG2'.

DONE

GET-ORG2  
 RUN  
 ORG2

HELLO! OTIS HERE AGAIN. THIS IS THE SECOND PROGRAM IN  
 THE SERIES ON ORGANIC CHEMISTRY. IF YOU HAVEN'T DONE SO  
 ALREADY, GET-ORG1. BY THE WAY, WHO IS THIS?RICHARD  
 OH, IT'S YOU AGAIN, RICHARD. HAVEN'T GIVEN UP YET, I SEE.

ONE THING I DIDN'T TALK ABOUT LAST TIME IS 'WHAT IF ALL THE  
 CARBONS AREN'T IN A STRAIGHT LINE?' (I COULD TELL THAT  
 QUESTION WAS BOTHERING YOU, RICHARD).

COMPOUNDS WHICH HAVE THE SAME NUMBERS OF ELEMENTS  
 BUT IN A DIFFERENT ARRANGEMENT ARE CALLED 'ISOMERS'. FOR  
 EXAMPLE, HERE ARE THREE ISOMERS OF PENTANE:

```

      H           H
      HCH        HCH
    H H I H    H I H    H H H H H
    HC-C-C-CH  HC-C-CH  HC-C-C-C-CH
    H H H H    H I H    H H H H H
                  HCH
                  H

```

HOW MANY CARBONS DOES EACH ONE HAVE (ONE ANSWER)?3  
 COUNT AGAIN, RICHARD.  
 HOW MANY CARBONS DOES EACH ONE HAVE (ONE ANSWER)?  
 ??6

COUNT AGAIN, RICHARD.

HOW MANY CARBONS DOES EACH ONE HAVE (ONE ANSWER)?1  
 COUNT AGAIN, RICHARD.

WELL, YOU'VE HAD 3 TRIES. THERE ARE 5 IN EACH ONE.  
 NOW, HOW MANY HYDROGENS?13

COUNT AGAIN.

NOW, HOW MANY HYDROGENS?15

COUNT AGAIN.

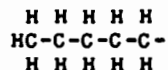
NOW, HOW MANY HYDROGENS?11

COUNT AGAIN.

GEE, RICHARD, THAT'S THE SECOND ONE IN A ROW YOU'VE MISSED.  
 THERE ARE 12 HYDROGENS IN EACH AND EVERY ONE.

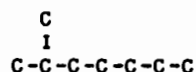


NOW, HOW DO WE NAME SUCH THINGS? FIRST OFF, H  
 A GROUP CONTAINING ONE CARBON IS CALLED A HC- H  
 'METHYL' GROUP. ONE WITH TWO CARBONS IS H  
 H H  
 HC-C- CALLED AN 'ETHYL GROUP. ONE WITH  
 H H THREE IS CALLED 'PROPYL' AND SO ON, USING THOSE  
 GREEK NAMES I SHOWED YOU IN 'ORG1'.  
 WHAT WOULD YOU CALL THIS GROUP?

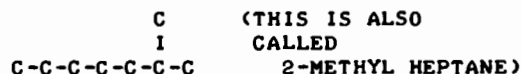


?PENTANE  
 THAT'S CLOSE BUT SIDE GROUPS END IN '-YL'. TRY AGAIN.  
 WHAT WOULD YOU CALL THIS GROUP?  
 ?PENTYL  
 RIGHT YOU ARE, RICHARD!

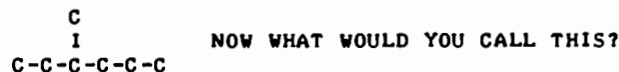
IN ORGANIC CHEMISTRY YOU HAVE TO NUMBER YOUR CARBONS IN  
 THE LONGEST, CONTINUOUS CHAIN AND THEN USE THOSE NUMBERS TO  
 TELL WHERE A SIDE GROUP IS. I'LL GIVE YOU AN EXAMPLE IN A  
 MOMENT BUT I'M GETTING TIRED OF TYPING ALL THOSE HYDROGENS  
 SO I'M GOING TO LEAVE THEM OFF FROM NOW ON. THE STRUCTURES  
 WILL BE EASIER TO SEE ANYWAY. FOR EXAMPLE:



IS CALLED 2-METHYL HEPTANE BECAUSE THERE ARE SEVEN  
 CARBONS ('HEPTANE') IN THE MAIN CHAIN AND THEN ON THE SECOND  
 CARBON ('2-') THERE IS A 'METHYL GROUP. .OK. WHICH  
 END DO YOU NUMBER FROM?---THE ONE WHICH GIVES YOU THE LOWEST  
 NUMBER FOR THE MOST COMPLICATED GROUP. CAUTION\*\*\*\*\*>>



(IT'S JUST THE SAME MOLECULE FROM THE OTHER SIDE)

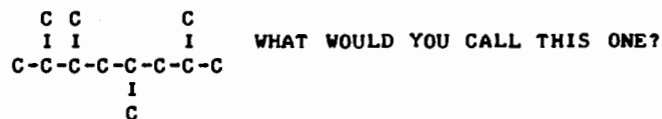
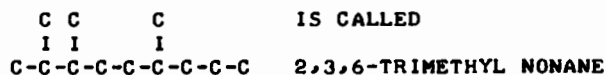


?4-METHYL HEXANE  
 YOU NUMBERED FROM THE WRONG END. COUNT AGAIN.  
 ?3-METHYLHEXANE  
 NO, THAT'S NOT IT. COUNT THE CARBONS IN THE MAIN CHAIN  
 AND THEN WHERE THE METHYL GROUP IS. NOW WHAT'S THAT  
 NAME AGAIN??3-METHYL HEXANE  
 THAT'S THE ANSWER. SAY, RICHARD, YOU'VE BEEN WATCHING!

SOMETIMES YOU CAN HAVE MORE THAN ONE OF A CERTAIN GROUP.  
 IF THAT HAPPENS, YOU HAVE TO TELL HOW MANY THERE ARE USING  
 SLIGHTLY DIFFERENT NOTATION:

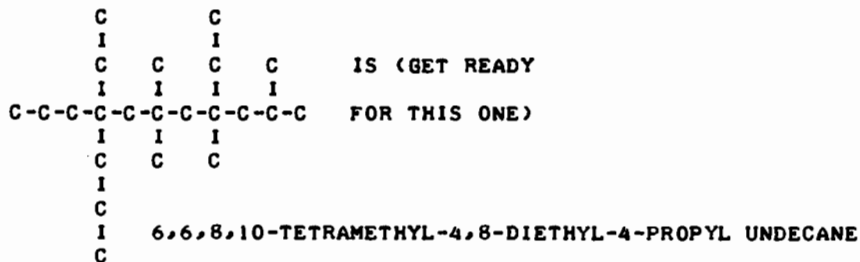
2 = DI-    4 = TETRA-    (SIX AND THE OTHERS  
 3 = TRI-    5 = PENTA-    ARE JUST LIKE YOUR  
                                 OTHER GREEK PREFIXES.)

FOR EXAMPLE:



72,3,5,7-OCTANE  
 YOU MADE SOME SORT OF ERROR. COUNT AGAIN. WHAT'S THE NAME?  
 72,3,5,7-METHYL OCTANE  
 YOU FORGOT TO TELL HOW MANY METHYLS. TRY AGAIN!  
 72,4,6,7-TETRAMETHYL OCTANE  
 YOU COUNTED FROM THE WRONG END. TRY AGAIN!  
 72,3,5,7-TETRAMETHYL OCTANE  
 YOU GOT IT RIGHT!!!!!! GOOD FOR YOU.

OF COURSE, YOU CAN HAVE OTHER GROUPS THAN 'METHYL'. IN NUMBERING, CARBON POSITIONS, YOU GIVE THE MOST COMPLICATED GROUP THE END WITH THE LOWEST NUMBER. IN NAMING, HOWEVER, YOU NAME THE SIMPLEST GROUP FIRST. FOR EXAMPLE:



HEY! YOU'VE BEEN AT THIS FOR 11 MINUTES, RICHARD. THAT'S LONG ENOUGH FOR ANYONE.

GOOD-BYE, RICHARD  
 OTIS

DONE



ORGCHE  
36646**TITLE:**

DRILL ON ORGANIC COMPOUND NOMENCLATURE

**DESCRIPTION:**

This program generates organic compounds of 10 different types, prints out representations of them, and names them.

**INSTRUCTIONS:**

The user may select one of the following options:

1. Drill on any of the following in random order.
2. Drill on alkanes.
3. Drill on alkenes.
4. Drill on alkynes.
5. Drill on alkylhalides.
6. Drill on alcohols.
7. Drill on ethers.
8. Drill on organic acids.
9. Drill on amines (secondary only).
10. Drill on ketones.
11. Drill on aldehydes.

He then chooses how many representations to be printed (maximum of 10).

The symbols +, - are used to represent single bonds, =, # to represent double bonds, \* to represent triple bonds. All hydrogen atoms have been omitted, except in hydroxyl radicals.

**SPECIAL  
CONSIDERATIONS:**

The longest carbon chain to be considered is of length 10., i.e., a decane, decene, etc.

Literature reference: Benfey, Otto Theodore. The Names and Structures of Organic Compounds. New York: John Wiley and Sons, Inc., 1966.

**FOR INSTRUCTIONAL PURPOSES**

Suitable Courses: Organic Chemistry

The program can be used for testing and for extra drill. The student may fold the output on the first starred line so the names of the compounds aren't visible. He then names the organic compounds, and compares his answers with the computer output.

**ACKNOWLEDGEMENTS:**

Phillip J. Short  
Burnsville Sr. High School

RUN

RUN  
ORGCHE

DRILL ON ORGANIC NOMENCLATURE

THE CODES ARE:

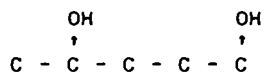
- 1) ALKANES
- 2) ALKENES
- 3) ALKYNES
- 4) HALOGEN SUBSTITUTIONS
- 5) ALCOHOLS
- 6) ETHERS
- 7) ORGANIC ACIDS
- 8) AMINES
- 9) KETONES
- 10) ALDEHYDES
- 0) ANY COMBINATION OF THE ABOVE

WHAT CODE : ?0

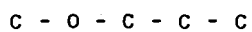
HOW MANY : ?10

1,- BOTH REPRESENT SINGLE BONDS, #,= BOTH REPRESENT DOUBLE BONDS, AND \* IS USED TO REPRESENT A TRIPLE BOND.

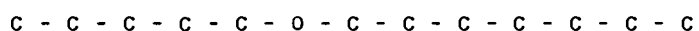
( 1 )



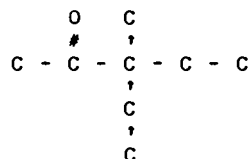
( 2 )



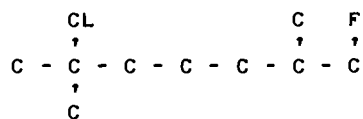
( 3 )



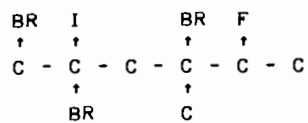
( 4 )



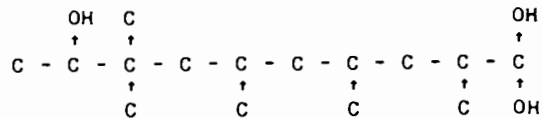
( 5 )



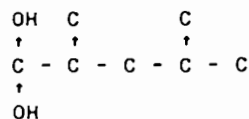
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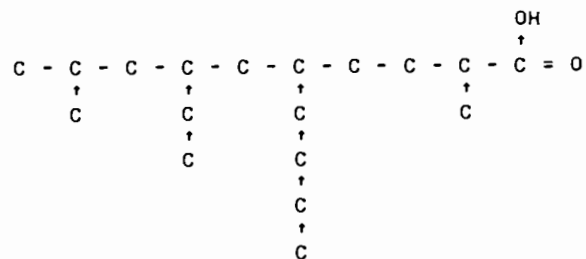
( 7 )



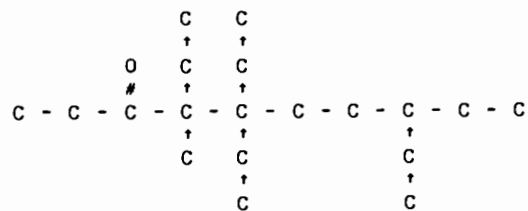
( 8 )



( 9 )



( 10 )



\*\*\*\*\*FOLD UNDER\*\*\*\*\*

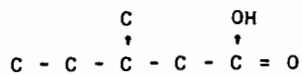
- ( 1 ) ) 1,4-PENTANEDIOL
- ( 2 ) ) METHYLPROPYL ETHER
- ( 3 ) ) PENTYLHEPTYL ETHER
- ( 4 ) ) 3-METHYL-3-ETHYL-2-PENTANONE
- ( 5 ) ) 6-CHLORO-1-FLUORO-2,6-DIMETHYLHEPTANE
- ( 6 ) ) 1,2,4-TRIBROMO-5-FLUORO-2-iodo-4-METHYLHEXANE



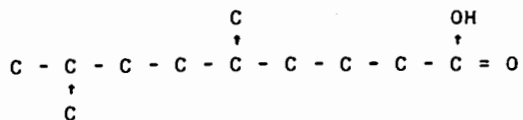




( 9 )



( 10 )



\*\*\*\*\*FOLD UNDER\*\*\*\*\*

- ( 1 )    )    2,2-DIMETHYLBUTANOIC ACID
- ( 2 )    )    8-METHYL-4-PROPYLNONANOIC ACID
- ( 3 )    )    4,9-DIMETHYL-5,8-DIETHYL-5-BUTYLDECANOIC ACID
- ( 4 )    )    6-ETHYLDECANOIC ACID
- ( 5 )    )    2,7,8-TRIMETHYL-4,6-DIPROPYL-5-BUTYLNONANOIC ACID
- ( 6 )    )    3-METHYLBUTANOIC ACID
- ( 7 )    )    2-METHYLNONANOIC ACID
- ( 8 )    )    6-METHYLNONANOIC ACID
- ( 9 )    )    3-METHYLPENTANOIC ACID
- ( 10 )    )    5,8-DIMETHYLNONANOIC ACID

\*\*\*\*\*

DONE

PZHYP  
36759**TITLE:**

SCIENTIFIC METHOD AND HYPOTHESIS

**DESCRIPTION:**

This is a PILOT language program concerning the scientific method and its relation to hypothesis and observation.

**INSTRUCTIONS:**

This program is stored in 2 files named P-HYP1 and P-HYP2 for use on the HP 2000E System; and is stored in 1 file named P-HYP for use on the HP 2000 Series System.

Execute as with any PILOT language program. The scratch file should be at least 2 records.

See PILOTE (HP 36637) to use this program on the HP 2000E System.

See PILOTF (HP 36756) to use this program on the HP 2000 Series System.

1. Example: (2000E version)
  - OPE-SCR,2
  - GET-PILOT
  - 1 FILES P-HYP1, P-HYP2, SCR
  - RUN
  - NUMBER PROGRAM FILES ?2
2. Example: (2000F version)
  - CRE-SCR,2
  - GET-PILOTF
  - RUN
  - NAME OF PILOT PROGRAM ? PZHYP
  - NAME OF SCRATCH FILE ? SCR
  - ?RUN

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES  
Suitable Course(s): Introductory Science Courses

Student Background Required: None

This program leads the student through an example in observation and hypothesis formation. It was designed for any introductory science course where this concept is discussed.

**ACKNOWLEDGEMENTS:**

Lawrence E. Turner, Jr.  
Pacific Union College

LISTING

1 Files PZHYP1,PZHYP2,SCR
RUN
PILOT

NUMBER PROGRAM FILES ?2

PILOT

HI THERE! THIS IS A TUTORIAL LESSON TO TEACH YOU SOMETHING ABOUT
SCIENTIFIC METHOD.

WHAT IS YOUR NAME ?PETE
VERY NICE! AND WHAT IS YOUR MAJOR ?SPANISH
WELL, I DON'T RECOGNIZE THAT AS A SCIENCE MAJOR, BUT I HOPE THAT THIS
SESSION WILL BE INTERESTING AND EDUCATIONAL.

AS WE PROCEED THROUGH THIS MATERIAL, I WILL ASK YOU QUESTIONS, PLEASE
RESPOND NATURALLY AND DON'T WORRY IF YOU DON'T KNOW THE ANSWER OR EVEN
UNDERSTAND THE QUESTION. YOU WILL NOT BE GRADED BUT RATHER WILL BE LED
THROUGH THE MATERIAL IN A PLEASANT (HOPEFULLY) MANNER SUCH THAT YOU
WILL HAVE LEARNED SOMETHING BY TIME WE ARE FINISHED.

FIRST PETE, WHAT IS THE MOST BASIC AND IMPORTANT PROCESS IN SCIENTIFIC
INQUIRY ?A PREMISE

NOT QUITE, ALL SCIENTIFIC INQUIRY AND LEARNING BEGINS WITH OBSERVING
THE NATURAL WORLD. OBSERVATION AND EXPERIMENTATION ARE ABSOLUTELY
FUNDAMENTAL.

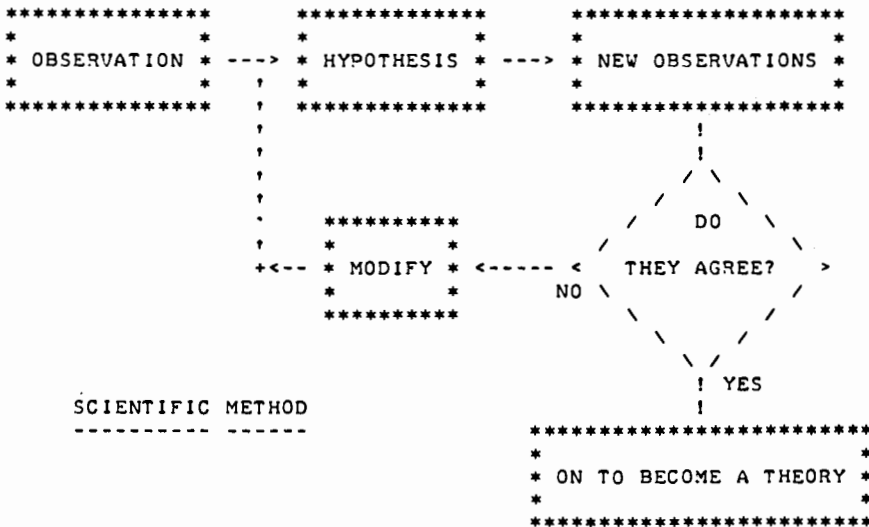
ONCE A CERTAIN SET OF OBSERVATIONS ARE MADE, WHAT IS THE NEXT STEP IN
THE PROCESS ?INTERPRET THEM

WELL, ONE TRIES TO FORM A HYPOTHESIS OR MODEL FOR THE PHENOMENON.
USUSALLY THIS IS IN TERMS WITH WHICH ONE IS FAMILIAR (ANALOGY) OR IT
MAY BE A MATHEMATICAL EXPRESSION OR ONE OF SEVERAL DIFFERENT FORMS
RANGING IN COMPLEXITY FROM EXTREMELY SIMPLE TO QUITE INVOLVED. IN ANY
CASE THE HYPOTHESIS MUST EXPLAIN THE OBSERVATIONS. IT IS AN EDUCATED
GUESS.

IN ADDITION, A GOOD HYPOTHESIS MUST PROVIDE SOMETHING ELSE. WHAT IS
THIS ?BE CONSISTENT

NO, A GOOD HYPOTHESIS DOES PROVIDE FOR FURTHER PREDICTION. ONE THEN
ATTEMPTS TO OBSERVE THIS TO TEST THE HYPOTHESIS. IF THE HYPOTHESIS IS
INCORRECT IT MUST BE MODIFIED TO SATISFACTORY EXPLAIN THE NEW DATA.

LET ME PUT IT GRAPHICALLY:



SCIENTIFIC METHOD
-----

OK, WHAT PURPOSE DOES 'MODIFY' SERVE ?CHANGE THE HYPOTHESIS
RIGHT, THE HYPOTHESIS MUST ACCURATELY ACCOUNT FOR ALL THE OBSERVATIONS
(INCLUDING THE NEW ONES!), SO IT MUST BE CORRECTED. IF IT IS SO
INCOMPLETE THAT IT MUST BE DISCARDED AND A NEW ONE TRIED, THEN SO BE

IT! ONE SHOULD NOT HANG ONTO OBSOLETE CONCEPTS JUST BECAUSE THEY ARE THERE!

IF AFTER REPEATED TESTING, THE HYPOTHESIS CORRECTLY PREDICTS ALL NEW OBSERVATIONS, IT BECOMES A THEORY. AND IF A THEORY IS OF SUFFICIENT GENERALITY AND DESCRIBES THE NATURAL PHENOMENA ACCURATELY, IT MAY BE ELEVATED TO WHAT STATUS ?I DON'T KNOW WELL, IT MAY BECOME A SCIENTIFIC LAW! BOTH SCIENTIFIC THEORIES AND LAWS MUST HAVE OTHER QUALITIES SUCH AS: GENERALITY, SIMPLICITY, AND BEAUTY. THESE QUALITIES ARE SOMETIMES DIFFICULT TO DEFINE PRECISELY. WE ARE MORE CONCERNED HERE WITH THE INTERACTION BETWEEN OBSERVATION AND HYPOTHESIS, SO SUCH CONSIDERATIONS NEED NOT WORRY YOU!

AS A SIMPLE EXAMPLE, LET US CONSIDER A SEQUENCE OF LETTERS AS OUR INITIAL OBSERVATION. NAMELY:

T T F F S S E

WE SUSPECT THAT THESE ARE PART OF A MORE GENERAL PATTERN. THE FIRST STEP IS TO DESCRIBE THE OBSERVATIONS. HOW WOULD YOU DESCRIBE THEM??

?2,2,2,1 PATTERN

OK, A VERY SIMPLE WAY (AT LEAST FOR A SMALL SET OF DATA!) IS TO PUT IT IN A TABLE.

| NUMBER | DATUM |
|--------|-------|
| 1      | T     |
| 2      | T     |
| 3      | F     |
| 4      | F     |
| 5      | S     |
| 6      | S     |
| 7      | E     |

THIS IS A TYPE OF HYPOTHESIS. ANOTHER SIMILAR WAY OF DESCRIBING THE OBSERVATIONS THAT IS ALSO A HYPOTHESIS IS:

THE SEQUENCE IS FORMED FROM PAIRS OF LETTERS MADE UP OF 'T', 'F', 'S' IN ORDER, AND IS ENDED WITH A SINGLE 'E'.

WHAT BAD FEATURE DO THESE TWO HYPOTHESES HAVE??

?NO EXPLANATION OR PREDICTION

VERY GOOD PETE! THEY DESCRIBE THE OBSERVATIONS VERY WELL, BUT THERE IS NO PROVISION FOR PREDICTING ANY NEW OBSERVATIONS. SUCH A HYPOTHESIS IS TERMED 'AD HOC'. THIS IS A LATIN TERM MEANING 'FOR THIS CASE ONLY'. THERE IS NO WAY TO TEST THIS TYPE OF HYPOTHESIS.

LET'S TRY AND PREDICT THE NEXT LETTER IN THE SEQUENCE!

T T F F S S E .

WHAT LETTER DO YOU THINK REPLACES THE PERIOD ?E THAT IS MOST LOGICAL. THE SEQUENCE WOULD THEN LOOK:

T T F F S S E 'E'

CAREFULLY STATE IN WORDS THE HYPOTHESIS THAT LEADS TO THIS PREDICTION. (KEEP IT TO ONE LINE OR LESS, SORRY!)

?SEQUENCE IS DOUBLE LETTERS BEGIN WITH T AND F, GO FORWARD IN ALPHABET

REMEMBER THAT THE FINAL 'E' IS ONLY A PREDICTION, IT HAS NOT YET BEEN OBSERVED. NOW PETE, WHAT IS THE NEXT STEP IN THE INQUIRY PROCESS??

?TEST IT

OK, LET'S GO AND TRY TO OBSERVE THE NEXT LETTER! AFTER MUCH EXPERIMENTATION WE FIND:

T T F F S S E N

WHOOPS, NATURE IS NOT ALWAYS EASY TO PIN DOWN! THE NEW DATUM DOES NOT AGREE WITH YOUR PREDICTION. THUS WE MUST MODIFY THE HYPOTHESIS.

>> I MUST ASSURE YOU THAT THE SEQUENCE OF LETTERS DOES <<  
>> FOLLOW A DEFINITE PATTERN. THEY ARE NOT JUST ANY <<  
>> RANDOM CHOICES!! I BELIEVE IN BEING ORDERLY! <<

WE COULD STILL SIMPLY FORM AN AD HOC HYPOTHESIS, BUT WE ARE INTERESTED IN DETERMINING THE BIG PICTURE. WE WANT TO BE ABLE TO PREDICT THE NEXT LETTER(S)!

FROM THIS POINT IT GETS MUCH MORE DIFFICULT. MANY PEOPLE ARE STUMPED HERE. HOWEVER, PETE SINCE YOU ARE A SPANISH MAJOR, I AM CONFIDENT THAT YOU WILL PERCEIVE THE PATTERN AND DEDUCE THE NEXT LETTER!

T T F F S S E N .

WELL, WHAT IS THE NEXT LETTER ?DON'T KM-NOW  
OK, WHAT IS YOUR HYPOTHESIS??  
?LOST IT

I DON'T QUITE BUY YOUR HYPOTHESIS; HOWEVER, A MOST LOGICAL DEDUCTION WOULD BE A 'T'. THE HYPOTHESIS IS THEN:

THE SEQUENCE OF LETTERS IS FORMED BY THE FIRST LETTER OF THE NAME OF THE INTEGERS (IN ENGLISH!), STARTING WITH TWO.

THUS THE SEQUENCE WOULD BE:

T T F F S S E N 'T'

WITH THE 'T' COMING FROM 'TEN'. AGAIN, WHAT MUST WE DO NEXT??  
?TEST IT  
THAT'S RIGHT PETE! LET'S TRY AND OBSERVE THE NEXT LETTER, AND IT IS:  
'Z'!!! THUS WE HAVE:

T T F F S S E N Z .

DON'T BE TOO DISCOURAGED. ACTUALLY, YOU NEED ONLY TO MODIFY YOUR HYPOTHESIS A SMALL AMOUNT. IT IS BASICALLY CORRECT!

LET ME ENCOURAGE YOUR BASIC HYPOTHESIS. IF THE SEQUENCE IS RELATED TO THE INTEGERS, THEN IT SHOULD ALSO PREDICT A CHARACTER PRECEEDING THE FIRST 'T'. WHAT SHOULD IT BE ?  
THAT IS VERY GOOD PETE! WE SHOULD FIND AN 'O' WHICH COMES FROM 'ONE' PRECEEDING THE 'T' FROM 'TWO'. INDEED, IF YOU LOOK IN THE RIGHT PLACE, YOU DO OBSERVE:

O T T F F S S E N Z .

THUS, YOUR BASIC HYPOTHESIS THAT THESE LETTERS ARE RELATED TO THE ENGLISH NAMES OF THE INTEGERS IS STRENGTHENED, AT LEAST FOR THE FIRST NINE! HOWEVER, IT MUST ALSO EXPLAIN WHY 'TEN' BECOMES A 'Z'. NOW, HOW IS THE NUMBER TEN DIFFERENT FROM: ONE, TWO, THREE, . . . , AND NINE??  
?2 DIGITS  
OF COURSE! 'TEN' HAS TWO DIGITS INSTEAD OF JUST ONE:

10 --> ONE ZERO

NOW, PETE, DO YOU SEE WHERE THE 'Z' COMES FROM? WHAT HYPOTHESIS EXPLAINS THIS??

?FIRST Z INDICATES FIRST 2-DIGIT NUMBER WITH 1 ZERO

AND WHAT LETTER IS NEXT (REPLACING THE PERIOD) ?E  
I DON'T THINK THAT FOLLOWS FROM THE HYPOTHESIS. 'ELEVEN' IS THE NEXT NUMBER IN THE SEQUENCE:

11 --> ONE ONE! SO WE SHOULD GET AN 'O'!!!

O T T F F S S E N Z 'O'

AND SURE ENOUGH, 'O' IS THE NEXT LETTER, AND NATURE IN A RARE MOMENT OF GENEROSITY EASILY REVEALS THAT THE ONE AFTER THAT IS A 'T'! SO:

. . . O T T F F S S E N Z O T . . .

THUS OUR HYPOTHESIS IS CONFIRMED WITH NO FURTHER MODIFICATION.

THE SEQUENCE IS FORMED FROM THE ENGLISH NAMES OF THE INTEGERS. IN EACH CASE THE CHARACTER IS THE FIRST LETTER OF THE DIGIT IN THE UNIT'S PLACE.

COULD YOU NOW STATE THAT THE HYPOTHESIS IS A THEORY ?YES  
 NO, NO, NO!! IT IS STILL A LONG WAY FROM BECOMING A THEORY. IT MAY  
 FAIL ON THE 13-TH CHARACTER (MAYBE THE CHARACTER IS REALLY A 'L' FOR  
 'BAD LUCK!'). WE WOULD HOPE THAT NATURE ISN'T THAT CAPRICIOUS AND IS  
 REALLY SIMPLE AND LOGICAL WITH VERY FEW EXCEPTIONS!

BY THE WAY, WE HAVE DEVELOPED SEVERAL DIFFERENT HYPOTHESES. ON OUR  
 ORIGINAL SET OF DATA,

T T F F S S E

ARE ANY OF THESE HYPOTHESES INCORRECT (CONSIDERING ONLY THIS SMALL SET  
 OF DATA) ?NO  
 OF COURSE, THEY ARE ALL CORRECT. THEY ALL EXPLAIN THIS ORIGINAL SET OF  
 OBSERVATIONS PRECISELY! HOWEVER, SOME ARE 'BAD', AND NOT BECAUSE THEY  
 ARE INCORRECT ABOUT THE SUBSEQUENT DATA, BUT BECAUSE THEY LACK WHAT  
 QUALITY??

?CORRECT PREDICTIONS

RIGHT! AT LEAST TWO OF OUR HYPOTHESES (THE TABLE AND THE ORIGINAL  
 VERBAL DESCRIPTION) FAILED TO MAKE ANY PREDICTION ABOUT ANY POSSIBLE  
 NEW OBSERVATIONS. THE OTHERS MAY BE INCOMPLETE, BUT THEY WERE NOT  
 'BAD' IN THIS SENSE! THEY AT LEAST PREDICTED SOMETHING SO THEY COULD  
 BE TESTED. THEY MAY HAVE BEEN WRONG, BUT THEY WERE GOOD IN THAT THEY  
 LED TO SOME FURTHER THOUGHT AND INVESTIGATION. WHAT DO WE CALL A  
 HYPOTHESIS THAT FAILS TO PREDICT ANYTHING NEW ?DON'T KNOW  
 SORRY, THE TERM IS 'AD HOC'. SUCH HYPOTHESES CANNOT BE TESTED AGAINST  
 FURTHER OBSERVATIONS. THEY ARE A 'DEAD END'!!

I WISH TO MAKE ONE LAST POINT: NOTE THAT FOR A LIMITED SET OF DATA  
 THERE WERE SEVERAL DIFFERENT (AND PERHAPS PHILOSOPHICALLY CONFLICTING  
 HYPOTHESES) THAT PERFECTLY EXPLAINED THE KNOWN OBSERVATIONS. THIS IS  
 NOT A UNIQUE SITUATION! IN THIS CASE ONE USUALLY SELECTS THE ONE THAT  
 BEST AGREES WITH HIS PHILOSOPHICAL OUTLOOK UNTIL FURTHER OBSERVATIONS  
 SELECTS THE PROPER ONE.

DO YOU THINK THIS IS INTELLECTUALLY HONEST ?YES

I HOPE THAT YOU ENJOYED THIS EXERCISE, PETE! AND I WISH YOU SUCCESS IN  
 PURSUING YOUR SPANISH MAJOR.

END

TRY AGAIN ?NO

DONE



**TITLE:** KEPLER'S THIRD LAW

**DESCRIPTION:** This program is a PILOT language program designed to give the beginning Astronomy student help in understanding Kepler's third law and to help him with the arithmetic involved in computing periods and semimajor axes.

**INSTRUCTIONS:**

2000E: The program is stored on three files: P-KEP1, P-KEP2, and P-KEP3. The scratch file should be at least 4 records in length.

2000 Series: The program is stored on the file: PZKEPL. The scratch file

See PILOTE (HP 36637) to use this program on the HP 2000E system.

See PILOTF (HP 36756) to use this program on the HP 2000F system.

**SPECIAL CONSIDERATIONS:**

The program takes files of length: (HP 2000E) P-KEP1,48; P-KEP2,48; P-KEP3,32.

(HP 2000F) P-KEPL,58

FOR INSTRUCTIONAL PURPOSES  
Suitable Course(s): Introductory Astronomy.

Student Background Required: None.

There are two applications for this program. The first is a tutorial session for beginning Astronomy students in Kepler's laws with the main emphasis on the third law. All the terms necessary in understanding and using Kepler's third law are discussed. If a student answers certain questions correctly, he proceeds through the program faster than if he has trouble. At the end is a "miniprogram" to calculate the periods and semimajor axes from any values he wishes to try. The computer does the messy arithmetic for him.

The second use is for students who understand Kepler's laws and only wish to use the computer to calculate their own values. They can proceed directly to the "miniprogram" at the end, skipping the tutorial portion.

**ACKNOWLEDGEMENTS:** Lawrence E. Turner, Jr.  
Pacific Union College



GET-PILOTF  
RUN  
PILOTF

NAME OF PILOT PROGRAM ?P-KEPL  
NAME OF SCRATCH FILE ?SCR

?RUN

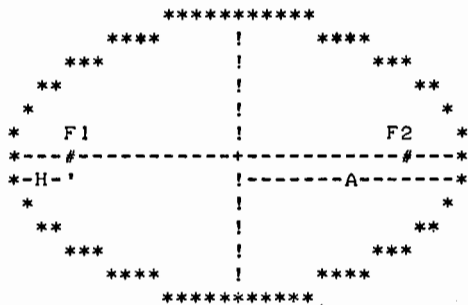
PILOT

KEPLER'S THREE LAWS ARE VERY IMPORTANT IN UNDERSTANDING THE ORBITS OF THE PLANETS, COMETS, OR ANY SATELLITE. THEY MAY BE DERIVED FROM NEWTON'S LAWS AND HIS FORM OF THE GRAVITATIONAL FORCE; HOWEVER, THEY ARE A NICE SUMMARY OF THE MOTION OF THE PLANETS.

HAVE YOU STUDIED KEPLER'S LAWS BEFORE ?NO  
WELL, THEN IT IS A GOOD IDEA TO START WITH THE FIRST TWO, SINCE WE WILL NEED THE CONCEPTS DEVELOPED WITH THOSE.

BEFORE WE GO TO FAR, I WOULD LIKE YOUR NAME ?PETE  
THANK YOU! I THINK A NAME IS MUCH MORE FRIENDLY THAN A RATHER IMPERSONAL PRONOUN!

FIRST PETE, KEPLER'S FIRST LAW DESCRIBES THE SHAPE OF THE ORBIT OF A PLANET OR SATELLITE. WHAT IS THE SHAPE OF AN ORBIT ?ELLIPTICAL  
THAT IS, OF COURSE, ABSOLUTELY CORRECT PETE! BEFORE WE STATE KEPLER'S FIRST LAW IN ALL OF ITS GLORY LET'S CONSIDER AN ELLIPSE AND DEFINE SOME TERMS.



OK, PETE, WHAT IS THE DISTANCE 'A' CALLED ?RADIUS  
WELL, I WILL TELL YOU. THAT IS THE SEMIMAJOR AXIS OF THE ELLIPSE.  
AND WHAT IS TWICE THE SEMIMAJOR AXIS CALLED (THE DISTANCE FROM ONE END OF THE ELLIPSE TO THE OTHER) ?MAJOR AXIS  
GOOD!  
WHAT ARE THE POINTS 'F1' AND 'F2' CALLED ?FOCUS  
VERY GOOD. THEY ARE THE FOCI OF THE ELLIPSE (SINGULAR IS 'FOCUS').

KEPLER'S FIRST LAW STATES:

'EACH PLANET MOVES ABOUT THE SUN IN AN ORBIT THAT IS AN ELLIPSE, WITH THE SUN AT THE FOCUS OF THE ELLIPSE.'

NOW IF WE REPLACE THE FOCUS 'F1' WITH THE SUN, WHAT IS THE DISTANCE 'H' CALLED ?K  
NOT EXACTLY, THAT IS THE PERIHELION DISTANCE, OR THE DISTANCE OF CLOSEST APPROACH OF THE PLANET TO THE SUN.  
WE WILL NOT EXPLICITLY NEED KEPLER'S SECOND LAW FOR THIS EXERCISE; HOWEVER, FOR THE SAKE OF COMPLETENESS, LET US STATE IT:

'THE STRAIGHT LINE JOINING A PLANET AND THE SUN SWEEPS OUT EQUAL AREAS IN SPACE IN EQUAL INTERVALS OF TIME.'

THIS BASICALLY TELLS HOW THE PLANET MOVES AROUND ITS ORBIT. WHEN IT IS CLOSE TO THE SUN IT MOVES FASTER THEN WHEN IT IS FURTHER AWAY.

WE ARE NOW READY TO DISCUSS KEPLER'S THIRD LAW. IT GIVES A SIMPLE RELATIONSHIP BETWEEN THE SEMIMAJOR AXIS AND THE PERIOD OF THE PLANETARY ORBIT.

WHAT IS THE PERIOD OF AN ORBIT ? CYCLE  
NOT EXACTLY, IT IS JUST THE TIME IT TAKES FOR THE PLANET TO COMPLETE ONE REVOLUTION AROUND THE SUN.

IN WORDS WE CAN STATE KEPLER'S THIRD LAW:

'THE SQUARES OF THE PERIODS OF THE PLANETS ARE IN DIRECT PROPORTION TO THE CUBES OF THE SEMIMAJOR AXES OF THEIR ORBITS.'

IN AN ALGEBRAIC EQUATION THIS BECOMES:

$$P^2 = K \cdot A^3$$

WHERE '^' MEANS 'RAISE TO A POWER' AND '\*' MEANS MULTIPLY. 'P' IS THE PERIOD, 'A' IS THE SEMIMAJOR AXIS, AND 'K' IS A CONSTANT AND DEPENDS ON THE UNITS USED.

WE CAN SOLVE THIS EQUATION FOR EITHER 'P' OR 'A' IN TERMS OF THE OTHER. BUT FIRST WE NEED TO KNOW 'K'. TO DETERMINE THIS, LET US USE QUANTITIES THAT WE KNOW ABOUT THE EARTH'S ORBIT.

WHAT IS THE PERIOD OF THE EARTH'S ORBIT ? 365 DAYS

VERY FINE PETE! THE PERIOD OF THE EARTH'S ORBIT IS 365 DAYS (ACTUALLY 365.2564 DAYS) OR ONE YEAR!

THE SEMIMAJOR AXIS OF THE EARTH'S ORBIT IS THE SAME AS THE MEAN DISTANCE FROM THE EARTH TO THE SUN WHICH IN TURN IS APPROXIMATELY THE RADIUS OF THE ORBIT.

OK, WHAT IS THE MEAN DISTANCE FROM THE EARTH TO THE SUN??

? 100 MILLION MILES

YOU ARE WITH IT TODAY PETE! THE MEAN DISTANCE (OR THE SEMIMAJOR AXIS) OF THE EARTH TO THE SUN IS 93 MILLION MILES, 150 MILLION KILOMETERS, 1.5E11 METERS, 1.5E13 CENTIMETERS, OR SIMPLY 1 AU (ASTRONOMICAL UNIT)!

(THE 'E' IN NUMBERS INDICATE A POWER OF TEN.)

IN TERMS OF THE UNITS 'YEARS' AND 'ASTRONOMICAL UNITS', THE VALUE OF 'K' IS ESPECIALLY SIMPLE. WHAT DO YOU SUPPOSE IT IS ?

•  
•  
•



**TITLE:**

PHOSYN: Photosynthesis Experiment

**DESCRIPTION:**

This program investigates changes in the rate of photosynthesis when carbon dioxide concentration and light intensity are varied.

OBJECTIVES:

- A. To permit the student to see the effects of varying two of the factors of the photosynthetic reaction.
- B. To reinforce the concept of the fundamental importance of the process of photosynthesis.
- C. To lead the student to develop ideas for increasing a plant's food output by manipulating factors involved in photosynthesis.
- D. To learn or practice graphing.
- E. To learn the concept of controlled experimentation.
- F. Analysis and interpretation of data.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - An understanding of the photosynthetic process.
- B. Materials - graph paper

DISCUSSION:

- A. Operational Suggestions
  1. Student level - average
  2. Pitfalls to avoid -
    - a. If the student is not familiar with decimals, allow him to use integers for graphing
    - b. The computer levels off at a light intensity of 12. If a student selects all of his light intensity values above 11, a straight line of asterisks will appear on the graph.
    - c. Remind students that the computer plotted graph is to be viewed sideways. (see run)
  3. Students work in groups of 5 or less. Allow one group at a time at the computer while the remaining groups are engaged in a related activity.

Continued on following page.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

DISCUSSION continued

B. Suggested Follow-up

The students, after running the program, are expected to graph the results obtained from varying the carbon dioxide concentration.

Elicit from the student:

1. What happens to the rate of photosynthesis as:
  - a. The carbon dioxide concentration increases?
  - b. The intensity of the light increases?
2. How might you increase the size of tomatoes grown in a greenhouse? What, if any, limitations are there to this type of increase?
3. What is apt to happen to the world's food supply if the amount of carbon dioxide or the light intensity was reduced by one-half?
4. Compare your graph with the graph made on the computer. Point out similarities and differences. Explain them.

RUN

RUN  
PHOSYN

HELLO. BY NOW YOU SHOULD KNOW FROM YOUR LECTURES WHAT PHOTOSYNTHESIS IS. THIS LABORATORY WILL ENABLE YOU TO CONDUCT EXPERIMENTS ON THE COMPUTER WHICH WOULD NOT BE PRACTICAL DURING CLASS TIME.

SINCE ALL OF OUR FOOD COMES FROM PLANTS, LET'S FIND OUT HOW CHANGING THE AMOUNT OF CARBON DIOXIDE OR THE INTENSITY OF LIGHT WILL AFFECT THE PLANT'S RATE OF PHOTOSYNTHESIS, MEASURED IN MICROGRAMS OF GLUCOSE PRODUCED PER DAY.

LET'S BEGIN WITH CHANGING THE LIGHT INTENSITY. YOU WILL VARY THIS BY SELECTING INTEGER VALUES IN THE RANGE OF 0 TO 30 (THE UNITS FOR LIGHT INTENSITY ARE IN ERGS/SEC/SQ.CM) BY VARYING ONLY ONE FACTOR AT A TIME, WE ARE CONDUCTING A CONTROLLED EXPERIMENT. WE WILL ASSUME THAT OUR PLANT HAS ALL OF THE CARBON DIOXIDE, WATER AND CHLOROPHYLL THAT IT NEEDS.

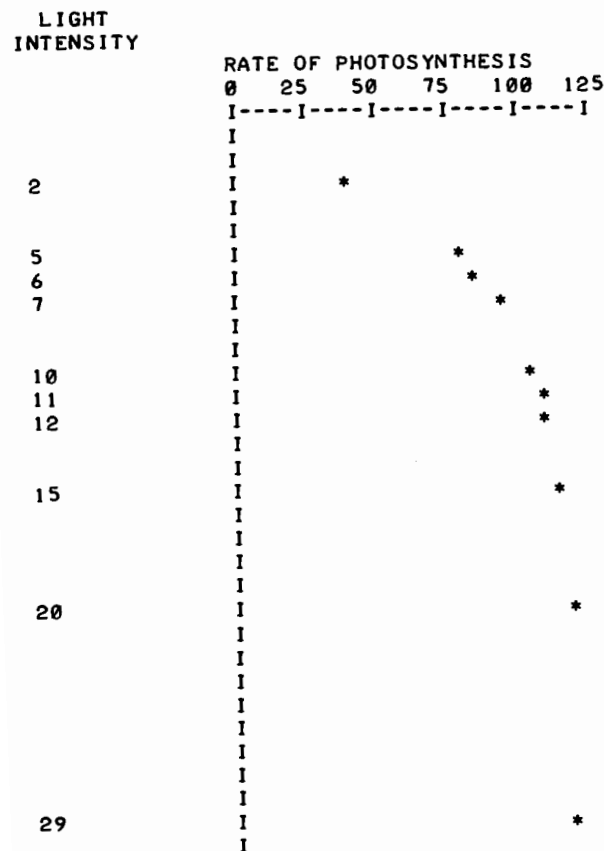
YOU SHOULD CHOOSE BETWEEN FIVE AND TEN LIGHT INTENSITY VALUES. TYPE IN ONLY ONE VALUE AFTER EACH QUESTION MARK. BY TYPING IN 100, NO MORE QUESTION MARKS WILL APPEAR AND THE PROGRAM WILL CONTINUE.  
(NOTE: 'RP' MEANS RATE OF PHOTOSYNTHESIS)

LIGHT INTENSITY(LI)?2

RP= 45  
(LI)?15  
RP= 121  
(LI)?7  
RP= 99  
(LI)?29  
RP= 125  
(LI)?20  
RP= 124  
(LI)?4-5  
RP= 84  
(LI)?6  
RP= 92  
(LI)?11  
RP= 114  
(LI)?12  
RP= 116  
(LI)?10  
RP= 111

1 = TABLE ONLY, 2 = PLOT ONLY, 3 = BOTH?3

| LIGHT INTENSITY | RATE OF PHOTOSYNTHESIS |
|-----------------|------------------------|
| 2               | 44.81                  |
| 5               | 83.8                   |
| 6               | 92                     |
| 7               | 98.57                  |
| 10              | 111.42                 |
| 11              | 114.12                 |
| 12              | 116.29                 |
| 15              | 120.52                 |
| 20              | 123.52                 |
| 29              | 124.8                  |



O.K. LET'S NOW VARY THE AMOUNT OF CARBON DIOXIDE IN THE ATMOSPHERE SURROUNDING OUR PLANT.

THIS TIME ASSUME OUR PLANT HAS ALL THE LIGHT, WATER AND CHLOROPHYLL THAT IT NEEDS.

LET THE VALUES YOU SELECT FOR THE CARBON DIOXIDE CONCENTRATION BE FOR TWO DECIMAL PLACES ONLY, AND IN THE RANGE OF 0 TO .30 UNITS FOR CO2 CONC. ARE CUBIC CENTIMETERS PER LITER OF AIR.

AS BEFORE, I WILL TYPE IN A '?' AND THEN YOU TYPE IN THE CARBON DIOXIDE CONC. AVAILABLE TO THE PLANT. THIS TIME YOU MUST CHOOSE TEN DIFFERENT VALUES. REMEMBER RP = RATE OF PHOTOSYNTHESIS.

CARBON DIOXIDE CONC.(CO2)?.10

RP= 118  
 (CO2)?.20  
 RP= 125  
 (CO2)?.30  
 RP= 125  
 (CO2)?.15  
 RP= 124  
 (CO2)?.05  
 RP= 94  
 (CO2)?.25  
 RP= 125  
 (CO2)?.02  
 RP= 54  
 (CO2)?0  
 RP= 0  
 (CO2)?.11  
 RP= 119  
 (CO2)?.20  
 RP= 125

1 = TABLE ONLY, 2 = PLOT ONLY, 3 = BOTH?3

| CO2 CONC. | RATE OF PHOTOSYNTHESIS |
|-----------|------------------------|
| 0         | 0                      |
| .02       | 53.8793                |
| .05       | 94.1092                |
| .1        | 117.816                |
| .11       | 119.253                |
| .15       | 123.563                |
| .2        | 125                    |
| .25       | 125                    |
| .3        | 125                    |

| CO2 CONC. | RATE OF PHOTOSYNTHESIS |    |    |    |     |     |
|-----------|------------------------|----|----|----|-----|-----|
|           | 0                      | 25 | 50 | 75 | 100 | 125 |
| 0         | I*                     |    |    |    |     |     |
| .02       | I                      |    | *  |    |     |     |
| .05       | I                      |    |    | *  |     |     |
| .1        | I                      |    |    |    | *   |     |
| .11       | I                      |    |    |    | *   |     |
| .15       | I                      |    |    |    | *   |     |
| .2        | I                      |    |    |    | *   |     |
| .25       | I                      |    |    |    | *   |     |
| .3        | I                      |    |    |    | *   |     |

DO YOU KNOW WHAT IS HAPPENING IN BOTH THESE INSTANCES?

DONE

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b>            | PHOTEL: Photoelectric Effect <span style="float: right;">PHOTEL<br/>36317.</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>DESCRIPTION:</b>      | An experiment involving the photoelectric effect is simulated by the computer, to enable students to develop a qualitative understanding of the phenomenon.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                          | <u>OBJECTIVES:</u><br>To demonstrate a "critical wavelength" for photo-electronic emission.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>INSTRUCTIONS:</b>     | <u>PRELIMINARY PREPARATION:</u><br>A. Student <ol style="list-style-type: none"><li>1. Prior discussion of the phenomenon as an introduction to modern physics</li><li>2. Students must be previously aware of such properties of light as wave-length and intensity.</li></ol> B. Materials - none<br><br><u>DISCUSSION:</u><br>The student is permitted to select any one of five metals, which is subsequently subjected to ultraviolet radiation. The electrons are "counted" by an ammeter incorporated in the simulated experimental set-up.<br>The data collected is tabulated for three trials, indicating the current measured for various wavelengths. The data will indicate that: <ol style="list-style-type: none"><li>1. The photoelectric emission is a function of wavelength;</li><li>2. For light of wavelength less than the critical value, the number of electrons emitted is dependent upon the incident light intensity; and</li><li>3. For wavelengths greater than the critical value, light intensity has no effect on the emission of electrons.</li></ol> The program is designed for individual qualitative investigation of the phenomena, but may also be utilized by small groups.<br><br>It should be noted that this program is advantageous where limited or non-existent lab equipment hinders actual experimentation. |
| <b>ACKNOWLEDGEMENTS:</b> | Huntington Project<br>Polytechnic Institute of Brooklyn                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |



RUN

RUN  
PHOTEL

## THE PHOTOELECTRIC EFFECT

WHEN LIGHT OF SHORT WAVELENGTH FALLS ON A METAL SURFACE, ELECTRONS ARE EJECTED FROM THE METAL. ACCORDING TO THE DESCRIPTION OF THIS PHENOMENA BY EINSTEIN, THERE IS A MAXIMUM WAVELENGTH FOR EACH METAL ABOVE WHICH NO ELECTRONS ARE EMITTED. IN THIS EXPERIMENT WE WILL DETERMINE THE CRITICAL WAVELENGTH AT WHICH THIS OCCURS.

THE METAL SELECTED WILL BE PLACED IN A VACUUM WHERE IT WILL BE BOMBARDED BY SOFT X-RAYS. THE NUMBER OF ELECTRONS EJECTED WILL BE COLLECTED AND COUNTED WITH AN AMMETER. (NOTE: THE CURRENT IS RELATED TO THE NUMBER OF ELECTRONS EMITTED BY THE METAL).

SELECT ONE OF THE METALS LISTED BY TYPING ITS NUMBER.

- 1) SILVER
- 2) BISMUTH
- 3) CADMIUM
- 4) LEAD
- 5) PLATINUM

?3

| WAVELENGTH | MEASURED CURRENT (MICROAMPERES) |         |         |
|------------|---------------------------------|---------|---------|
|            | TRIAL 1                         | TRIAL 2 | TRIAL 3 |
| 2380       | 20.5                            | 20.8    | 20      |
| 2500       | 20.5                            | 20.1    | 20.6    |
| 2631       | 20.1                            | 20.4    | 20.8    |
| 2777       | 20.3                            | 20.2    | 20.4    |
| 2941       | 20.3                            | 20.1    | 20      |
| 3124       | 20.6                            | 20      | 20.2    |
| 3333       | 2.2                             | 4.4     | 1.4     |
| 3571       | 1.4                             | 2.4     | 3.7     |
| 3846       | 2.4                             | 0       | 4.9     |

DO YOU WISH TO INCREASE THE LIGHT INTENSITY?  
(1=YES, 0=NO) : ?1

BY WHAT FACTOR? (SELECT FACTOR BETWEEN 1 AND 10).  
?7

| WAVELENGTH | MEASURED CURRENT (MICROAMPERES) |         |         |
|------------|---------------------------------|---------|---------|
|            | TRIAL 1                         | TRIAL 2 | TRIAL 3 |
| 2380       | 140.1                           | 140.1   | 140     |
| 2500       | 140                             | 140.1   | 140.1   |
| 2631       | 140.1                           | 140     | 140     |
| 2777       | 140                             | 140.1   | 140.1   |
| 2941       | 140.1                           | 140     | 140.1   |
| 3124       | 140.1                           | 140     | 140     |
| 3333       | 3.5                             | 3.5     | 3.6     |
| 3571       | 4.5                             | 2.2     | 3.6     |
| 3846       | 4                               | 4.6     | 4.7     |

DO YOU WISH TO INCREASE THE LIGHT INTENSITY?  
(1=YES, 0=NO) : ?0

DO YOU WISH TO TRY ANOTHER METAL (1=YES, 0=NO) : ?1  
SELECT ONE OF THE METALS LISTED BY TYPING ITS NUMBER.

- 1) SILVER
- 2) BISMUTH
- 3) CADMIUM
- 4) LEAD
- 5) PLATINUM

?2

| WAVELENGTH | MEASURED CURRENT (MICROAMPERES) |         |         |
|------------|---------------------------------|---------|---------|
|            | TRIAL 1                         | TRIAL 2 | TRIAL 3 |
| 2380       | 20.4                            | 20.4    | 20.3    |
| 2500       | 20.6                            | 20.1    | 20.2    |
| 2631       | 20.6                            | 20.1    | 20.7    |
| 2777       | 20.5                            | 20.3    | 20.1    |
| 2941       | 20                              | 20.1    | 20.7    |
| 3124       | 4.6                             | 1.7     | 1.7     |
| 3333       | 2.6                             | 4.2     | 4.6     |
| 3571       | 2                               | 2       | 3.9     |
| 3846       | 2.8                             | 4.8     | 4.4     |

DO YOU WISH TO INCREASE THE LIGHT INTENSITY?  
(1=YES, 0=NO) : ?0

DO YOU WISH TO TRY ANOTHER METAL (1=YES, 0=NO) : ?0

NOW BY PLOTTING THE WAVELENGTH VS. THE MEASURED CURRENT,  
(AVERAGE OF THREE TRIALS), THE PHOTOELECTRIC EFFECT AS  
DESCRIBED BY EINSTEIN WILL BECOME APPARENT.

THANK YOU.

DONE



**TITLE:**

PHOTON: Energy Level Problem

**DESCRIPTION:**

The student fires 15 shots, from a photon gun, at a mythical gaseous element with 4 randomly-selected energy levels. After each shot, the computer prints out the energies of photons, if any, emitted by the gas. The student is to construct an energy level diagram for the element from a knowledge of the energies of the photons emitted.

OBJECTIVES:

To promote a better understanding of how energy levels are determined from a knowledge of the emissions of excited atoms.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

A. Student - It is desirable that he have run BOHR, A833-36313, in Volume IV but it is not a necessity.

B. Materials - none

DISCUSSION:

The computer randomly selects 4 energy levels for the element. The energies range between  $1 \times 10^{-19}$  and  $15 \times 10^{-19}$  joules.

The energies of the students' 15 shots are picked at random, but cover the range from 1 to 15. Whenever one of the photons shot by the student is capable of exciting the atom all of the possible photon emissions from that excited state are printed.

By examining the photons emitted as a result of the 15 shots the student can construct an energy-level diagram of the element and account for each photon.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
PHOTON

IMAGINE THAT YOU HAVE A PHOTON GUN THAT FIRES PHOTONS WITH  
RANDOMLY SELECTED ENERGIES.

YOU WANT TO FIND SOME OF THE ENERGY LEVELS OF A GAS THAT  
YOU HAVE ISOLATED FROM A SAMPLE OF MOON ROCK. YOU WILL  
DO IT BY FIRING PHOTONS INTO THE GAS AND MEASURING THE  
ENERGIES OF PHOTONS EMITTED BY THE GAS. THE GAS WILL EMIT  
ONLY IF THE PHOTON YOU FIRED IS CAPABLE OF EXCITING ITS  
ATOMS TO HIGHER ENERGY STATES.

TO FIRE A BURST OF SINGLE ENERGY PHOTONS INTO THE GAS TYPE 1  
TO CEASE FIRING PHOTONS TYPE 0  
YOU HAVE 15 SHOTS TO DETERMINE THE ENERGY LEVELS.

|          | SHOT NUMBER | ENERGY OF EMITTED PHOTONS (E-19 JOULES) |   |   |   |    |   |   |
|----------|-------------|-----------------------------------------|---|---|---|----|---|---|
| FIRE!!!? |             |                                         |   |   |   |    |   |   |
| FIRE!!!? | 1           | 4                                       |   |   |   |    |   |   |
| FIRE!!!? | 2           | 0                                       |   |   |   |    |   |   |
| FIRE!!!? | 3           | 0                                       |   |   |   |    |   |   |
| FIRE!!!? | 4           | 9                                       | 7 | 4 | 5 | 3  | 2 |   |
| FIRE!!!? | 5           | 7                                       | 4 | 3 |   |    |   |   |
| FIRE!!!? | 6           | 15                                      | 9 | 7 | 4 | 11 | 5 | 3 |
| 8 2      | 6           |                                         |   |   |   |    |   |   |
| FIRE!!!? | 7           | 0                                       |   |   |   |    |   |   |
| FIRE!!!? | 8           | 0                                       |   |   |   |    |   |   |
| FIRE!!!? | 9           | 0                                       |   |   |   |    |   |   |
| FIRE!!!? | 10          | 0                                       |   |   |   |    |   |   |
| FIRE!!!? | 11          | 0                                       |   |   |   |    |   |   |
| FIRE!!!? | 12          | 0                                       |   |   |   |    |   |   |
| FIRE!!!? | 13          | 0                                       |   |   |   |    |   |   |
| FIRE!!!? |             |                                         |   |   |   |    |   |   |
| ???      |             |                                         |   |   |   |    |   |   |
| FIRE!!!? | 14          | 0                                       |   |   |   |    |   |   |
| FIRE!!!? | 15          | 0                                       |   |   |   |    |   |   |

FIND THE ENERGY LEVELS OF OUR ELEMENT - MYSTERIUM  
AND ACCOUNT FOR EACH OF THE EMITTED PHOTONS BY DRAWING  
AN ENERGY LEVEL DIAGRAM AND SHOWING WHICH TRANSITIONS  
GIVE RISE TO THE PHOTONS.

DONE

**TITLE:**

PH,POH,PCT, DISSOCIATION

**DESCRIPTION:**

A class presentation designed to calculate pH, pOH, and percent dissociation of weak monoprotic acids, using the quadratic equations for rigorous solutions.

OBJECTIVES:

- A. To illustrate the relationships between the magnitude of the  $K_a$  value, and the strength of the acid.
- B. To show the relationship between pOH and pH.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - The distinction between weak and strong acids should have been covered. The student should also be aware of the role hydrogen ion concentration plays in acid-base calculations, and the effect it has on hydroxide ion concentration.

DISCUSSION:

This program can be used in different ways, depending upon the ability level of the group.

1. With groups of average abilities, it is used primarily as a calculator, to solve large numbers of problems in a minimum amount of time.
2. In above average groups, the program listing was used as a device to illustrate theory. The entire lesson consists of an extensive step-wise explanation of the program list. In these classes all students were familiar with the Basic programming language. Some calculations built into the program (lines 41-43) are not part of the normal curriculum, but are necessary to solve the problem as the product of the  $K_a$  value and the concentration approaches  $1 \times 10^{-14}$ .

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
PHPOH

THIS PROGRAM WILL FIND THE PH, POH, AND PCT DISSOCIATION  
FOR ANY WEAK MONOPROTIC ACID.

KA OF ACID =?1E-5  
MOLAR CONCENTRATION OF ACID =?1

PH= 2.5            POH= 11.5            PCT. DISSOCIATION= .315728

ANY MORE PROBLEMS (1=YES, 0=NO)?1

KA OF ACID =?1E-3  
MOLAR CONCENTRATION OF ACID =?2

PH= 1.35            POH= 12.65            PCT. DISSOCIATION= 2.21121

ANY MORE PROBLEMS (1=YES, 0=NO)?1

KA OF ACID =?1E-10  
MOLAR CONCENTRATION OF ACID =?1

PH= 5            POH= 9            PCT. DISSOCIATION= 9.99895E-04

ANY MORE PROBLEMS (1=YES, 0=NO)?1

KA OF ACID =?1E-15  
MOLAR CONCENTRATION OF ACID =?2

PH= 6.96            POH= 7.04            PCT. DISSOCIATION= 9.12871E-07

ANY MORE PROBLEMS (1=YES, 0=NO)?0

DONE

**TITLE:**

PLANK: A Photoelectric Simulation

**DESCRIPTION:**

This program simulates an experiment to determine Plank's constant, threshold frequency, and work function of a metal.

OBJECTIVES:

- A. To enable the student to do an experiment on the computer that he is not likely to be able to do in a high-school laboratory.
- B. A better understanding of the photoelectric effect.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student
  1. He should have read and studied about threshold frequency, cut-off potential, and know (schematically) how the experimental apparatus used in such an experiment works.
  2. It is desirable that he have run PHOTEL A833-36317 in Volume IV - though not a necessity.
- B. Materials - Graph paper

DISCUSSION:

The student may choose one of the five metals in the program, the intensity of the x-rays used, and the number of different x-ray frequencies he would like to use. The computer then randomly chooses an x-ray frequency, and prints it for the student to see. The student enters voltages to be used as retarding potentials in the simulated tube and the computer prints a current for each potential entered until the current is zero when the cut-off potential is reached. A new frequency x-ray is then used and the student again tries to find the correct potential for cut-off.

Finally, a table of frequencies and cut-off potentials are printed and an assignment given (plot a graph and answer questions).

The student may then run the program again with a different intensity and the same metal, or he may change the metal and intensity.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn



RUN

RUN  
PLANK

IN THIS EXPERIMENT YOU WILL BE GIVEN THE FREQUENCY OF THE X-RAYS BEING USED AND YOU ARE TO DETERMINE THE VOLTAGE SETTING (RETARDING POTENTIAL) NECESSARY TO CAUSE THE COLLECTOR CURRENT TO DECREASE TO ZERO.

FIRST CHOOSE THE METAL YOU WISH TO USE FOR YOUR PHOTO-SENSITIVE SURFACE.

1 SILVER, 2 BISMUTH, 3 CADMIUM, 4 LEAD, 5 PLATINUM

WHICH METAL DO YOU CHOOSE?4

WHAT INTENSITY OF X-RAYS WILL YOU USE (FROM 1 TO 5)?3

HOW MANY DIFFERENT X-RAY FREQUENCIES WOULD YOU LIKE TO USE TO RADIATE YOUR SAMPLE (FROM 5 TO 8)?7

THE X-RAY FREQUENCY IS 9.45 E15

VOLTAGES HIGHER THAN CUT OFF WILL GIVE CURRENT READINGS OF ZERO SO TRY LOWER ONES. I'LL NOTIFY YOU OF CUT OFF.

FIND THE CUT OFF (STOPPING) VOLTAGE.

|          |            |     |
|----------|------------|-----|
| V=?24    | I=0        |     |
| V=?30    | I=0        |     |
| V=?26    | I=0        |     |
| V=?25    | I=0        |     |
| V=?24.5  | I=0        |     |
| V=?6     | I=0        |     |
| V=?16    | I=0        |     |
| V=?39    | I=0        |     |
| V=?12    | I=0        |     |
| V=?56    | I=0        |     |
| V=?23    | I=0        |     |
| V=?0-26  | I=0        |     |
| V=?34    | I=0        |     |
| V=?47    | I=0        |     |
| V=?64    | I=0        |     |
| V=?24.55 | I=0        |     |
| V=?6     | I=0        |     |
| V=?9     | I=0        |     |
| V=?100   | I=0        |     |
| V=?0     | I= 60.0323 | E-6 |
| V=?3     | I=0        |     |
| V=?-10   | I= 60.0089 | E-6 |
| V=?-100  | I= 60.0095 | E-6 |
| V=?-12   | I= 60.0856 | E-6 |

|        |            |     |
|--------|------------|-----|
| V=?1   | I= 37.0269 | E-6 |
| V=?2   | I= 13.9936 | E-6 |
| V=?3   | I=0        |     |
| V=?2.2 | I= 9.41514 | E-6 |
| V=?2.4 | I= 4.79061 | E-6 |
| V=?2.6 | CUT OFF    | I=0 |

THE X-RAY FREQUENCY IS 9.89 E15

FIND THE CUT OFF (STOPPING) VOLTAGE.

|        |            |     |
|--------|------------|-----|
| V=?5   | I=0        |     |
| V=?2   | I= 32.9376 | E-6 |
| V=?1   | I= 46.496  | E-6 |
| V=?3   | I= 19.3768 | E-6 |
| V=?4   | I= 5.84878 | E-6 |
| V=?4.3 | I= 1.79048 | E-6 |
| V=?4.5 | CUT OFF    | I=0 |

THE X-RAY FREQUENCY IS 17.65 E15

FIND THE CUT OFF (STOPPING) VOLTAGE.

|         |            |     |
|---------|------------|-----|
| V=?17   | I= 32.1368 | E-6 |
| V=?18   | I= 30.478  | E-6 |
| V=?21   | I= 25.5547 | E-6 |
| V=?26   | I= 17.3469 | E-6 |
| V=?45   | I=0        |     |
| V=?40   | I=0        |     |
| V=?35   | I= 2.56914 | E-6 |
| V=?35.4 | I= 1.93469 | E-6 |
| V=?35.7 | I= 1.41014 | E-6 |
| V=?36   | I= .956199 | E-6 |
| V=?36.9 | I=0        |     |
| V=?36.5 | CUT OFF    | I=0 |

THE X-RAY FREQUENCY IS 17 E15

FIND THE CUT OFF (STOPPING) VOLTAGE.

|       |            |     |
|-------|------------|-----|
| V=?36 | I=0        |     |
| V=?30 | I= 6.85579 | E-6 |
| V=?31 | I= 5.0843  | E-6 |
| V=?34 | I=0        |     |
| V=?33 | I= 1.56898 | E-6 |



V=?33.5 I= .689666 E-6  
V=?33.7 I= .301843 E-6  
V=?33.9 CUT OFF I=0

THE X-RAY FREQUENCY IS 12.04 E15

FIND THE CUT OFF (STOPPING) VOLTAGE.

V=?20 I=0  
V=?25 I=0  
V=?29 I=0  
V=?31 I=0  
V=?15 I=0  
V=?18 I=0  
V=?35 I=0  
V=?40 I=0  
V=?33 I=0  
V=?37 I=0  
V=?22 I=0  
V=?24 I=0  
V=?26 I=0  
V=?28 I=0  
V=?12 I= 6.02932 E-6  
V=?13 I= 1.53507 E-6  
V=?13.6 I=0  
V=?13.4 CUT OFF I=0

THE X-RAY FREQUENCY IS 10.68 E15

FIND THE CUT OFF (STOPPING) VOLTAGE.

V=?10 I=0  
V=?12 I=0  
V=?14 I=0  
V=?6 I= 13.2536 E-6  
V=?8.9 I=0  
V=?7.9 I=0  
V=?7 I= 5.475 E-6  
V=?7.2 I= 3.94767 E-6  
V=?7.5 I= 1.56603 E-6  
V=?7.7 CUT OFF I=0

THE X-RAY FREQUENCY IS 15.25 E15

FIND THE CUT OFF (STOPPING) VOLTAGE.

|         |            |     |
|---------|------------|-----|
| V=?33   | I=0        |     |
| V=?30   | I=0        |     |
| V=?35   | I=0        |     |
| V=?25   | I= 3.69909 | E-6 |
| V=?26   | I= 1.42204 | E-6 |
| V=?27   | I=0        |     |
| V=?26.6 | CUT OFF    | I=0 |

| X-RAY<br>FREQUENCY<br>E15 FPS<br>----- | CUT OFF<br>VOLTAGE<br>VOLTS<br>----- |
|----------------------------------------|--------------------------------------|
| 9.45                                   | 2.6                                  |
| 9.89                                   | 4.5                                  |
| 17.65                                  | 36.5                                 |
| 17                                     | 33.9                                 |
| 12.04                                  | 13.4                                 |
| 10.68                                  | 7.7                                  |
| 15.25                                  | 26.6                                 |

PLOT A GRAPH OF CUT OFF VOLTAGES (Y AXIS) VS. FREQUENCY

WHAT IS THE MEANING OF THE POINT AT WHICH THE EXTRAPOLATED GRAPH INTERCEPTS THE VOLTAGE AXIS?

WHAT IS THE LOWEST FREQUENCY THAT WILL CAUSE EMISSION OF PHOTOELECTRONS FROM THIS METAL?

REMEMBER THAT THE RETARDING POTENTIAL APPLIED BETWEEN THE EMITTER AND THE COLLECTOR AT CUT OFF, EXPRESSED IN ELECTRON VOLTS, IS EQUAL TO THE KINETIC ENERGY OF THE FASTEST ELECTRONS ESCAPING FROM THE EMITTER. FIND THE SLOPE OF THE GRAPH BUT EXPRESS THE STOPPING POTENTIAL IN JOULES.

WHAT IS THE VALUE OF THE SLOPE OF THE GRAPH AND WHAT SPECIAL NAME IS GIVEN TO THIS CONSTANT?

THE SAME METAL WITH A DIFFERENT INTENSITY IS WORTH INVESTIGATING. WHEN YOU DO THIS EXPLAIN THE MEANING OF ITS GRAPH WHEN COMPARED TO THE PREVIOUS ONE.

YOU MAY ALSO WISH TO TRY A DIFFERENT METAL AND EXPLAIN THE MEANING OF ITS GRAPH WHEN COMPARED TO YOUR OTHER ONES, OR COMPARED WITH THOSE OF ANOTHER STUDENT.

DO YOU WISH TO TRY A DIFFERENT INTENSITY OR A DIFFERENT METAL (1=YES, 0=NO) : ?0

DONE



POLUT  
36639**TITLE:** WATER POLLUTION SIMULATION**DESCRIPTION:** POLUT is a simulation designed to expand understanding of the problems associated with the management of our water resources. The effects of several variables on the quality of a water resource can be studied.

POLUT was developed by the Huntington II Project at the Polytechnic Institute of Brooklyn under the direction of L. Braun. This work was partially supported by the National Science Foundation, Grant GW-5883.

**INSTRUCTIONS:** The user is asked to specify the following characteristics:

- A. The kind of body of water.
- B. The water temperature in degrees fahrenheit.
- C. The kind of waste dumped into the water.
- D. The rate of dumping of waste, in parts per million (PPM) per day.
- E. The type of treatment of the waste.

The simulation takes place and the user may specify output in either: a graph, a table, or both.

**SPECIAL  
CONSIDERATIONS:**

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                   |        |
|-------------------|--------|
| Student Workbook  | \$ .30 |
| Teachers Guide    | .30    |
| Resource Handbook | .50    |

**ACKNOWLEDGEMENTS:** Huntington II Project  
State University of New York

**RUN**

RUN  
POLUT

WATER POLLUTION STUDY

INSTRUCTIONS (1=YES, 0=NO)?1

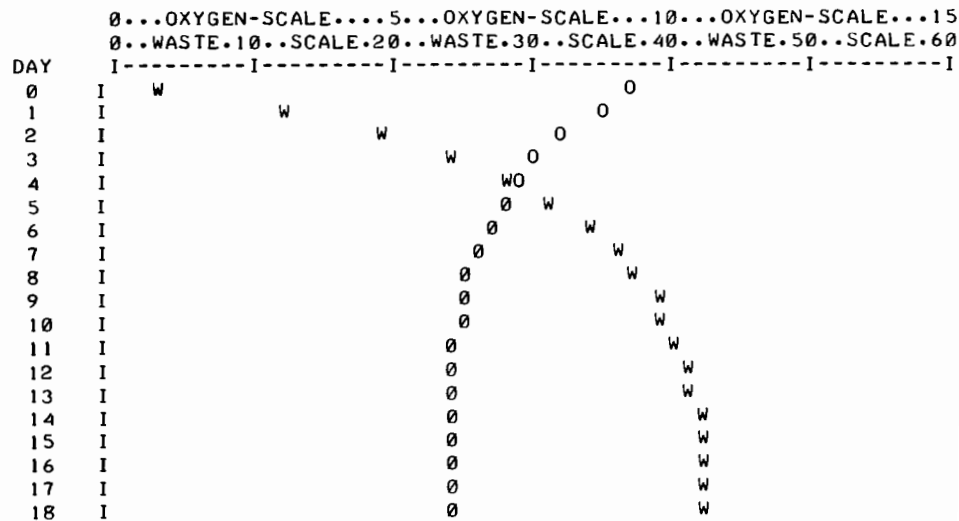
IN THIS STUDY YOU CAN SPECIFY THE FOLLOWING CHARACTERISTICS:

- A. THE KIND OF BODY OF WATER:
  - 1. LARGE POND
  - 2. LARGE LAKE
  - 3. SLOW-MOVING RIVER
  - 4. FAST-MOVING RIVER
- B. THE WATER TEMPERATURE IN DEGREES FAHRENHEIT:
- C. THE KIND OF WASTE DUMPED INTO THE WATER:
  - 1. INDUSTRIAL
  - 2. SEWAGE
- D. THE RATE OF DUMPING OF WASTE, IN PARTS PER MILLION (PPM)/DAY.
- E. THE TYPE OF TREATMENT OF THE WASTE:
  - 0. NONE
  - 1. PRIMARY (SEDIMENTATION OR PASSAGE THROUGH FINE SCREENS TO REMOVE GROSS SOLIDS)
  - 2. SECONDARY (SAND FILTERS OR THE ACTIVATED SLUDGE METHOD TO REMOVE DISSOLVED AND COLLOIDAL ORGANIC MATTER)

\*\*\*\*\*

BODY OF WATER?4  
 WATER TEMPERATURE?60  
 KIND OF WASTE?1  
 DUMPING RATE?10  
 TYPE OF TREATMENT?0

DO YOU WANT: A GRAPH(1), A TABLE(2), OR BOTH(3)?1



THE WASTE CONTENT AND OXYGEN CONTENT WILL REMAIN AT THESE LEVELS UNTIL ONE OF THE VARIABLES CHANGES.

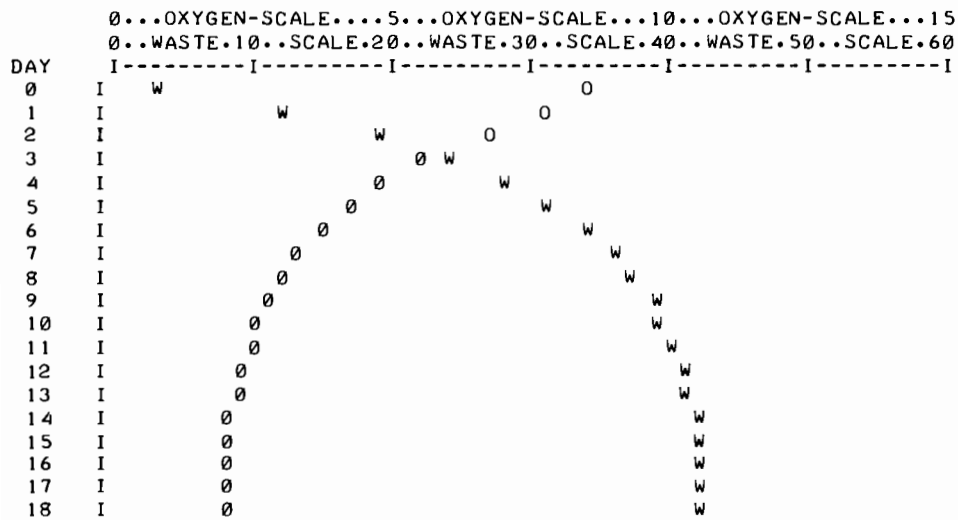
ANOTHER RUN (1=YES, 0=NO)?1

\*\*\*\*\*

BODY OF WATER?3  
 WATER TEMPERATURE?60  
 KIND OF WASTE?1  
 DUMPING RATE?10  
 TYPE OF TREATMENT?0

DO YOU WANT: A GRAPH(1), A TABLE(2), OR BOTH(3)?1

AFTER DAY 3 THE FISH BEGIN TO DIE, BECAUSE  
 THE OXYGEN CONTENT OF THE WATER DROPPED BELOW 5 PPM.



THE WASTE CONTENT AND OXYGEN CONTENT WILL REMAIN AT  
 THESE LEVELS UNTIL ONE OF THE VARIABLES CHANGES.

ANOTHER RUN (1=YES, 0=NO)?0

DONE





|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |                  |        |                |     |                   |     |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------|--------|----------------|-----|-------------------|-----|
| <b>TITLE:</b>                      | POPULATION GROWTH                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | POP<br>36844 |                  |        |                |     |                   |     |
| <b>DESCRIPTION:</b>                | <p>The POP SERIES programs are designed to allow a student with little mathematical background to explore various simple mathematical models of population growth. Student exercises revolve about studies of the growth of a gypsy-moth population. The gypsy moth was chosen as the primary animal for investigation because of its current ecological interest as an important species with few natural enemies and because its population meets the assumptions of the models presented in the POP SERIES.</p> <p>The following models are explored in the POP SERIES.</p> <p style="padding-left: 40px;">POP1 - simple exponential growth<br/>(population explosion)</p> <p style="padding-left: 40px;">POP2 - logistic model<br/>(environmental limiting factor)</p> <p style="padding-left: 40px;">POP3 - logistic model with a low-density modification</p> <p>Each of these programs is general enough so that it can be used to model other plant and animal populations.</p> |              |                  |        |                |     |                   |     |
| <b>INSTRUCTIONS:</b>               | See Special Considerations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |              |                  |        |                |     |                   |     |
| <b>SPECIAL<br/>CONSIDERATIONS:</b> | <p>The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.</p> <table border="0" style="margin-left: 40px;"> <tr> <td>Student Workbook</td> <td style="text-align: right;">\$ .30</td> </tr> <tr> <td>Teachers Guide</td> <td style="text-align: right;">.30</td> </tr> <tr> <td>Resource Handbook</td> <td style="text-align: right;">.50</td> </tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              | Student Workbook | \$ .30 | Teachers Guide | .30 | Resource Handbook | .50 |
| Student Workbook                   | \$ .30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |              |                  |        |                |     |                   |     |
| Teachers Guide                     | .30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |                  |        |                |     |                   |     |
| Resource Handbook                  | .50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |              |                  |        |                |     |                   |     |
| <b>ACKNOWLEDGEMENTS:</b>           | Huntington II Project<br>State University of New York                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |                  |        |                |     |                   |     |

RUN

RUN  
POP

## POPULATION GROWTH SIMULATION

WHICH POPULATION MODEL? (1, 2, OR 3). TYPE IN NUMBER?1

P(0)=?2

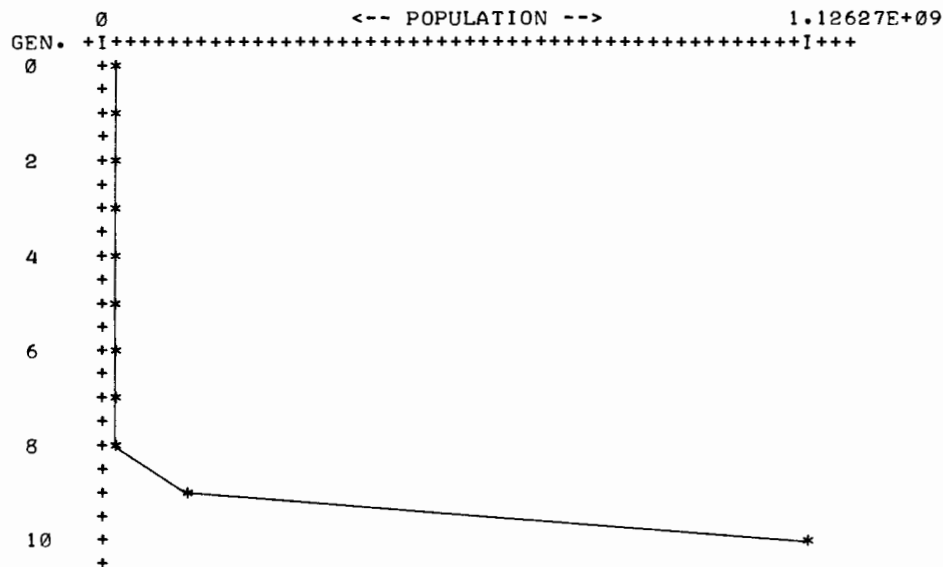
REPRO RATE=?7.5

TIME UNIT PER GENERATION?1

NO. OF GENERATIONS?10

OUTPUT DESIRED: 1=TABLE, 2=GRAPH, 3=BOTH?3

| GEN. | TIME | POP.        |
|------|------|-------------|
| 0    | 0    | 2           |
| 1    | 1    | 15          |
| 2    | 2    | 113         |
| 3    | 3    | 844         |
| 4    | 4    | 6328        |
| 5    | 5    | 47461.      |
| 6    | 6    | 355957.     |
| 7    | 7    | 2.66968E+06 |
| 8    | 8    | 2.00226E+07 |
| 9    | 9    | 1.50169E+08 |
| 10   | 10   | 1.12627E+09 |



ANOTHER RUN? (YES=1, NO=0)?1

WHICH POPULATION MODEL? (1, 2, OR 3). TYPE IN NUMBER?2

P(0)=?2

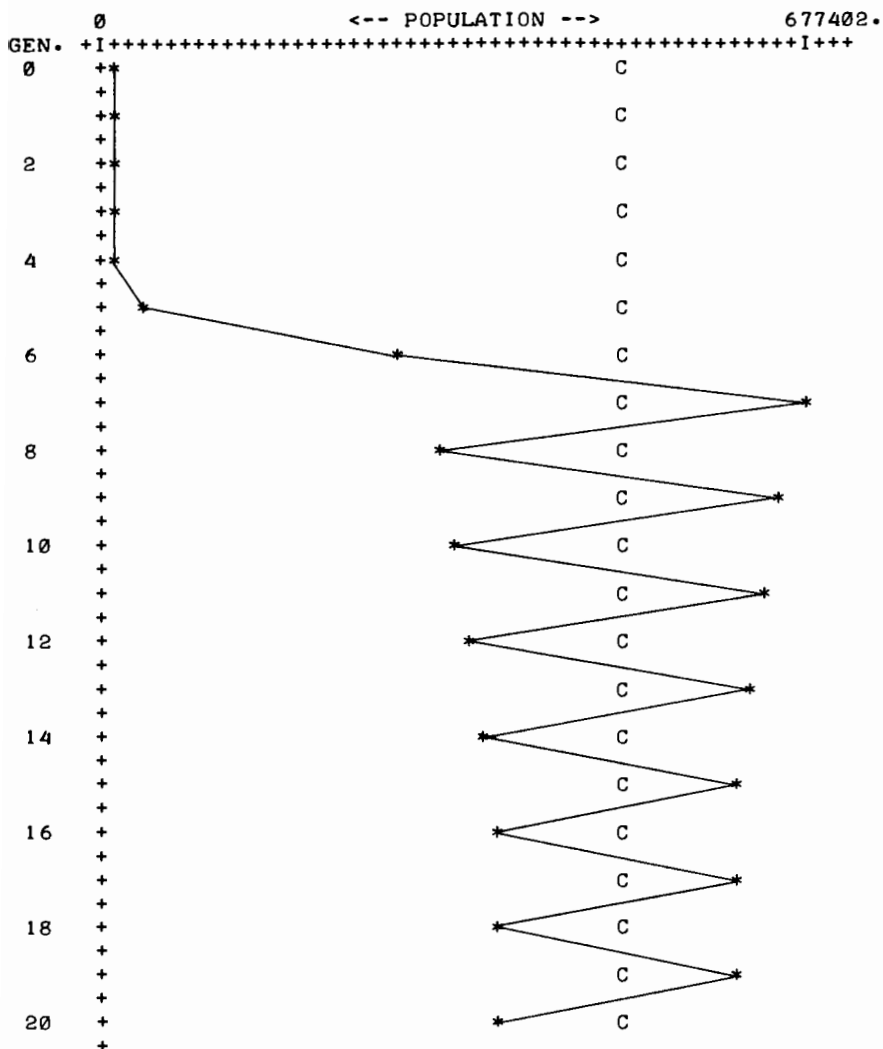
REPRO RATE=?7.5

TIME UNIT PER GENERATION?1

CARRYING CAPACITY?500000

NO. OF GENERATIONS?20

OUTPUT DESIRED: 1=TABLE, 2=GRAPH, 3=BOTH?2



ANOTHER RUN? (YES=1, NO=0)?1

WHICH POPULATION MODEL? (1, 2, OR 3). TYPE IN NUMBER?3

P(0)=?2

REPRO RATE=?7.5

TIME UNIT PER GENERATION?1

CARRYING CAPACITY?500000

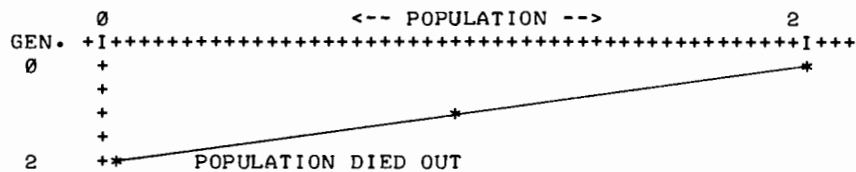
AT WHAT PO P. DO LOW DENSITY EFFECTS FIRST BEGIN?100

NO. OF GENERATIONS?10

OUTPUT DESIRED: 1=TABLE, 2=GRAPH, 3=BOTH?3

| GEN. | TIME | POP. |
|------|------|------|
| 0    | 0    | 2    |
| 1    | 1    | 1    |
| 2    | 2    | 0    |

POPULATION DIED OUT



ANOTHER RUN? (YES=1, NO=0)?1

WHICH POPULATION MODEL? (1, 2, OR 3). TYPE IN NUMBER?3

P(0)=?5  
 REPRO RATE=?7.5  
 TIME UNIT PER GENERATION?1  
 CARRYING CAPACITY?500000  
 AT WHAT PO P. DO LOW DENSITY EFFECTS FIRST BEGIN?100  
 NO. OF GENERATIONS?10  
 OUTPUT DESIRED: 1=TABLE, 2=GRAPH, 3=BOTH?1

| GEN.  | TIME  | POP.  |
|-------|-------|-------|
| ----- | ----- | ----- |
| 0     | 0     | 5     |
| 1     | 1     | 5     |
| 2     | 2     | 5     |
| 3     | 3     | 5     |
| 4     | 4     | 5     |
| 5     | 5     | 5     |
| 6     | 6     | 5     |
| 7     | 7     | 5     |
| 8     | 8     | 5     |
| 9     | 9     | 5     |
| 10    | 10    | 5     |

ANOTHER RUN? (YES=1, NO=0)?1

WHICH POPULATION MODEL? (1, 2, OR 3). TYPE IN NUMBER?3

P(0)=?6  
 REPRO RATE=?7.5  
 TIME UNIT PER GENERATION?1  
 CARRYING CAPACITY?500000  
 AT WHAT PO P. DO LOW DENSITY EFFECTS FIRST BEGIN?100  
 NO. OF GENERATIONS?10  
 OUTPUT DESIRED: 1=TABLE, 2=GRAPH, 3=BOTH?1

| GEN.  | TIME  | POP.    |
|-------|-------|---------|
| ----- | ----- | -----   |
| 0     | 0     | 6       |
| 1     | 1     | 7       |
| 2     | 2     | 10      |
| 3     | 3     | 19      |
| 4     | 4     | 62      |
| 5     | 5     | 393     |
| 6     | 6     | 2943    |
| 7     | 7     | 21812   |
| 8     | 8     | 149825. |
| 9     | 9     | 614375. |
| 10    | 10    | 387493. |

ANOTHER RUN? (YES=1, NO=0)?0

DONE

**TITLE:**

PRCNT: Percent Composition

**DESCRIPTION:**

This program is designed to calculate the percent composition (by weight) of a compound that may contain up to 5 elements. The program also contains a detailed sample calculation which is optional.

OBJECTIVES:

- A. For the students who are familiar with percentage, this program may be used as a self-teaching device to show how this concept applies to a chemical situation.
- B. The program may be used as a calculator to:
- 1) Illustrate the Law of Multiple Proportions
  - 2) Illustrate the Law of Definite Proportions
  - 3) Work out percent water of hydration, percent sulfate, nitrate, etc. (see discussion)
  - 4) Check homework problems, class problems, lab problems, etc.
- C. The program may be used as a tutorial device for students having difficulty.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - The student should at least have an understanding of the concept of percentage. The teacher may also wish to discuss how this concept applies to chemical compounds.
- B. Materials - none

DISCUSSION:

This program makes it possible for the teacher to spend very little time in class on percent composition and still have the student receive ample instruction and drill on the topic. This is possible since the program may be used in a number of situations such as teaching, self-teaching, and tutorial.

It should be brought to the students' attention that % water of hydration, % sulfate, % nitrate, etc., may be calculated by treating the groups of atoms as a single element when entering data.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
PRCNT

THIS PROGRAM IS DESIGNED TO CALCULATE THE PERCENT  
COMPOSITION BY WEIGHT OF A COMPOUND THAT MAY CONTAIN  
FROM 2 TO 5 ELEMENTS.

DO YOU WANT TO SEE A SAMPLE CALCULATION?  
ANSWER 1 FOR YES OR 0 (ZERO) FOR NO?1

EXAMPLE : THE PERCENT COMPOSITION OF SULFURIC ACID

LET W1 = ATOMIC WEIGHT OF HYDROGEN  
LET A1 = THE NO. OF HYDROGEN ATOMS IN THE FORMULA  
LET W2 = THE ATOMIC WEIGHT OF SULFUR  
LET A2 = THE NO. OF SULFUR ATOMS IN THE FORMULA  
LET W3 = THE ATOMIC WEIGHT OF OXYGEN  
LET A3 = THE NO. OF OXYGEN ATOMS IN THE FORMULA

Y= FORMULA WEIGHT OF SULFURIC ACID  
Y= (W1\*A1) + (W2\*A2) + (W3\*A3)  
Y= (1.008\*2) + (32.064\*1) + (15.999\*4)  
Y= 98.076

PERCENT H = (W1\*A1/Y)\*100  
PERCENT H = (1.008\*2/98.076)\*100  
PERCENT H = 2.005

PERCENT S = (W2\*A2/Y)\*100  
PERCENT S = (32.064\*1/98.076)\*100  
PERCENT S = 32.693

PERCENT O = (W3\*A3/Y)\*100  
PERCENT O = (15.999\*4/98.076)\*100  
PERCENT O = 65.2514

DO YOU WANT TO DO A PROBLEM ?  
ANSWER 1 FOR YES OR 0 (ZERO) FOR NO?1

WHAT IS THE NUMBER OF ELEMENTS IN THE FORMULA?3  
TYPE (THE ATOMIC WEIGHT,NO. OF ATOMS) FOR EACH ELEMENT,  
ONE ELEMENT TO A LINE.  
?12.011,12  
?1.008,22  
?15.999,11

\*\*\*\*\*

FORMULA WEIGHT = 342.297

| ATOMIC WEIGHT | NO. OF ATOMS | PERCENT COMPOSITION |
|---------------|--------------|---------------------|
| 12.011        | 12           | 42.1073             |
| 1.008         | 22           | 6.47858             |
| 15.999        | 11           | 51.4141             |

\*\*\*\*\*

DO YOU WANT TO DO ANOTHER PROBLEM?  
ANSWER 1 FOR YES OR 0 (ZERO) FOR NO?0

DONE

PRJTL  
36631

**TITLE:**

PROJECTILE MOTION

**DESCRIPTION:**

By entering the firing angle and initial speed, the computer calculates the coordinates, vertical and horizontal velocities, and speed of a projectile for equal time intervals.

OBJECTIVES:

To show the independence of the horizontal and vertical velocities of a projectile, and to facilitate the plotting of its path by eliminating tedious calculations.

**INSTRUCTIONS:**

PRELIMINARY PREPARATION:

- A. Student - Knowledge of motion at constant velocity and at constant acceleration; and the vector nature of velocity and acceleration.
- B. Materials - graph paper

DISCUSSION:

The student enters an angle and an initial speed of a projectile. A table of time, X and Y coordinates, horizontal and vertical velocities, and speed of the projectile is printed.

The student may then plot a graph of the position of the projectile, and draw vectors at each coordinate point to show the vertical and horizontal components of its velocity.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn



RUN

RUN  
PRJTL

SUPPOSE YOU ARE GOING TO FIRE A PROJECTILE INTO THE AIR.  
IF YOU ENTER A VALUE FOR ANGLE OF ELEVATION AND INITIAL  
VELOCITY, THE RANGE AND HEIGHT WILL BE EVALUATED. ENTER  
YOUR INFORMATION IN THE FORM A,V AFTER THE QUESTION MARK.  
(REMEMBER, THE ANGLE IS IN DEGREES AND THE INITIAL  
VELOCITY IS IN METERS/SECOND.)

WHAT ARE YOUR VALUES?30,200

THE TOTAL FLIGHT TIME WAS 20.3943 SECONDS  
THE RANGE WAS 3532.4 METERS  
THE MAXIMUM HEIGHT WAS 509.858 METERS

BECAUSE THERE IS NO FRICTION, THE HORIZONTAL VELOCITY IS  
CONSTANT. HORIZONTAL VELOCITY = 173.205

THE FOLLOWING ARE POINTS ON THE CURVE AT VARIOUS TIME INTERVALS:

| TIME    | X-COORD | Y-COORD | VERTICAL<br>VELOCITY | SPEED   |
|---------|---------|---------|----------------------|---------|
| ----    | -----   | -----   | -----                | -----   |
| 0       | 0       | 0       | 100.                 | 200     |
| 1.85403 | 321.127 | 168.548 | 81.8181              | 191.557 |
| 3.70806 | 642.254 | 303.386 | 63.6363              | 184.525 |
| 5.56209 | 963.382 | 404.515 | 45.4545              | 179.07  |
| 7.41611 | 1284.51 | 471.934 | 27.2727              | 175.339 |
| 9.27014 | 1605.64 | 505.644 | 9.09091              | 173.444 |
| 11.1242 | 1926.76 | 505.643 | -9.0909              | 173.444 |
| 12.9782 | 2247.89 | 471.934 | -27.2727             | 175.339 |
| 14.8322 | 2569.02 | 404.514 | -45.4545             | 179.07  |
| 16.6863 | 2890.14 | 303.385 | -63.6363             | 184.525 |
| 18.5403 | 3211.27 | 168.547 | -81.8181             | 191.557 |
| 20.3943 | 3532.4  | 0       | -99.9999             | 200     |

THE ANGLE AT WHICH YOU FIRED THE PROJECTILE DOES NOT  
YIELD THE MAXIMUM RANGE. WHAT ANGLE DOES?45

45 DEGREES GIVES THE MAXIMUM RANGE OF 4077.65

WOULD YOU LIKE ANOTHER RUN WITH DIFFERENT A AND V?  
(1=YES, 0=NO) : 0

DONE

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b>            | REFLECT: Least Time Principle and Light                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>DESCRIPTION:</b>      | <p>An analogy is given for a light-ray reflected from a plane surface to demonstrate the "least-time" principle and its relationship to the reflection laws of light.</p> <p><u>OBJECTIVES:</u></p> <p>To demonstrate the consequences of the "least-time" principle.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>INSTRUCTIONS:</b>     | <p><u>PRELIMINARY PREPARATION:</u></p> <p>A. Student - Should be familiar with the reflection laws of light.</p> <p>B. Materials - graph paper.</p> <p><u>DISCUSSION:</u></p> <p>Given points <math>P_1</math> and <math>P_2</math> and the line <math>l</math>, the student can vary the point <math>P_3</math> to note the effects on angles <math>P</math> and <math>Q</math> and their relationship to the time required to traverse the path <math>P_1P_3P_2</math>.</p> <p>The program is presented as a game in which a horse (lightray) must complete a journey within a specified time. The student is limited to seven choices of <math>P_3</math> to complete the task. After a successful journey, the student may vary the point <math>P_2</math> to further establish the principle of least time.</p> <p>This program has been extremely helpful in developing the least-time concept and its relationship to the laws of reflection.</p> <p>It is applicable to a classroom situation as well as small study groups.</p> |
| <b>ACKNOWLEDGEMENTS:</b> | Huntington Project<br>Polytechnic Institute of Brooklyn                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

RUN  
RUN  
REFLECT

YOU ARE CAMPING OUT WEST IN COORDINATE NATIONAL PARK ON  
ORDINATE MOUNTAIN, LOCATED 10 MILES NORTH OF THE  
DESERTED TOWN OF ORIGIN, WHICH IS CONVENIENTLY LOCATED  
AT (0,0) ON THE LOCAL MAP.

A CALAMITY STRIKES! THE NEAREST HELP IS AT THE  
BAR 30:30 RANCH, LOCATED AT COORDINATES (30,30).  
TO GET THERE, YOU MUST RIDE AN OLD HORSE  
(NAMED LIGHTRAY) WHO :  
A) WILL ONLY WALK 5 MILES PER HOUR  
B) WILL CEASE TO WALK (AND EXIST) AFTER 10 HOURS  
C) MUST HAVE A DRINK OF WATER SOMEWHERE ALONG THE  
ABSCISSA RIVER, WHICH (IF YOU HAVEN'T GUESSED) RUNS  
ALONG THE ABSCISSA IN COORDINATE PARK

HERE IS YOUR PROBLEM: YOU MUST PICK A SPOT  
(FROM 0 TO 30) ALONG THE ABSCISSA RIVER DURING THE  
TRIP TO GIVE LIGHTRAY A DRINK, AND STILL MAKE IT TO  
THE BAR 30:30 WITHIN THE TIME ALLOWED. LIGHTRAY, USING  
HORSE SENSE, KNOWS ALL THE ANGLES, SO WE WILL GIVE  
THEM TO YOU, TOO.

WHERE WILL LIGHTRAY STOP FOR A DRINK?7

ANGLE APPROACHING RIVER IS 55 DEGREES.  
ANGLE LEAVING RIVER IS 53 DEGREES.

WHERE WILL LIGHTRAY STOP FOR A DRINK?25

ANGLE APPROACHING RIVER IS 89 DEGREES.  
ANGLE LEAVING RIVER IS 45 DEGREES.  
HEY - THIS TRIP TAKES LONGER!  
YOU HAVE A DEAD HORSE ON YOUR HANDS. TRY AGAIN.

WHERE WILL LIGHTRAY STOP FOR A DRINK?6

ANGLE APPROACHING RIVER IS 59 DEGREES.  
ANGLE LEAVING RIVER IS 51 DEGREES.  
WELL, YOU ARE CLOSER THAN LAST TIME.  
KEEP AN EYE ON THOSE ANGLES, THOUGH.  
LET'S GO BACK FOR ANOTHER HORSE.

WHERE WILL LIGHTRAY STOP FOR A DRINK?8

ANGLE APPROACHING RIVER IS 51 DEGREES.  
ANGLE LEAVING RIVER IS 54 DEGREES.  
WELL, YOU ARE CLOSER THAN LAST TIME.  
KEEP AN EYE ON THOSE ANGLES, THOUGH.  
LET'S GO BACK FOR ANOTHER HORSE.

WHERE WILL LIGHTRAY STOP FOR A DRINK?7.4

ANGLE APPROACHING RIVER IS 53 DEGREES.  
ANGLE LEAVING RIVER IS 53 DEGREES.  
NICE WORK. YOU MADE IT.  
THE TRIP TOOK ABOUT 10.0001 HOURS.  
YOU CAN SEE THAT USING HORSE SENSE, LIGHTRAY KNOWS THAT  
THE ANGLES HAVE TO BE EQUAL OF REFLECTION FOR A  
MINIMUM TIME TRIP.

IF YOU WANT TO MOVE THE RANCH, TYPE 1  
IF YOU WANT TO SEE SOMETHING ELSE, TYPE 2  
IF YOU WANT TO QUIT, TYPE 3

?2  
TIME FOR AN ACTUAL LIGHTRAY TO COMPLETE THE TRIP IS:  
2.75455E-04 SECONDS.

THANK YOU FOR PLAYING.

DONE

**TITLE:**

COMPUTER-AUGMENTED PHYSICS TOPICS (OPTICS)

**DESCRIPTION:**

This program provides practice in using the formulas for images formed by mirrors with circular surfaces, as given in the module, Computer-Augmented Physics Topics (Optics, Part 3) of the Hewlett Packard Curriculum Series. Some algebraic transformation of the given formulas may be necessary for calculating the answers.

This program uses Calculator Mode as a student option in answering questions.

**INSTRUCTIONS:**

Problems are of two general types:

1. Given focal length, object height, and object distance, calculate image distance and image height.
2. Given image distance and object distance, calculate focal length.

In either case, the student is also asked to specify whether the image formed is real or virtual.

To enter Calculator mode (before entering answer), the student types 999999 as the answer.

APPEND - DESCAL before RUNNING the program.

See DESCAL (HP 36674) in Volume IV for instructions in using the calculator mode.

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Physics (secondary)

Student Background Required: Algebra, formulas for circular mirrors  
(concurrent)

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5648 Computer-Augmented Physics Topics (student text)  
HP 5951-5649 Computer-Augmented Physics Topics (problem solutions)  
HP 5951-5650 Computer-Augmented Physics Topics (classroom set - 30  
student books and 1 problem solutions)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project  
Scientific Press  
1629 Channing Ave.  
Palo Alto, California 94303

**ACKNOWLEDGEMENTS:**

Project Solo  
University of Pittsburgh

RUN

APPEND-DESCAL  
REFLEC  
RUN

THIS PROGRAM WILL DEAL WITH THE PHYSICS OF CURVED MIRRORS.  
THE FORMULAS WHICH YOU WILL NEED MAY BE FOUND IN THE MODULE.  
REMEMBER -- TYPE 999999 FOR CALCULATOR MODE.

THE FOCAL LENGTH OF A CURVED MIRROR IS FOUND TO BE 6.6 CM.  
AN OBJECT 1.4 CM HIGH IS PLACED 5.3 CM AWAY FROM  
THE MIRROR. TYPE IN THE IMAGE DISTANCE FROM THE MIRROR IN CM.

DISTANCE=?999999  
CALCULATOR MODE.  
CLEARED TO ZERO  
1ST NUMBER?5.3  
FUNCTION?RCP  
RCP= .188679

FUNCTION?CLR  
CLEARED TO ZERO  
1ST NUMBER?6.6  
FUNCTION?RCP  
RCP= .151515

FUNCTION?SUB  
2ND NUMBER?.188679  
SUB=-3.71639E-02

FUNCTION?RCP  
RCP=-26.9079

FUNCTION?EXT  
EXIT.  
DISTANCE=?-26.91  
GOOD FOR YOU.  
NOW TYPE IN THE HEIGHT OF THE IMAGE (HI) IN CM.  
HEIGHT=?999999  
CALCULATOR MODE.  
CLEARED TO ZERO  
1ST NUMBER?1.4  
FUNCTION?MUL  
2ND NUMBER?-26.9079  
MUL=-37.6711

FUNCTION?DIV  
2ND NUMBER?5.3  
DIV=-7.10775

FUNCTION?EXT  
EXIT.  
HEIGHT=?-7.10775  
GOOD. YOU'RE RIGHT.  
IS THE IMAGE REAL OR VIRTUAL (1=REAL, 0=VIRTUAL)?0  
RIGHT ON!

DO YOU WANT TO TRY ANOTHER PROBLEM LIKE THIS ONE  
(0=NO, 1=YES)?0

OK, THEN, HOW ABOUT THIS ONE?

THE IMAGE OF AN OBJECT PLACED 4.74 CM AWAY FROM A CURVED  
MIRROR IS FOUND TO BE LOCATED 6.17 CM AWAY FROM THE  
MIRROR. INPUT THE FOCAL LENGTH OF THE MIRROR.

FOCAL LENGTH = ?999999  
CALCULATOR MODE.  
CLEARED TO ZERO  
1ST NUMBER?4.74  
FUNCTION?ADD  
2ND NUMBER?6.17  
ADD= 10.91

FUNCTION?CLR  
CLEARED TO ZERO  
1ST NUMBER?4.74  
FUNCTION?MUL  
2ND NUMBER?6.17  
MUL= 29.2458

FUNCTION?DIV  
2ND NUMBER?10.91  
DIV= 2.68064

FUNCTION?EXT  
EXIT.  
FOCAL LENGTH = ?2.681  
RIGHT.. GOOD  
IS THE IMAGE REAL OR VIRTUAL (1=REAL, 0=VIRTUAL)?1  
RIGHT ON!

DO YOU WANT TO TRY ANOTHER PROBLEM LIKE THIS ONE  
(0=NO, 1=YES)?0  
SO LONG, THEN. TRY THE NEXT PROGRAM, REFRAC.  
AU REVOIR

DONE



|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>TITLE:</b>                  | COMPUTER-AUGMENTED PHYSICS TOPICS (OPTICS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | REFRAC<br>36669 |
| <b>DESCRIPTION:</b>            | <p>This program provides practice in using the formulas for refraction through plane surfaces and thin lenses given in the module, Computer-Augmented Physics Topics of the Hewlett Packard Curriculum Series.</p> <p>The program uses Calculator Mode as a student option in answering questions.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |
| <b>INSTRUCTIONS:</b>           | <p>There are two types of problems:</p> <ol style="list-style-type: none"> <li>1. Given the angle of incidence and the angle of refraction (in degrees) of light incident on a plane surface, calculate the index of refraction, and identify the material from a table of indices of refraction given in the module.</li> <li>2. Given the two radii of the opposing surfaces of a thin lens, and the index of refraction of the material of the lens, calculate the focal length.</li> </ol> <p>To enter the Calculator Mode while answering a question, the student types 999999 as the answer.</p>                                                                                                                                                                                                                                     |                 |
| <b>SPECIAL CONSIDERATIONS:</b> | <p>Complete instructions for the Calculator Mode are given in a separate module. Examples of its use in this program are given in the curriculum material listed below.</p> <p style="margin-left: 40px;">HP 5951-5648 Computer-Augmented Physics Topics (student text)<br/> HP 5951-5649 Computer-Augmented Physics Topics (problem solutions)<br/> HP 5951-5650 Computer-Augmented Physics Topics (classroom set - 30 student books and 1 problem solutions)</p> <p>For ordering information of curriculum material, contact:<br/> Hewlett-Packard Computer Curriculum Project<br/> Scientific Press<br/> 1629 Channing Ave.<br/> Palo Alto, California 94303</p> <p>FOR INSTRUCTIONAL PURPOSES<br/> Suitable Courses: Physics (optics)</p> <p>Student Background Required: Algebra, Snell's law, "lensmaker's formula" (concurrent)</p> |                 |
| <b>ACKNOWLEDGEMENTS:</b>       | Project Solo<br>University of Pittsburgh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |



RUN

APPEND-DESCAL  
 RUN  
 REFRAC

THIS PROGRAM WILL DEAL WITH REFRACTION AND THE PHYSICS OF THIN LENSES.  
 THE FORMULAS THAT YOU WILL NEED MAY BE FOUND IN THE MODULE.  
 REMEMBER--999999 FOR CALCULATOR MODE.

LIGHT TRAVELING THROUGH A VACUUM (N1=1) IS INCIDENT ON AN OBJECT AT AN ANGLE OF 23.88 DEGREES, AND IS REFRACTED TO AN ANGLE OF 11.11 DEGREES.  
 WHAT IS THE INDEX OF REFRACTION (N2) OF THE MATERIAL?

N2 = ?999999  
 CALCULATOR MODE.  
 CLEARED TO ZERO  
 1ST NUMBER?11.11  
 FUNCTION?DTR  
 DTR= .193906

FUNCTION?SIN  
 SIN= .192693

FUNCTION?CLR  
 CLEARED TO ZERO  
 1ST NUMBER?23.88  
 FUNCTION?DTR  
 DTR= .416785

FUNCTION?SIN  
 SIN= .404822

FUNCTION?DIV  
 2ND NUMBER?.192693  
 DIV= 2.10087

FUNCTION?EXT  
 EXIT.  
 N2 = ?2.10  
 EXCELLENT- YOU'RE RIGHT

REFER TO THE MODULE. TYPE IN THE NUMBER OF THE MATERIAL.  
 ?10  
 RIGHT YOU ARE.

WOULD YOU LIKE TO TRY ANOTHER LIKE THIS (1=YES, 0=NO)?0  
 USING THE 'LENSMAKER'S FORMULA,' CALCULATE THE FOCAL LENGTH OF A THIN LENS MADE FROM GLASS (N=1.5), IF THE RADII OF THE OPPOSING SURFACES ARE 2 AND 3.5 CM.  
 FOCAL LENGTH (CM) = ?999999

CALCULATOR MODE.  
 CLEARED TO ZERO  
 1ST NUMBER?3.5  
 FUNCTION?RCP  
 RCP= .285714

FUNCTION?ADD  
 2ND NUMBER?.5  
 ADD= .785714

FUNCTION?MUL  
 2ND NUMBER?.5  
 MUL= .392857

FUNCTION?RCP  
 RCP= 2.54545

FUNCTION?EXT  
 EXIT.  
 FOCAL LENGTH (CM) = ?2.55  
 GOOD YOU ARE CORRECT

HOW ABOUT ANOTHER ONE LIKE THIS (0=NO, 1=YES);

?0

OK, NOW TRY YOUR HAND AT WRITING A PROGRAM TO COMPLETE  
THE TABLE IN PART 3 OF THE MODULE.

DONE



SLITS  
36351**TITLE:**

SLITS: Youngs Double Slit Experiment

**DESCRIPTION:**

Young's Double Slit Experiment is simulated by the computer to permit greater exploration of the influence of wavelength and slit-separation on the interference pattern. (This is a plotting program.)

OBJECTIVES:

To determine, qualitatively, the effects of slit-separation, inter-screen spacing distance ( $d$ ) and wavelength ( $w$ ), in altering the location of the maxima and minima of the intensity bands of light.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - An instruction sheet is helpful in leading the student through a logical approach. It is also recommended that students understand the superposition of waves before executing this program.
- B. Materials - none.

DISCUSSION:A. Operational Suggestions

1. The objectives of this program are best accomplished with small groups (3 to 4 students) to permit discussion and development of ideas concerning the relationships involved.
2. The program has worked well with highly-motivated students and has often led into detailed discussions of related topics. However, it has been found to be relatively ineffectual with poorly-motivated students.

B. Suggested Follow-up

This program permits the exploration of the parameters involved in double-slit interference patterns without the requirement of extensive equipment and/or set-ups. It is recommended that this simulated experiment be employed after the student has familiarized himself with the normal lab experiment.

To enhance the operation of this program, it is further recommended that an instruction sheet (see attachment) be constructed to enable efficient exploration of this phenomenon. By varying the slit-separation ( $d$ ), the student can observe the effects by noting the relative separations between adjacent maxima. In a similar manner, changes effectuated by the various wavelengths can also be noted.

**ACKNOWLEDGEMENTS:**

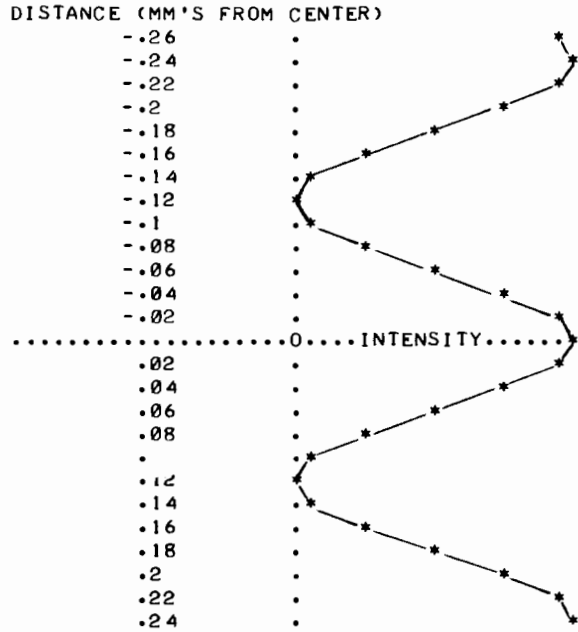
Huntington Project  
State University of New York

RUN

RUN  
SLITS

YOUNG'S DOUBLE SLIT EXPERIMENT

L = 2 METERS W = 6000 ANGSTROMS D = .5 MILLIMETERS

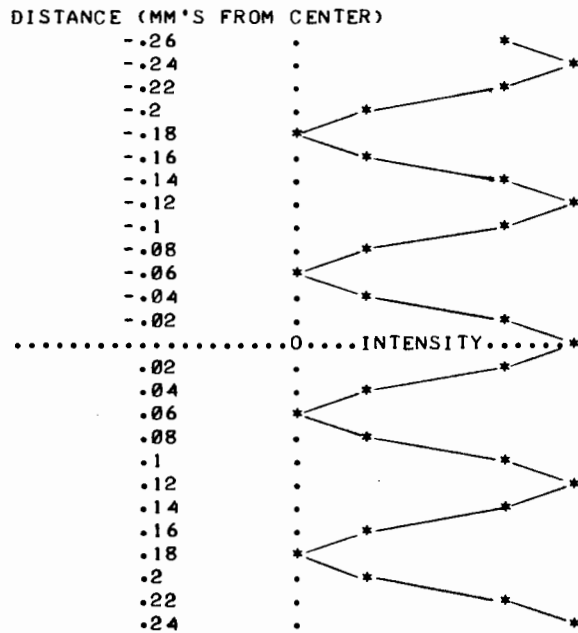


ABOVE IS AN ILLUSTRATIVE RUN WITH PRE-DETERMINED VALUES FOR WAVELENGTH (W), DISTANCE BETWEEN SLITS AND SCREEN (L), AND SLIT SEPARATION - CENTER TO CENTER (D). NOW YOU MAY VARY THESE PARAMETERS, ONE AT A TIME.

\*\*\*\*\*

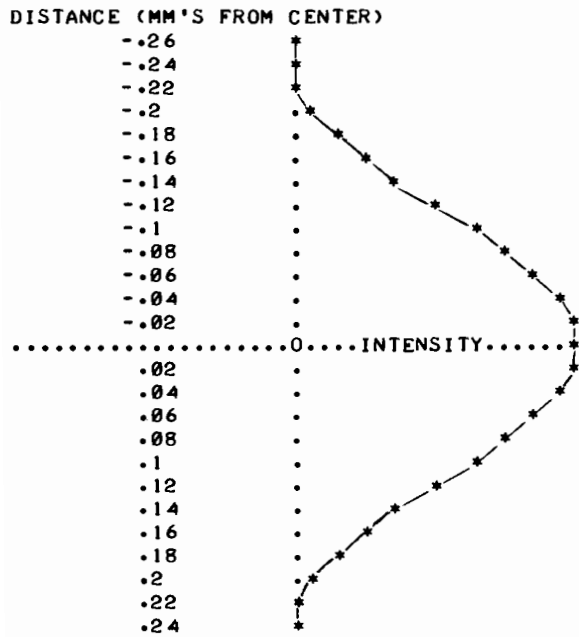
WHAT IS THE NEW SLIT SEPARATION (D) IN MILLIMETERS?1

L = 2 METERS W = 6000 ANGSTROMS D = 1 MILLIMETERS



WOULD YOU LIKE TO TRY ANOTHER VALUE OF D (1-YES, 0-NO)?1  
 WHAT IS THE NEW SLIT SEPARATION (D) IN MILLIMETERS?.25

L = 2 METERS W = 6000 ANGSTROMS D = .25 MILLIMETERS

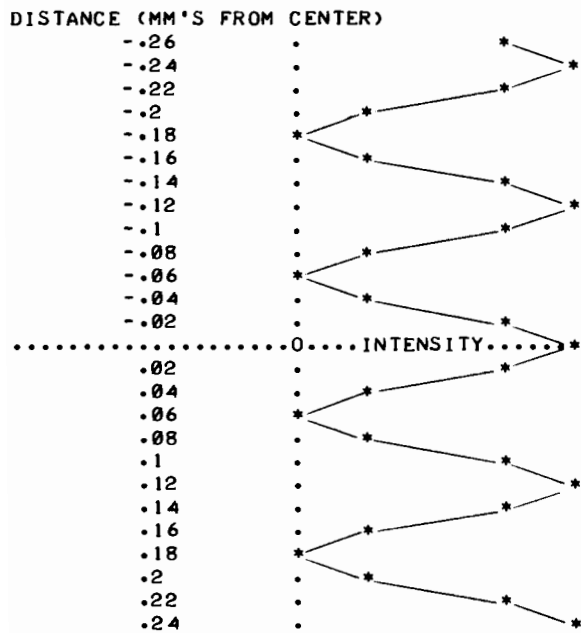


WOULD YOU LIKE TO TRY ANOTHER VALUE OF D (1-YES, 0-NO)?0

\*\*\*\*\*

WHAT IS THE NEW WAVELENGTH (W) IN ANGSTROMS?3000

L = 2 METERS W = 3000 ANGSTROMS D = .5 MILLIMETERS



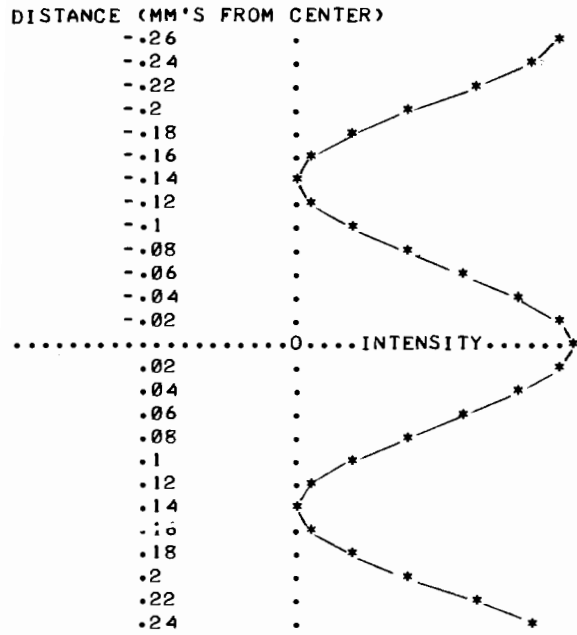
WOULD YOU LIKE TO TRY ANOTHER VALUE OF W (1-YES, 0-NO)?1

WHAT IS THE NEW WAVELENGTH (W) IN ANGSTROMS?15000

A WAVELENGTH OF 15000 IS INFRARED LIGHT AND NOT VISIBLE.  
 THE INTERFERENCE PATTERN WILL BE VISIBLE USING DETECTORS ONLY. TRY ANOTHER WAVELENGTH.

WHAT IS THE NEW WAVELENGTH (W) IN ANGSTROMS?6900

L = 2 METERS W = 6900 ANGSTROMS D = .5 MILLIMETERS

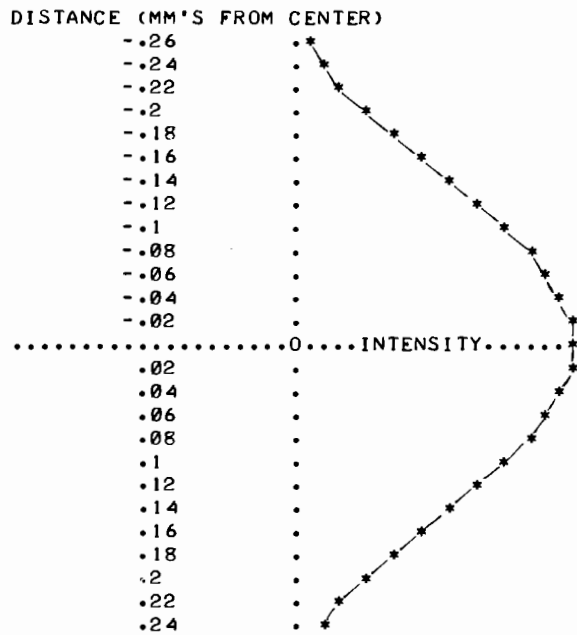


WOULD YOU LIKE TO TRY ANOTHER VALUE OF W (1-YES, 0-NO)?0

\*\*\*\*\*

WHAT IS THE NEW DISTANCE FROM SLITS TO SCREEN (L) IN METERS?5

L = 5 METERS W = 6000 ANGSTROMS D = .5 MILLIMETERS

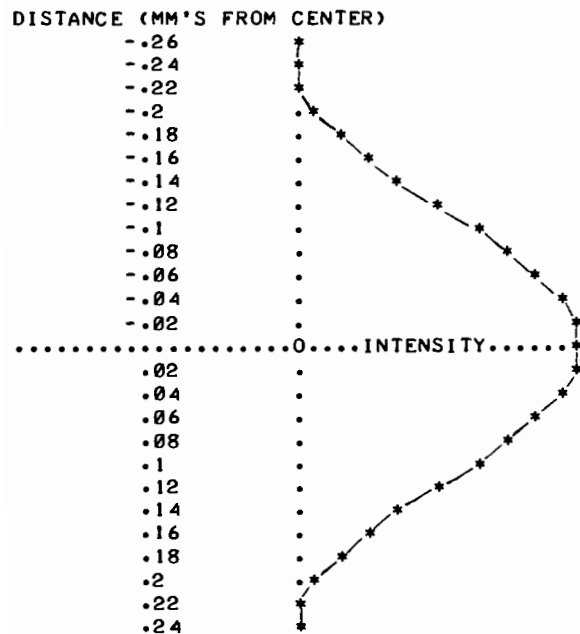


WOULD YOU LIKE TO TRY ANOTHER VALUE OF L (1-YES, 0-NO)?0

\*\*\*\*\*

YOU WILL NOW BE GIVEN A LIGHT SOURCE OF UNKNOWN WAVELENGTH. YOU WILL SPECIFY THE SLIT SEPARATION (D), AND THE DISTANCE FROM SLITS TO SCREEN (L). WHAT IS THE NEW SLIT SEPARATION (D) IN MILLIMETERS?.5 WHAT IS THE NEW DISTANCE FROM SLITS TO SCREEN (L) IN METERS?4

L = 4 METERS W = ? ANGSTROMS D = .5 MILLIMETERS



WOULD YOU LIKE A PLOT FOR OTHER VALUES OF D AND L (1-YES, 0-NO)?0  
 WHAT DO YOU THINK THE UNKNOWN WAVELENGTH (W) IS?6000  
 PRETTY GOOD! THE WAVELENGTH WAS 6000 ANGSTROMS.  
 WOULD YOU LIKE TO TRY ANOTHER UNKNOWN WAVELENGTH(1-YES, 0-NO)?0

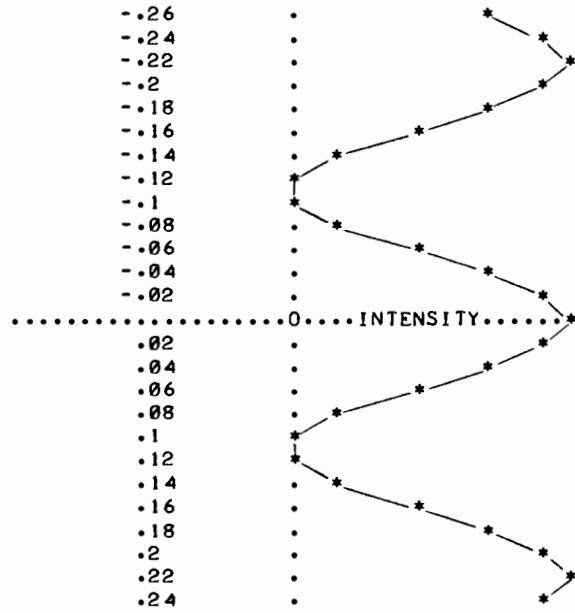
\*\*\*\*\*

WOULD YOU LIKE A PLOT WITH YOUR OWN VALUES FOR WAVELENGTH (W), SLIT SEPARATION (D), AND DISTANCE FROM SLITS TO SCREEN (L) (1-YES, 0-NO)?1  
 WHAT IS THE NEW WAVELENGTH (W) IN ANGSTROMS?5500  
 WHAT IS THE NEW SLIT SEPARATION (D) IN MILLIMETERS?.75  
 WHAT IS THE NEW DISTANCE FROM SLITS TO SCREEN (L) IN METERS?3

L = 3 METERS W = 5500 ANGSTROMS D = .75 MILLIMETERS



DISTANCE (MM'S FROM CENTER)



ANOTHER ONE (1-YES, 0-NO)

?0

\*\*\*\*\*

HOPE YOU HAD FUN!

DONE

SNELL  
36320**TITLE:**

SNELL: Snell's Law

**DESCRIPTION:**

Snell's law is presented pictorially by plotting the path of a light ray as it crosses a boundary separating two different media.

OBJECTIVES:

To permit students to "see" the refraction of light, including the case when the critical angle is exceeded and reflection occurs.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

A. Student - The terms associated with Snell's law, such as refraction, media, normals, etc., must be presented prior to the running of this program.

B. Materials - No additional supplies or materials are necessary.

DISCUSSION:

Snell's law can be investigated independently by students by altering the angle of incidence, and/or the indices of refraction. The pictorial presentation is especially beneficial to students with reading problems, since the concepts implied by the mathematical relationships are presented heuristically.

In addition, the critical angle may be approached and exceeded, in the special case where  $n_2$  (second medium) is less than  $n_1$  (initial medium).

Queries are included as part of the program to reinforce the concepts.

The program is well suited for small groups or individuals, but may be utilized for large group presentation without program modification.

**ACKNOWLEDGEMENTS:**

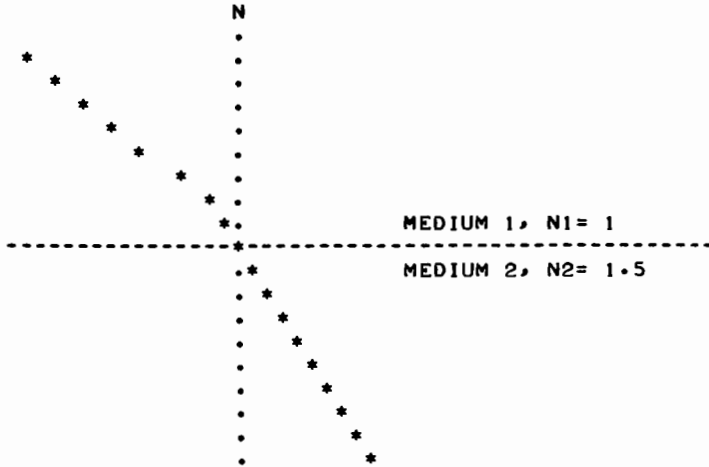
Huntington Project  
Polytechnic Institute of Brooklyn

RUN  
RUN  
SNELL

---REFRACTION OF LIGHT---

THIS PROGRAM WILL HELP YOU VISUALIZE THE REFRACTION OF LIGHT AS IT CROSSES A BOUNDARY SEPARATING TWO DIFFERENT MEDIA.

THE DIAGRAM BELOW SHOWS LIGHT INCIDENT TO THE BOUNDARY AT 45 DEGREES. THE INDICES OF REFRACTION ARE  $n_1=1.0$  AND  $n_2=1.5$  RESPECTIVELY.

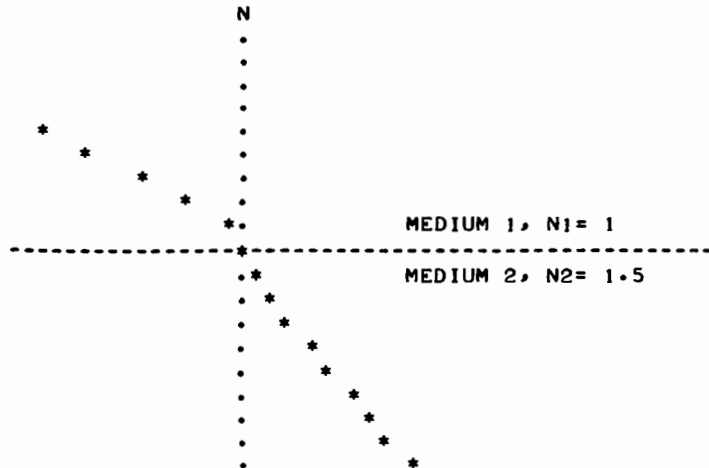


WHAT DO YOU THINK THE ANGLE OF REFRACTION IS?30  
YOU ARE WITHIN 10 PERCENT.  
THE ANGLE OF REFRACTION,  $A_2 = 28.126$

DO YOU WANT TO CONTINUE (1=YES, 0=NO) : ?1

NOW YOU CAN CHANGE THE INCIDENT ANGLE. THE REFRACTIVE INDICES WILL REMAIN AS  $n_1=1.0$  AND  $n_2=1.5$ .

REMEMBER, ONLY POSITIVE ANGLES BETWEEN 0 AND 90 DEGREES ARE PERMISSIBLE ENTRIES.  
SO, WHAT ANGLE DO YOU WANT?60



WHAT DO YOU THINK THE ANGLE OF REFRACTION IS?35  
YOU ARE WITHIN 10 PERCENT.  
THE ANGLE OF REFRACTION,  $A_2 = 35.264$

DO YOU WANT TO CONTINUE (1=YES, 0=NO) : ?1





|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b>            | SPACE: Spacecraft Orbits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>DESCRIPTION:</b>      | <p>The effects of speed on orbital motion can be demonstrated by incrementally altering the tangential velocity of an orbiting spacecraft. Limiting cases are included, i.e. exceeding the escape velocity and/or crashing into the earth.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                          | <p><u>OBJECTIVES:</u></p> <p>To demonstrate the effects of speed on orbital motion.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>INSTRUCTIONS:</b>     | <p><u>PRELIMINARY PREPARATION:</u></p> <p>A. Student - Student should be familiar with circular motion, central forces, and have some knowledge of conic sections.</p> <p>B. Materials - None</p> <p><u>DISCUSSION:</u></p> <p>Orbital motion is described in terms of the eccentricity (E) of the orbit, the period (T), and the maximum and minimum tangential velocities. The student selects the initial apogee and perigee (in miles) to define the orbit.</p> <p>After describing the initial orbit the limiting changes required to produce circular and parabolic orbits are given, as well as the changes required to produce an orbit that will be tangent to the earth's surface.</p> <p>The speed at the apogee and perigee is given and the student may alter either of these values (+ or -) incrementally. The new orbit will again be described in terms of E, T, and the velocities.</p> |
| <b>ACKNOWLEDGEMENTS:</b> | Huntington Project<br>Polytechnic Institute of Brooklyn                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

RUN  
RUN  
SPACE

SPACECRAFT ORBITS

WHAT IS THE MINIMUM AND MAXIMUM ALTITUDE OF THE SPACECRAFT  
ABOVE THE SURFACE OF THE EARTH IN MILES?150,230

THE ECCENTRICITY OF THE ORBIT IS 9.64088E-03

THE VELOCITY AT THE PERIGEE IS 25593.4 FEET/SECOND.

THE VELOCITY AT THE APOGEE IS 25104.6 FEET/SECOND.

THE PERIOD OF THE ORBIT IS 90.5043 MINUTES.

ADDING A VELOCITY INCREMENT TO THE PERIGEE  
OF 10427.9 FT/SEC WOULD RESULT IN A  
PARABOLIC ORBIT-- CAUSING THE SPACECRAFT TO FLY OFF INTO SPACE.

A CHANGE OF -122.488 FT/SEC WOULD PRODUCE A  
CIRCULAR ORBIT. HOWEVER, A VELOCITY INCREMENT  
OF -360.375 FT/SEC WOULD PRODUCE AN ORBIT  
THAT WOULD BE TANGENT TO THE EARTH'S SURFACE.

ADDING A VELOCITY INCREMENT TO THE APOGEE  
OF 10571. FT/SEC WOULD RESULT IN A  
PARABOLIC ORBIT-- CAUSING THE SPACECRAFT TO FLY OFF INTO SPACE.

A CHANGE OF 121.895 FT/SEC WOULD PRODUCE A  
CIRCULAR ORBIT. HOWEVER, A VELOCITY INCREMENT  
OF -236.695 FT/SEC WOULD PRODUCE AN ORBIT  
THAT WOULD BE TANGENT TO THE EARTH'S SURFACE.

DO YOU WANT TO ADD A VELOCITY INCREMENT AT THE  
PERIGEE(TYPE 1) OR AT THE APOGEE(TYPE 2) ?1

WHAT VELOCITY INCREMENT IS TO BE ADDED?-250

THE NEW ORBIT IS ELLIPTICAL  
WITH AN EBCENTRICITY OF 9.98735E-03

THE POINT WHERE THE VELOCITY INCREMENT WAS ADDED  
CORRESPONDS TO THE APOGEE OF THE NEW ORBIT  
THE PERIGEE OF THE NEW ORBIT IN MILES IS 68.7358

THE VELOCITY AT THE PERIGEE IS 25854.7 FT/SEC.

THE PERIOD OF THE NEW ORBIT IS 87.8788 MINUTES.

\*\*\*\*\*

BASED ON YOUR ORIGINAL ALTITUDES OF 150 AND 230 MILES  
WOULD YOU LIKE TO TRY DIFFERENT VELOCITY INCREMENTS  
(1-YES, 0-NO)?0

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)?0

\*\*\*\*\*

DONE

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TITLE:</b>                  | OPTICAL ABSORPTION SPECTRA SIMULATION,<br>2-SPECIES EQUILIBRIUM MIXTURES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>DESCRIPTION:</b>            | <p>This program computes and plots simulated optical absorption spectra for up to five equilibrium mixtures of a system of two interconvertible chemical species. The output resembles the recorder output of an infra-red, visible, or ultraviolet spectrophotometer.</p> <p>The program simply assigns a Gaussian curve to each of the two species. The two curves have their maxima separated by an arbitrary amount (variable D1 in the program) and are assigned arbitrary relative amplitudes (variable C1 in the program). The composite spectrum is taken to be the sum of the two curves, with each weighted by the mole fraction of the respective species. The mole fractions of one species (species 'A') are input by the student at execution time.</p> <p>The program can produce as many as five superimposed spectra, in which case the "isosbestic point" is quite evident. Each spectrum is plotted using an identifying digit as the plotting character.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>INSTRUCTIONS:</b>           | <p>At execution time, the student inputs:</p> <ol style="list-style-type: none"> <li>1. The number of spectra to be run (1-5)</li> <li>2. The mole fraction (concentration) of species 'A' for each spectrum.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>SPECIAL CONSIDERATIONS:</b> | <p>The relative spacing (<math>\lambda</math> max) and relative amplitudes (extinction coefficients) of the two absorption peaks can be changed by changing the respective data in line 210. This might necessitate a change in the plot scaling data in lines 102 and 112.</p> <p>FOR INSTRUCTIONAL PURPOSES<br/>Suitable Courses: Analytical Chemistry, Physical Chemistry</p> <p>Student Background Required: Students should be acquainted with theory and operation of an optical spectrometer, as well as with the concept of chemical equilibrium.</p> <p>This program is used to supplement laboratory experiments involving spectra of equilibrium mixtures in solution, such as the determination of the pK of an acid-base indicator. The program can be used before or after the actual experiment to give students a better feel for the idealized spectra of such systems. Program parameters (D1 and C1) can be adjusted by the instructor to make the simulated spectra more closely resemble those of the system being studied.</p> <p>The phenomenon of the isosbestic point (the common intersection of all the spectra generated when the <u>total</u> concentration of the chemical species is kept constant) is very easily discussed in terms of this program. Examination of the simple model used (line 280) shows that this special point arises because one curve is weighted by M while the other is weighted by 1-M. Such weighting leads to the common intersection which is the isosbestic point. The M, 1-M coefficients exactly correspond, of course, to the mole fraction relationship which exists in an equilibrium mixture of two interconvertible species.</p> |
| <b>ACKNOWLEDGEMENTS:</b>       | Leonard Jay Soltzberg<br>Simmons College                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |



# RUN

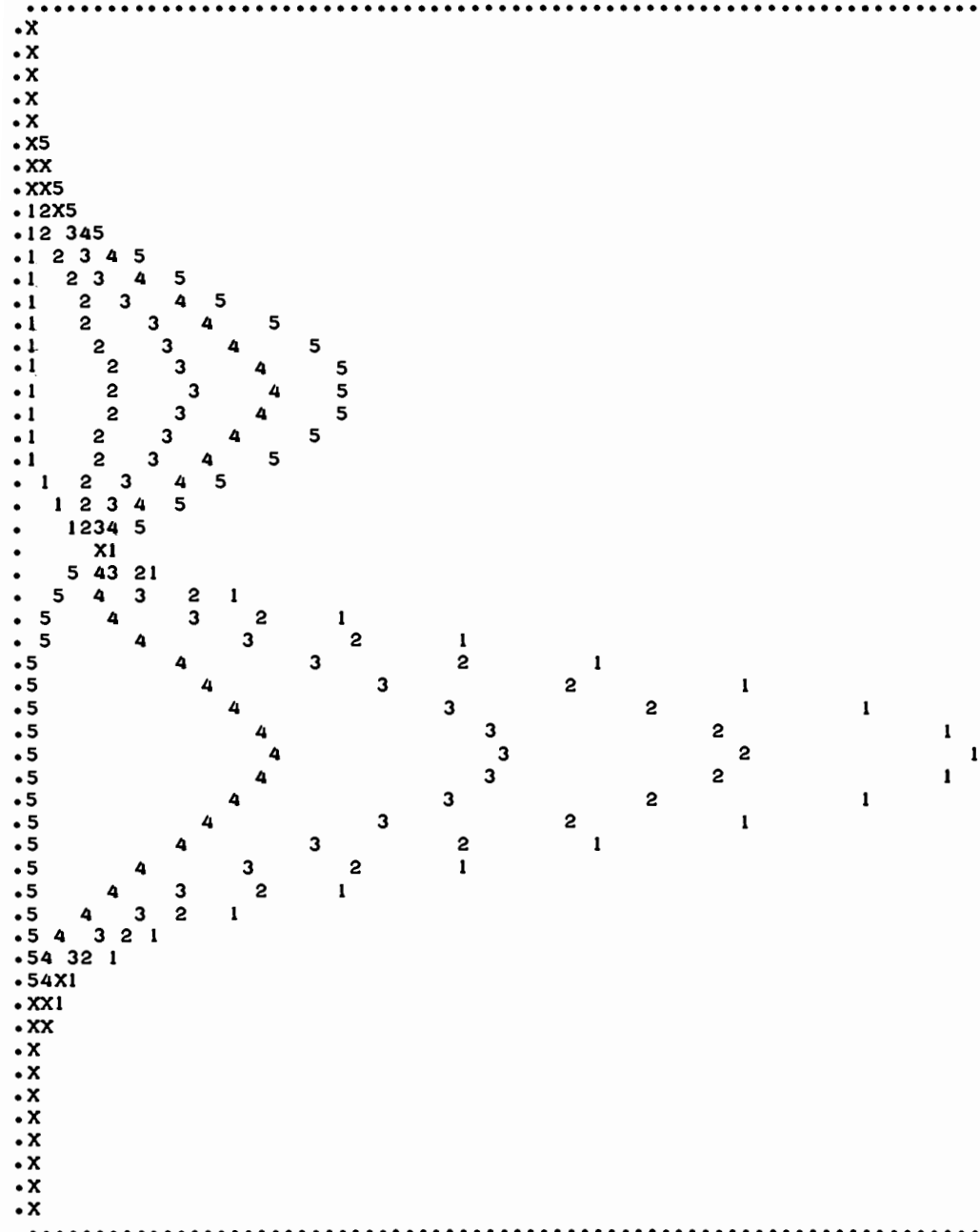
RUN

SPCTRA

NUMBER OF SPECTRA (5 MAX.)?5

ENTER MOLE FRACTION OF COMPONENT 'A' FOR EACH SPECTRUM

| SPECTRUM # | MOLE FRACTION OF 'A' |
|------------|----------------------|
| 1          | ?0.00                |
| 2          | ?0.25                |
| 3          | ?0.50                |
| 4          | ?0.75                |
| 5          | ?1.00                |



DONE

CONTRIBUTED PROGRAM **BASIC**

STERL  
36641

**TITLE:** FLY POPULATION CONTROL

**DESCRIPTION:** This program is a simulation designed to make possible any investigation of the effectiveness of two very different methods of pest control:  
1) the use of pesticides, and 2) the release of sterile males.

STERL was developed by the Huntington II Project at the Polytechnic Institute of Brooklyn under the direction of L. Braun. This work was partially supported by the National Science Foundation, Grant GW-5883.

**INSTRUCTIONS:** The user's goal is to destroy the fly population in a given area by choosing the methods of control. The program prompts appropriate response to indicate the type of control desired, and the simulation takes place.

**SPECIAL CONSIDERATIONS:** The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                          |               |
|--------------------------|---------------|
| <b>Student Workbook</b>  | <b>\$ .30</b> |
| <b>Teachers Guide</b>    | <b>.30</b>    |
| <b>Resource Handbook</b> | <b>.50</b>    |

**ACKNOWLEDGEMENTS:** Huntington II Project  
State University of New York

RUN

RUN  
STERL

CONTROL OF SCREW-WORM FLY POPULATION

INSTRUCTIONS (1=YES, 0=NO)?1

YOUR GOAL WILL BE TO ELIMINATE THE ONE MILLION MALE FLIES NOW IN YOUR 10000 SQUARE MILE AREA, THUS DESTROYING THE TOTAL FLY POPULATION. YOU MAY USE A PESTICIDE, RELEASE STERILE MALE FLIES, OR BOTH. INDICATE THE TYPE OF CONTROL PROGRAM YOU WANT BY TYPING IN THE APPROPRIATE RESPONSES TO THE FOLLOWING QUESTIONS:

'PESTICIDE?'

0= NO PESTICIDES.

1= PESTICIDES ON SPECIFIED DAYS. INDICATE THESE DAYS BY TYPING A DAY NUMBER (BETWEEN 1 AND 75) NEXT TO EACH '?' THAT APPEARS; TYPE 0 WHEN FINISHED.

'STERILE FLIES?'

0= NO STERILE FLIES.

1= STERILE FLIES WILL BE RELEASED. COMPUTER WILL ASK 'HOW OFTEN?' TYPE 1=DAILY OR 2=CERTAIN DAYS  
IF 1, SPECIFY NUMBER OF FLIES EACH DAY (UP TO 1000000), THE FIRST DAY OF THE PERIOD, AND THE LAST DAY (BETWEEN 1 AND 75 DAYS).  
IF 2, FOR EACH DAY SELECTED, SPECIFY THE DAY NUMBER (BETWEEN 1 AND 75) AND THE NUMBER OF STERILE FLIES (UP TO 1000000). USE A NEW LINE FOR EACH DAY.  
TYPE 0,0 WHEN FINISHED.

\*\*\*\*\*

PESTICIDE (1=YES, 0=NO)?1

WHICH DAYS

?1  
?11  
?21  
?31  
?41  
?51  
?61  
?71  
?0

STERILE FLIES (1=YES, 0=NO)?1

HOW OFTEN (1=DAILY, 2=SELECTED DAYS)?2

DAY, NUMBER OF FLIES

?2,1000000  
?3,1000000  
?4,1000000  
?12,1000000  
?13,1000000  
?14,1000000  
?22,1000000  
?23,1000000  
?24,1000000  
?0,0

|     |   | MILLIONS OF NORMAL ADULT MALE FLIES |           |           |           |           |               |
|-----|---|-------------------------------------|-----------|-----------|-----------|-----------|---------------|
|     |   | 0                                   | .2        | .4        | .6        | .8        | 1             |
| DAY | I | -----I                              | -----I    | -----I    | -----I    | -----I    | -----I        |
| 0   | I |                                     |           |           |           |           | * 1.00000E+06 |
| 1   | I | * 100000.                           |           |           |           |           |               |
| 2   | I |                                     |           | * 449489. |           |           |               |
| 3   | I |                                     |           | * 393439. |           |           |               |
| 4   | I |                                     |           | * 334594. |           |           |               |
| 5   | I |                                     |           | * 318814. |           |           |               |
| 6   | I |                                     |           |           | * 450118. |           |               |
| 7   | I |                                     |           |           | * 544413. |           |               |
| 8   | I |                                     |           |           |           | * 615256. |               |
| 9   | I |                                     |           |           |           | * 670304. |               |
| 10  | I |                                     |           |           |           | * 714209. |               |
| 11  | I | * 74996.                            |           |           |           |           |               |
| 12  | I |                                     |           | * 435154. |           |           |               |
| 13  | I |                                     |           | * 385717. |           |           |               |
| 14  | I |                                     |           | * 250520. |           |           |               |
| 15  | I | * 175145.                           |           |           |           |           |               |
| 16  | I | * 195974.                           |           |           |           |           |               |
| 17  | I | * 206759.                           |           |           |           |           |               |
| 18  | I | * 212442.                           |           |           |           |           |               |
| 19  | I | * 216854.                           |           |           |           |           |               |
| 20  | I | * 220481.                           |           |           |           |           |               |
| 21  | I | * 22402                             |           |           |           |           |               |
| 22  | I | * 182296.                           |           |           |           |           |               |
| 23  | I | * 164261.                           |           |           |           |           |               |
| 24  | I | * 93343.                            |           |           |           |           |               |
| 25  | I | * 83207.                            |           |           |           |           |               |
| 26  | I | * 115190.                           |           |           |           |           |               |
| 27  | I | * 134580.                           |           |           |           |           |               |
| 28  | I | * 146128.                           |           |           |           |           |               |
| 29  | I | * 157303.                           |           |           |           |           |               |
| 30  | I | * 169204.                           |           |           |           |           |               |
| 31  | I | * 18288                             |           |           |           |           |               |
| 32  | I |                                     | * 278245. |           |           |           |               |
| 33  | I |                                     |           | * 417323. |           |           |               |
| 34  | I |                                     |           | * 460778. |           |           |               |
| 35  | I |                                     |           | * 519622. |           |           |               |
| 36  | I |                                     |           | * 564348. |           |           |               |
| 37  | I |                                     |           | * 593302. |           |           |               |
| 38  | I |                                     |           | * 614001. |           |           |               |
| 39  | I |                                     |           | * 631237. |           |           |               |
| 40  | I |                                     |           | * 648231. |           |           |               |
| 41  | I | * 66531.                            |           |           |           |           |               |
| 42  | I | * 181276.                           |           |           |           |           |               |
| 43  | I | * 260112.                           |           |           |           |           |               |
| 44  | I | * 322424.                           |           |           |           |           |               |
| 45  | I |                                     | * 398735. |           |           |           |               |
| 46  | I |                                     | * 476509. |           |           |           |               |
| 47  | I |                                     | * 545846. |           |           |           |               |
| 48  | I |                                     | * 607354. |           |           |           |               |
| 49  | I |                                     | * 646326. |           |           |           |               |
| 50  | I |                                     | * 691699. |           |           |           |               |
| 51  | I | * 74036.                            |           |           |           |           |               |
| 52  | I |                                     |           |           |           |           | * 1.00000E+06 |
| 53  | I |                                     |           |           |           |           | * 1.00000E+06 |
| 54  | I |                                     |           |           |           |           | * 999637.     |
| 55  | I |                                     |           |           |           |           | * 1.00000E+06 |
| 56  | I |                                     |           |           |           |           | * 1.00000E+06 |
| 57  | I |                                     |           |           |           |           | * 1.00000E+06 |
| 58  | I |                                     |           |           |           |           | * 1.00000E+06 |
| 59  | I |                                     |           |           |           |           | * 1.00000E+06 |
| 60  | I |                                     |           |           |           |           | * 1.00000E+06 |
| 61  | I | * 99999.                            |           |           |           |           | * 1.00000E+06 |
| 62  | I |                                     |           | * 443562. |           |           |               |
| 63  | I |                                     |           | * 596412. |           |           |               |
| 64  | I |                                     |           | * 636960. |           |           |               |
| 65  | I |                                     |           | * 675094. |           |           |               |
| 66  | I |                                     |           | * 707673. |           |           |               |
| 67  | I |                                     |           | * 734624. |           |           |               |
| 68  | I |                                     |           | * 756652. |           |           |               |
| 69  | I |                                     |           | * 710685. |           |           |               |
| 70  | I |                                     |           | * 723414. |           |           |               |
| 71  | I | * 74181.                            |           |           |           |           |               |
| 72  | I |                                     |           |           |           |           | * 999999.     |
| 73  | I |                                     |           |           |           |           | * 1.00000E+06 |
| 74  | I |                                     |           |           |           |           | * 999760.     |

75 I \* 1.00000E+06  
I-----I-----I-----I-----I-----I

COST OF FLY CONTROL: \$ 890000.

ANOTHER RUN (1=YES, 0=NO)?0

DONE

**TITLE:**

MASS VOLUME

**DESCRIPTION:**

This program solves mass-mass, mass-volume, and volume-volume problems. The input may be in grams and/or moles and the output will be in grams, moles and/or liters.

OBJECTIVES:

To provide the teacher and the student with a stoichiometry calculator to be used where either finds it applicable.

**INSTRUCTIONS:**

PRELIMINARY PREPARATION:

- A. Student - The student must have an introduction to stoichiometry.
- B. Materials - None

DISCUSSION:

Some of the situations where this program is useful:

- A. In Class
  - 1. Enables teacher to cover a large number of problems without using time to do calculations.
  - 2. Can be used in conjunction with a problem exercise in class so teacher can go around and give individual help.
- B. Outside of Class
  - 1. Tutorial Work.
  - 2. Students can check homework problems during study periods or after school.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
STOICH

DO YOU WISH TO SKIP THE INSTRUCTIONS? 1 FOR YES ,0 FOR NO?0  
THIS PROGRAM IS DESIGNED TO SOLVE:

- 1. MASS-MASS PROBLEMS
- 2. MASS-VOLUME PROBLEMS
- 3. VOLUME-VOLUME PROBLEMS

SOME GENERAL INSTRUCTIONS FOR USING THE PROGRAM WILL  
BE HELPFUL AT THIS TIME.

- 1. IF TWO PIECES OF DATA ARE REQUESTED, BE SURE TO  
GIVE THEM IN THE ORDER REQUESTED AND SEPARATE  
THEM WITH A COMMA.
- 2. THE BALANCED EQUATION IS THE FIRST THING  
NEEDED WITH EACH TYPE OF PROBLEM SO HAVE IT PREPARED.
- 3. THE FORMULA WEIGHTS ARE NEEDED NEXT SO HAVE THEM  
PREPARED.

PICK THE TYPE OF CALCULATION YOU DESIRE BY ANSWERING THE  
FOLLOWING QUESTION WITH A 1,2, OR 3:

- 1 FOR MASS-MASS CALCULATIONS
- 2 FOR MASS-VOLUME CALCULATIONS
- 3 FOR VOLUME-VOLUME CALCULATIONS

WHAT IS THE NUMBER OF YOUR CHOICE?1

\*\*\*\*\*

PROVIDE THE FOLLOWING DATA FOR THIS MASS-MASS PROBLEM:

HOW MANY MOLES OF KNOWN COMPOUND AND UNKNOWN COMPOUND  
ARE SHOWN IN THE BALANCED CHEMICAL EQUATION?1,1  
WHAT IS THE FORMULA WEIGHT OF THE KNOWN COMPOUND  
AND THE UNKNOWN COMPOUND ?100,56  
WHAT MASS, IN GRAMS, OF THE KNOWN COMPOUND IS INVOLVED  
IN THE CHEMICAL REACTION? IF THIS INFORMATION IS AVAILABLE  
IN MOLES ANSWER ZERO (0) AND WAIT FOR THE NEXT QUESTION?50.0  
ANSWERS: ..... .5                      MOLES OF UNKN. CPD.  
..... 28              GRAMS OF UNKN. CPD.

\*\*\*\*\*

DO YOU WISH TO SOLVE ANOTHER PROBLEM? ANSWER 1 FOR M-M,  
2 FOR M-V, 3 FOR V-V, AND ZERO (0) TO END THE PROGRAM.?2

\*\*\*\*\*

PROVIDE THE FOLLOWING DATA FOR THIS MASS-VOLUME PROBLEM:

HOW MANY MOLES OF KNOWN COMPOUND AND UNKNOWN COMPOUND  
ARE SHOWN IN THE BALANCED EQUATION?2,2  
WHAT IS THE FORMULA WEIGHT OF THE KNOWN COMPOUND AND THE  
UNKNOWN COMPOUND?18,2  
WHAT MASS, IN GRAMS, OF THE KNOWN COMPOUND IS INVOLVED  
IN THE CHEMICAL REACTION? IF ONLY VOLUME IS KNOWN  
ANSWER ZERO (0) AND WAIT FOR THE NEXT QUESTION?20.0  
ANSWERS: ..... 1.11111              MOLES OF UNKN. GAS  
..... 24.8889              LITERS OF UNKN. GAS

\*\*\*\*\*

DO YOU WISH TO SOLVE ANOTHER PROBLEM? ANSWER 1 FOR M-M,  
2 FOR M-V, 3 FOR V-V, AND ZERO (0) TO END THE PROGRAM.?3

\*\*\*\*\*

PROVIDE THE FOLLOWING DATA FOR THIS VOLUME-VOLUME PROBLEM:

HOW MANY MOLES KNOWN GAS AND UNKNOWN GAS ARE SHOWN  
IN THE BALANCED EQUATION?1.3,3  
WHAT IS THE VOLUME IN LITERS OF THE KNOWN GAS INVOLVED  
IN THE CHEMICAL REACTION? (VOLUME MUST BE AT STP.)?146  
ANSWER: ..... 336.923              LITERS OF UNKN. GAS

\*\*\*\*\*

DO YOU WISH TO SOLVE ANOTHER PROBLEM? ANSWER 1 FOR M-M,  
2 FOR M-V, 3 FOR V-V, AND ZERO (0) TO END THE PROGRAM.?1

\*\*\*\*\*

PROVIDE THE FOLLOWING DATA FOR THIS MASS-MASS PROBLEM:

HOW MANY MOLES OF KNOWN COMPOUND AND UNKNOWN COMPOUND  
ARE SHOWN IN THE BALANCED CHEMICAL EQUATION?1,1  
WHAT IS THE FORMULA WEIGHT OF THE KNOWN COMPOUND  
AND THE UNKNOWN COMPOUND ?56,74  
WHAT MASS, IN GRAMS, OF THE KNOWN COMPOUND IS INVOLVED  
IN THE CHEMICAL REACTION? IF THIS INFORMATION IS AVAILABLE  
IN MOLES ANSWER ZERO (0) AND WAIT FOR THE NEXT QUESTION?0  
HOW MANY MOLES OF KNOWN COMPOUND WERE INVOLVED IN  
THE CHEMICAL REACTION?2.9  
ANSWERS: ..... 2.9                    MOLES OF UNKN. CPD.  
          ..... 214.6                    GRAMS OF UNKN. CPD.

\*\*\*\*\*

DO YOU WISH TO SOLVE ANOTHER PROBLEM? ANSWER 1 FOR M-M,  
2 FOR M-V, 3 FOR V-V, AND ZERO (0) TO END THE PROGRAM.?2

\*\*\*\*\*

PROVIDE THE FOLLOWING DATA FOR THIS MASS-VOLUME PROBLEM:

HOW MANY MOLES OF KNOWN COMPOUND AND UNKNOWN COMPOUND  
ARE SHOWN IN THE BALANCED EQUATION?1,2  
WHAT IS THE FORMULA WEIGHT OF THE KNOWN COMPOUND AND THE  
UNKNOWN COMPOUND?2,23  
WHAT MASS, IN GRAMS, OF THE KNOWN COMPOUND IS INVOLVED  
IN THE CHEMICAL REACTION? IF ONLY VOLUME IS KNOWN  
ANSWER ZERO (0) AND WAIT FOR THE NEXT QUESTION?0  
WHAT IS THE VOLUME, IN LITERS, OF THE KNOWN GAS  
INVOLVED IN THE CHEMICAL REACTION? (VOLUME MUST BE AT STP)?212  
ANSWERS: ..... 18.9286                    MOLES OF UNKN. CPD.  
          ..... 435.357                    GRAMS OF UNKN. CPD.

\*\*\*\*\*

DO YOU WISH TO SOLVE ANOTHER PROBLEM? ANSWER 1 FOR M-M,  
2 FOR M-V, 3 FOR V-V, AND ZERO (0) TO END THE PROGRAM.?0

\*\*\*\*\*

DONE





CONTRIBUTED PROGRAM **BASIC**

USPOP  
36802

**TITLE:**

HUMAN POPULATION PROJECTION

**DESCRIPTION:**

USPOP is a highly flexible human population model. The student can investigate the effects of fertility, age of mother at birth of child, sex ratio of the offspring and age-dependent mortality on population size and structure. Through use of 1970 census data, held in DATA statements, the student need enter only a few of the required inputs.

If the student or teacher wishes to model situations other than that collected in the DATA statements, all or some of the required inputs may have to be changed.

**INSTRUCTIONS:**

USPOP uses simulation techniques as a stimulus to learning in the teaching of many key demographic concepts involving population growth and age distribution. Students play the role of demographers projecting future population trends. The STUDENT MANUAL (See "SPECIAL CONSIDERATIONS") leads the student through a series of five investigations, each involving a single concept. The following concepts are explored:

INVESTIGATION #1: Effect of fertility on population growth. Fertility is seen to have a major impact on population growth.

INVESTIGATION #2: Effect of time of birth of first child on the population-growth rate. Surprisingly, delaying the birth of the first child can slow population growth, even if the total number of offspring remains constant.

INVESTIGATION #3: Effect of reducing infant mortality. Reducing infant mortality to the lowest level realistically possible is seen to have only a minor impact on future population size.

INVESTIGATIONS #4 and #5: Exploration of factors affecting age distribution in a population. Again fertility is seen as the major factor. Mortality is important, but it has only a secondary effect on age distribution in the population.

**SPECIAL  
CONSIDERATIONS:**

The Huntington II Project recommends that for use of this program in the classrooms it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts, 01754.

|                   |        |
|-------------------|--------|
| Student Workbook  | \$ .30 |
| Teachers Guide    | \$ .30 |
| Resource Handbook | \$ .50 |

**ACKNOWLEDGEMENTS:**

Huntington II Project  
State University of New York

RUN

RUN  
USPOP

DO YOU WANT REPORTS 1) EVERY 5 YEAR INTERVAL  
OR 2) SELECTED YEARS?1

YEAR AT START OF PROJECTION?1970

DO YOU ASSUME STANDARD FERTILITY (1=YES,0=NO)?1  
WILL FERTILITY (1) STAY AT 2.45 OR (2) CHANGE SLOWLY  
TO A NEW LEVEL?1

DO YOU ASSUME STANDARD BIRTH DISTRIBUTION (1=YES,0=NO)?0  
PCT. FERTILITY OCCURING IN FEMALES AGES:

|    |            |     |
|----|------------|-----|
| 10 | - 14       | ?30 |
| 15 | - 19       | ?40 |
| 20 | - 24       | ?30 |
| 25 | - 29       | ?0  |
| 30 | - 34       | ?0  |
| 35 | - 39       | ?0  |
| 40 | - 44       | ?0  |
| 45 | AND OLDER? | ?0  |

DO YOU ASSUME STANDARD SEX RATIO (1=YES,0=NO)?1

DO YOU ASSUME STANDARD MORTALITY (1=YES,0=NO)?1

DO YOU ASSUME STANDARD POPULATION (1=YES,0=NO)?1

REPORT:1)SHORT 2)LONG 3)GRAPH 4)CHANGE ASSUMPTIONS 5)END?1

YEAR 1970 POP= 204.8 MILLION FERTILITY 2.45

REPORT:?1

YEAR 1975 POP= 218.8 MILLION FERTILITY 2.45

REPORT:?1

YEAR 1980 POP= 233.6 MILLION FERTILITY 2.45

REPORT:?1

YEAR 1985 POP= 247 MILLION FERTILITY 2.45

REPORT:?1

YEAR 1990 POP= 260.3 MILLION FERTILITY 2.45

REPORT:?1

YEAR 1995 POP= 274.9 MILLION FERTILITY 2.45

REPORT:?1

YEAR 2000 POP= 291 MILLION FERTILITY 2.45

REPORT:?5

ANOTHER PROJECTION (1=YES, 0=NO)?0

DONE

RUN  
USPOP

DO YOU WANT REPORTS 1) EVERY 5 YEAR INTERVAL  
OR 2) SELECTED YEARS?2

YEAR AT START OF PROJECTION?1975

DO YOU ASSUME STANDARD FERTILITY (1=YES,0=NO)?0  
FERTILITY IN 1975 ?2.06  
WILL FERTILITY (1) STAY AT 2.06 OR (2) CHANGE SLOWLY  
TO A NEW LEVEL?2

WHAT FERTILITY WILL BE STABLE?1  
HOW MANY DECADES UNTIL FERTILITY REACHES 1 ?3.5

DO YOU ASSUME STANDARD BIRTH DISTRIBUTION (1=YES,0=NO)?0  
 PCT. FERTILITY OCCURRING IN FEMALES AGES:  
 10 - 14 7.5  
 15 - 19 7.20  
 20 - 24 7.40  
 25 - 29 7.20  
 30 - 34 7.10  
 35 - 39 7.5  
 40 - 44 7.4.5  
 45 AND OLDER?0

DO YOU ASSUME STANDARD SEX RATIO (1=YES,0=NO)?0  
 PERCENT FEMALE BIRTHS?30

DO YOU ASSUME STANDARD MORTALITY (1=YES,0=NO)?0  
 CHANGE IN MORTALITY OCCURRING IN FEMALES  
 GROUPS (FROM AGE, TO AGE)?0,4

| GROUP | CURRENT DEATH/1000 | NEW VALUE |
|-------|--------------------|-----------|
| 0 - 4 | 17.8               | 710       |



CHANGE IN MORTALITY OCCURRING IN MALES  
 GROUPS (FROM AGE, TO AGE)?0,4

| GROUP | CURRENT DEATH/1000 | NEW VALUE |
|-------|--------------------|-----------|
| 0 - 4 | 22.5               | 714       |

DO YOU ASSUME STANDARD POPULATION (1=YES,0=NO)?0

CHANGE IN FEMALE POPULATION  
 GROUPS (FROM AGE, TO AGE)?0,0

| GROUP   | CURRENT POPULATION MILLIONS | NEW VALUE |
|---------|-----------------------------|-----------|
| 15 - 19 | 9.8                         | 78        |
| 20 - 24 | 8.6                         | 74.3      |
| 25 - 29 | 6.8                         | 73.4      |
| 30 - 34 | 5.7                         | 72.8      |

REPORT:1)SHORT 2)LONG 3)GRAPH 4)CHANGE ASSUMPTIONS 5)END?2

| YEAR 1975 AGES | POP= 192.4 FEMALES <-MILLIONS-> | MILLION MALES | FERTILITY 2.06 PCT. TOTAL |
|----------------|---------------------------------|---------------|---------------------------|
| 0 - 4          | 8.4                             | 8.7           | 8.9                       |
| 5 - 9          | 9.7                             | 10.1          | 10.3                      |
| 10 - 14        | 10.2                            | 10.5          | 10.8                      |
| 15 - 19        | 9.4                             | 8             | 9                         |
| 20 - 24        | 8.5                             | 4.3           | 6.6                       |
| 25 - 29        | 6.9                             | 3.4           | 5.3                       |
| 30 - 34        | 5.8                             | 2.8           | 4.4                       |
| 35 - 39        | 5.7                             | 5.5           | 5.8                       |
| 40 - 44        | 6.1                             | 5.8           | 6.1                       |
| 45 - 49        | 6.2                             | 5.9           | 6.3                       |
| 50 - 54        | 5.7                             | 5.3           | 5.7                       |
| 55 - 59        | 5.2                             | 4.7           | 5.1                       |
| 60 - 64        | 4.6                             | 4             | 4.5                       |
| 65 - 69        | 3.7                             | 3             | 3.5                       |
| 70 - 74        | 3.2                             | 2.3           | 2.9                       |
| 75 AND OVER    | 4.6                             | 2.9           | 3.9                       |

YEAR FOR NEXT REPORT?1985

REPORT:71

| YEAR 1985                 | POP= 206.5 | MILLION | FERTILITY 1.75714 |
|---------------------------|------------|---------|-------------------|
| YEAR FOR NEXT REPORT?1995 |            |         |                   |

REPORT:71

| YEAR 1995                 | POP= 217.4 | MILLION | FERTILITY 1.45429 |
|---------------------------|------------|---------|-------------------|
| YEAR FOR NEXT REPORT?2005 |            |         |                   |

REPORT:71

| YEAR 2005                 | POP= 215.8 | MILLION | FERTILITY 1.15143 |
|---------------------------|------------|---------|-------------------|
| YEAR FOR NEXT REPORT?2015 |            |         |                   |

REPORT:72

| YEAR 2015   | POP= 205.8           | MILLION | FERTILITY 1. |
|-------------|----------------------|---------|--------------|
| AGES        | FEMALES <-MILLIONS-> | MALES   | PCT. TOTAL   |
| 0 - 4       | 1.6                  | 3.8     | 2.6          |
| 5 - 9       | 2                    | 4.5     | 3.2          |
| 10 - 14     | 2.7                  | 5.9     | 4.2          |
| 15 - 19     | 3.7                  | 8.3     | 5.8          |
| 20 - 24     | 4.7                  | 10.3    | 7.3          |
| 25 - 29     | 5.3                  | 11.3    | 8            |
| 30 - 34     | 5.4                  | 11.4    | 8.2          |
| 35 - 39     | 5.2                  | 10.9    | 7.8          |
| 40 - 44     | 8.8                  | 8.8     | 8.6          |
| 45 - 49     | 9.9                  | 9.7     | 9.5          |
| 50 - 54     | 10                   | 9.7     | 9.5          |
| 55 - 59     | 8.9                  | 6.9     | 7.7          |
| 60 - 64     | 7.6                  | 3.4     | 5.4          |
| 65 - 69     | 5.7                  | 2.3     | 3.9          |
| 70 - 74     | 4.2                  | 1.4     | 2.7          |
| 75 AND OVER | 5.6                  | 4.1     | 4.7          |

YEAR FOR NEXT REPORT?2025

REPORT:71

| YEAR 2025                 | POP= 189.3 | MILLION | FERTILITY 1. |
|---------------------------|------------|---------|--------------|
| YEAR FOR NEXT REPORT?2035 |            |         |              |

REPORT:71

| YEAR 2035                 | POP= 165.7 | MILLION | FERTILITY 1. |
|---------------------------|------------|---------|--------------|
| YEAR FOR NEXT REPORT?2045 |            |         |              |

REPORT:71

| YEAR 2045                 | POP= 138.1 | MILLION | FERTILITY 1. |
|---------------------------|------------|---------|--------------|
| YEAR FOR NEXT REPORT?2055 |            |         |              |

REPORT:71

| YEAR 2055                 | POP= 113 | MILLION | FERTILITY 1. |
|---------------------------|----------|---------|--------------|
| YEAR FOR NEXT REPORT?2300 |          |         |              |

REPORT:72

| YEAR 2300   | POP= 27.9            | MILLION | FERTILITY 1. |
|-------------|----------------------|---------|--------------|
| AGES        | FEMALES <-MILLIONS-> | MALES   | PCT. TOTAL   |
| 0 - 4       | .2                   | .4      | 2.5          |
| 5 - 9       | .3                   | .6      | 3.3          |
| 10 - 14     | .4                   | .7      | 4.1          |
| 15 - 19     | .5                   | .8      | 5            |
| 20 - 24     | .6                   | .9      | 5.7          |
| 25 - 29     | .7                   | 1       | 6.5          |
| 30 - 34     | .8                   | 1.1     | 7.3          |
| 35 - 39     | .9                   | 1.1     | 7.5          |
| 40 - 44     | .9                   | 1.1     | 7.6          |
| 45 - 49     | .9                   | 1.1     | 7.7          |
| 50 - 54     | .9                   | 1.1     | 7.6          |
| 55 - 59     | .9                   | 1.1     | 7.5          |
| 60 - 64     | .9                   | 1       | 7.1          |
| 65 - 69     | .8                   | .8      | 6.3          |
| 70 - 74     | .7                   | .6      | 5.2          |
| 75 AND OVER | 1.3                  | .9      | 8.3          |

YEAR FOR NEXT REPORT?3000

REPORT:75

ANOTHER PROJECTION (1=YES, 0=NO)?0

DONE

VFIELD  
36322**TITLE:**

VFIELD: Potential Field Picture

**DESCRIPTION:**

This program plots a picture of the relative potential field strengths of regions surrounding two point charges.

OBJECTIVES:

To give the student a feel for how the electric potential field is altered by changing the positions of two point charges.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

A. Student - The concept of electric potential for a point charge should be understood, as well as equipotential lines and potential hills or swells.

B. Materials - none needed

DISCUSSION:

One run of this program requires much time, so it is not advised for use with a whole class. Individual students or small groups will derive the greatest benefit, or, alternatively, the teacher may make several runs before class and display the resulting plots during a class discussion.

The coordinate plane occupied by the charges is 30 x 30.

NOTE: The numbers in the plots indicate relative field strengths.

**ACKNOWLEDGEMENTS:**

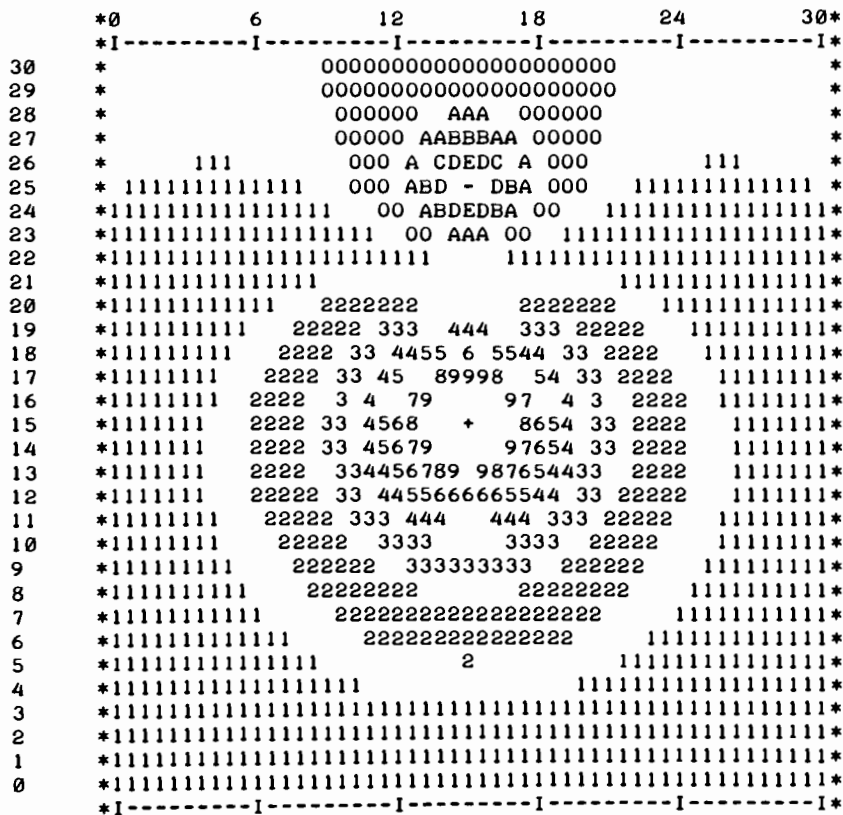
Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
VFIELD

THIS PROGRAM PLOTS A PICTURE OF THE RELATIVE ELECTRICAL POTENTIAL FIELD STRENGTHS IN THE REGION SURROUNDING TWO POINT CHARGES. THE CHARGES ARE IN A COORDINATE PLANE 30 BY 30. THE CHARGES MAY HAVE ANY VALUE WHOSE MAGNITUDE IS LESS THAN 10 , AND MAY BE ANYWHERE BETWEEN 0 AND 30 ON THE X AND Y AXES. THE MAGNITUDE OF THE FIELD DECREASES FROM 9 TO 1, 0, A TO J THAT IS, 9 TO 1 IS A POSITIVE POTENTIAL, 0 IS ROUGHLY 0, AND A=-1, B=-2, ... J=-9. (THERE IS NO 'I'.)

WHAT VALUES OF CHARGES DO YOU WISH TO STUDY?  
TO STUDY ONLY ONE CHARGE, MAKE THE SECOND CHARGE 0.  
ENTER TWO VALUES OF CHARGE : 710,-3.5  
WHERE SHALL THE FIRST CHARGE BE LOCATED?15,15  
WHERE SHALL THE SECOND CHARGE BE LOCATED?15,25



DO YOU WISH TO VIEW ANOTHER PLOT (1=YES, 0=NO) : 70

DONE

VLOCTY  
36323**TITLE:**

VLOCTY: Instantaneous Velocity

**DESCRIPTION:**

A graph of distance vs. time is plotted for a body accelerating at 1m/sec/sec. The average velocity is found for a point on the graph several times using  $V_{\text{average}} = (d_2 - d_1)/(T_2 - T_1)$  as  $(T_2 - T_1)$  gets smaller and smaller.

The program prints the instantaneous velocity at the points and allows the student to change some of the parameters involved.

OBJECTIVES:

To aid the student in understanding the meaning of instantaneous velocity and taking a limit.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - should know the definitions of average and instantaneous velocity
- B. Materials - none

DISCUSSION:

A good tutorial program or teaching aid. Student should realize that the slope of the line drawn between the points  $d_1, T_1$ , and  $d_2, T_2$  is the average velocity. As the second point is made to approach the first, the slope of this line approaches the value of the slope of the tangent line drawn to the first point - which is called the instantaneous velocity.

The student may then change the acceleration, time at which he wants to know the average speed, and the time interval,  $\Delta T$ .

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn



RUN  
 RUN  
 VLOCTY

AVERAGE AND INSTANTANEOUS VELOCITY

THIS PROGRAM CONSIDERS DISTANCE AS A FUNCTION OF TIME,  $D=F(T)$ . IT WILL CALCULATE THE AVERAGE VELOCITY DURING THE TIME INTERVAL  $T_1, T_2$  BY EVALUATING  $D$  AT THOSE TIMES GIVING  $D_1$  AND  $D_2$ . THE RESULT OF  $(D_2-D_1)/(T_2-T_1)$  YIELDS THE AVERAGE VELOCITY. AS  $T_2$  IS BROUGHT CLOSER AND CLOSER TO  $T_1$  THE RESULTANT AVERAGE VELOCITY WILL APPROACH THE INSTANTANEOUS VELOCITY AT  $T_1$ .

AFTER THE PROGRAM STOPS, TYPE IN THE FOLLOWING:  
 (END EACH LINE, INCLUDING 'RUN', WITH THE 'RETURN' KEY)

```
1 GO TO 300
300 DEF FND(T)=....(YOUR FUNCTION OF TIME)....
RUN
```

FOR EXAMPLE, TO USE THE EQUATION  $D=A*T*T$  WITH  $A=1$  YOU WOULD TYPE AS FOLLOWS:

```
1 GO TO 300
300 DEF FND(T)=1*T*T
RUN
```

YOU MIGHT TRY THAT AS YOUR FIRST RUN.  
 FOR SUBSEQUENT RUNS, YOU NEED ONLY CHANGE LINE 300 FOR A NEW FUNCTION, FOLLOWED BY 'RUN'.

DONE

```
1 GO TO 300
300 DEF FND(T)=1*T*T
RUN
VLOCTY
```

\*\*\*\*\*

WHAT ARE YOUR VALUES OF  $T_1$  AND  $T_2$  (SMALLER FIRST:  $T_1, T_2$ )?5,50

THE DISTANCE TRAVELED DURING THE INTERVAL IS 2475  
 THE AVERAGE VELOCITY IS 55

WOULD YOU LIKE TO CHANGE  $T_2$  (1-YES, 0-NO)?1  
 WHAT IS YOUR NEW VALUE FOR  $T_2$  ( $T_2$  MUST BE GREATER THAN  $T_1$ )?105

THE DISTANCE TRAVELED DURING THE INTERVAL IS 11000  
 THE AVERAGE VELOCITY IS 110

WOULD YOU LIKE TO CHANGE  $T_2$  (1-YES, 0-NO)?0

NOW WATCH THE AVERAGE VELOCITY AS  $T_2$  APPROACHES  $T_1$ .

| $T_2$   | $T_2-T_1$   | $D_2$   | $D_2-D_1$ | Average Velocity |
|---------|-------------|---------|-----------|------------------|
| 105     | 100         | 11025   | 11000     | 110              |
| 55      | 50          | 3025    | 3000      | 60               |
| 30      | 25          | 900     | 875       | 35               |
| 17.5    | 12.5        | 306.25  | 281.25    | 22.5             |
| 11.25   | 6.25        | 126.562 | 101.562   | 16.25            |
| 8.125   | 3.125       | 66.0156 | 41.0156   | 13.125           |
| 6.5625  | 1.5625      | 43.0664 | 18.0664   | 11.5625          |
| 5.78125 | .78125      | 33.4229 | 8.42285   | 10.7812          |
| 5.39062 | .390625     | 29.0588 | 4.05884   | 10.3906          |
| 5.19531 | .195312     | 26.9913 | 1.99127   | 10.1953          |
| 5.09766 | 9.76562E-02 | 25.9861 | .986099   | 10.0977          |
| 5.04883 | 4.88281E-02 | 25.4907 | .490665   | 10.0488          |

| T2              | T2-T1       | D2      | D2-D1       |         |
|-----------------|-------------|---------|-------------|---------|
| (D2-D1)/(T2-T1) |             |         |             |         |
| --              | -----       | --      | -----       |         |
| -----           |             |         |             |         |
| 5.02441         | 2.44141E-02 | 25.2447 | .244736     | 10.0244 |
| 5.01221         | .012207     | 25.1222 | .122219     | 10.0122 |
| 5.0061          | 6.10352E-03 | 25.0611 | 6.10733E-02 | 10.0063 |
| 5.00305         | 3.05176E-03 | 25.0305 | 3.05252E-02 | 10.0025 |
| 5.00153         | 1.52588E-03 | 25.0153 | 1.52626E-02 | 10.0025 |
| 5.00076         | 7.62939E-04 | 25.0076 | 7.62939E-03 | 10      |

NOTE THAT THE AVERAGE VELOCITY CHANGES VERY LITTLE AS T2 APPROACHES T1. T2 CAN NEVER EQUAL T1 SINCE (D2-D1)/(T2-T1) WOULD THEN RESULT IN A DIVISION BY ZERO.

\*\*\*\*\*

WOULD YOU LIKE TO TRY DIFFERENT VALUES OF T1 AND T2 (1-YES, 0-NO)?0  
 TO CHANGE YOUR FUNCTION SEE THE INSTRUCTIONS.  
 IF YOU ARE FINISHED, TYPE '1', AND THE 'RETURN' KEY AFTER THE PROGRAM STOPS.

DONE



**TITLE:**

WATER1: Water Budget Problem Check

**DESCRIPTION:**

This is a tutorial program which takes a student through the step-by-step calculations of a water budget, checks the correctness of his responses, and indicates the location of his errors. In difficult parts of the budget instructions, clues are given before the student is asked to re-calculate his work.

OBJECTIVES:

This program is designed to:

- A. Enable students to "visualize" an areas' climate in terms of its moisture patterns of usage, storage, recharge, and deficit.
- B. Illustrate the relationship of deficit and surplus in light of growing seasons for crops, watering of lawns, the need for irrigation, and the occurrence of floods.
- C. Develop the skills necessary for the successful completion of a water budget.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - Students should understand the following terms: potential evapotranspiration, actual evapotranspiration, deficit, and surplus. The concept of a change in value of a number (  $-ST$  or 'delta'- $ST$  ) should also have been covered.
- B. Materials - Ditto sheets containing water budget tables should be available for each class member. A sample table follows:

Continued on following page.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

WATER BUDGET  
FOR: \_\_\_\_\_

| Progress<br>code no. |  | J | F | M | A | M | J | J | A | S | O | N | D |
|----------------------|--|---|---|---|---|---|---|---|---|---|---|---|---|
| P                    |  |   |   |   |   |   |   |   |   |   |   |   |   |
| PE                   |  |   |   |   |   |   |   |   |   |   |   |   |   |
| P-<br>PE             |  |   |   |   |   |   |   |   |   |   |   |   |   |
| ST                   |  |   |   |   |   |   |   |   |   |   |   |   |   |
| $\Delta$ ST          |  |   |   |   |   |   |   |   |   |   |   |   |   |
| AE                   |  |   |   |   |   |   |   |   |   |   |   |   |   |
| D                    |  |   |   |   |   |   |   |   |   |   |   |   |   |
| S                    |  |   |   |   |   |   |   |   |   |   |   |   |   |

A set of water budget graphs should also be available if the teacher wishes to have his classes complete the graph in addition to the water budget. See: Investigating the Earth, Teacher's Guide, Part I. P. 402 of the Earth Science Curriculum Project.

DISCUSSION:

This program is applicable to individual or small group (5 or less) instruction, and is designed for average students.

The progress code number assigned to the student indicates to the program the extent to which the student has progressed through the program. These numbers should be chosen according to the following table:

| <u>Progress<br/>Code #</u> | <u>Stage of Calculation of Water Budget</u>    |
|----------------------------|------------------------------------------------|
| 0-10                       | Introductory information                       |
| 11-20                      | Student is ready for "P-PE" section of program |
| 21-30                      | ready for "ST" section of program              |
| 31-40                      | ready for "-ST" section of program             |
| 41-50                      | ready for "A.E." section of program            |
| 51-60                      | ready for "D" section of program               |
| 61-70                      | ready for "S" section of program               |

Each student may work on a different water budget by entering a unique set of data in lines 43 and 44. Line 42 also may be changed to indicate the region whose water budget is under study.

This program should be used in conjunction with program WATER2 A833-36327.

RUN  
RUN  
WATER1

WHAT IS YOUR PROGRESS CODE NUMBER?5

WATER BUDGET FOR RUTLAND,VT.:

=====

P:

|    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 57 | 48 | 63 | 74 | 80 | 90 | 86 | 86 | 92 | 94 |
| 88 | 56 |    |    |    |    |    |    |    |    |

PE:

|   |   |   |    |    |     |     |     |    |    |
|---|---|---|----|----|-----|-----|-----|----|----|
| 0 | 0 | 0 | 28 | 75 | 114 | 133 | 114 | 78 | 41 |
| 8 | 0 |   |    |    |     |     |     |    |    |

NOW, RETURN TO YOUR SEATS AND SEPARATELY WORK OUT YOUR VALUES  
FOR: 'P-PE' AND 'STORAGE'.  
RETURN ONLY AFTER YOUR TEACHER HAS CHECKED YOUR WORK AND GIVEN  
YOU A NEW PROGRESS CODE NUMBER!

DONE



CONTRIBUTED PROGRAM **BASIC**

WATER2  
36327

TITLE:

WATER2: Water Budget

DESCRIPTION:

This program prints out a completed water budget. It may be used by a teacher to quickly calculate a series of water budgets he plans to use or it may be employed with more advanced students to check out an entire budget in one run.

OBJECTIVES:

- A. To free teachers from the time-consuming task of calculating a number of practice water budgets.
- B. To allow students a rapid means of verifying budgets they have been assigned for practice and drill.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

- A. Student - Students should be completely familiar with the concepts of evapotranspiration, water surplus, water storage, and water deficit.
- B. Materials - A ditto of water budget tables as shown below:

WATER BUDGET  
FOR: \_\_\_\_\_

|             | J | F | M | A | M | J | J | A | S | O | N | D |
|-------------|---|---|---|---|---|---|---|---|---|---|---|---|
| P           |   |   |   |   |   |   |   |   |   |   |   |   |
| PE          |   |   |   |   |   |   |   |   |   |   |   |   |
| P-PE        |   |   |   |   |   |   |   |   |   |   |   |   |
| ST          |   |   |   |   |   |   |   |   |   |   |   |   |
| $\Delta$ ST |   |   |   |   |   |   |   |   |   |   |   |   |
| AE          |   |   |   |   |   |   |   |   |   |   |   |   |
| D           |   |   |   |   |   |   |   |   |   |   |   |   |
| S           |   |   |   |   |   |   |   |   |   |   |   |   |

Continued on following page.

ACKNOWLEDGEMENTS:

Huntington Project  
Polytechnic Institute of Brooklyn





**TITLE:**

WAVES: Sum of Two Waves

**DESCRIPTION:**

This program finds the sum of two waves: one predetermined by the program, and the other determined by the student. There are options of either displaying both waves and their sum, or just their sum.

OBJECTIVES:

To enable the student to study, independently, the effect of changes in wavelength, amplitude, and phase on the superposition pattern formed by two waves.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

A. Student - Some experience with "SLINKY" wave superposition: knowledge of phase, amplitude, and wave length.

B. Materials - none

DISCUSSION:

The student controlled wave ("B") may have wavelenghts ranging from 2 to 8, though only a wave length of 4 may be fully displayed. Its amplitude can be varied between 5 and 11, and its phase can be any decimal part of a wavelength.

The fixed wave ("A") has a wavelenght of 4, and an amplitude of 10.

The display consists of both waves, side by side, and their superposition, or just their superposition.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

**RUN**

RUN  
WAVES

WAVES AND THEIR SUPERPOSITION  
DO YOU NEED INSTRUCTIONS (1=YES, 0=NO) : ?1

IN THIS PROGRAM YOU MAY OBSERVE THE EFFECTS OF  
CHANGING WAVELENGTH, AMPLITUDE, AND PHASE ON TWO  
WAVES AND ON THEIR SUM (OR SUPERPOSITION).

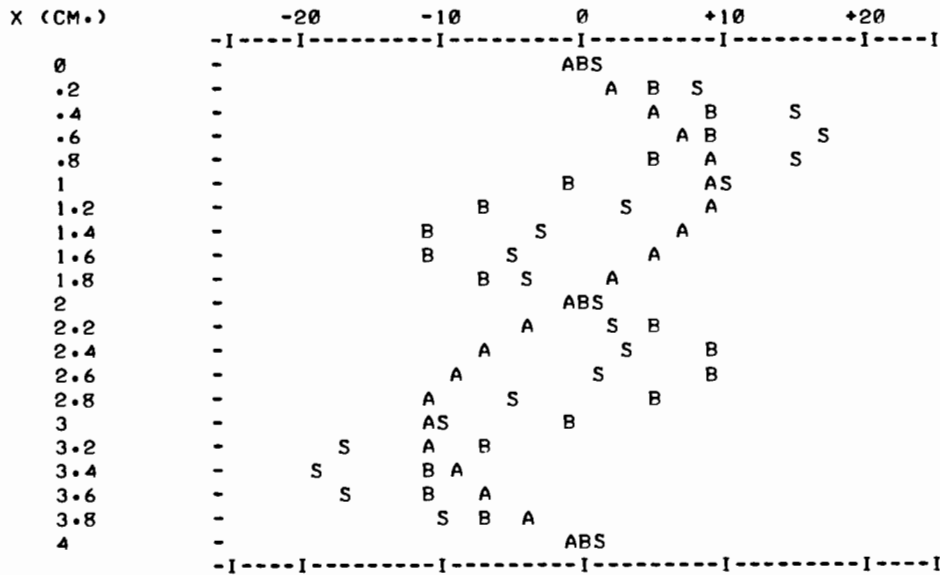
WAVE 'A' IS FIXED. ITS WAVELENGTH IS 4, ITS AMPLITUDE  
IS 10, AND ITS PHASE IS 0.

WAVE 'B' MAY BE CHANGED BY YOU. FOR BEST RESULTS :  
WAVELENGTH (L) BETWEEN 2 AND 4  
AMPLITUDE (A) BETWEEN 5 AND 10  
PHASE (P) BETWEEN 0 AND 1  
(FOR EXAMPLE, .5 PHASE = 1/2 WAVELENGTH)

IT IS EASIEST TO SEE THE EFFECTS OF CHANGES IN EACH  
PARAMETER IF YOU HOLD TWO CONSTANT AND VARY THE OTHER,  
ALTHOUGH ALL THREE MAY BE VARIED AT ONCE.

WHAT IS YOUR CHOICE OF WAVELENGTH, AMPLITUDE, AND PHASE?2,10,0

NOTATION: A = 'A' WAVE  
B = 'B' WAVE  
S = SUPERPOSITION WAVE



WANT TO TRY ANOTHER SET OF VALUES (1=YES, 0=NO) : ?0

DONE

CONTRIBUTED PROGRAM **BASIC**KEYSIG  
36258

**TITLE:** GIVES MAJOR SCALES

**DESCRIPTION:** This program prints out the major scale of any musical key that is requested or all of them at once. They are printed on a staff with keysignature, and at the bottom of each measure abbreviation of the key is printed.

**INSTRUCTIONS:** To get all of the major scales printed, just type "ALL" at the question mark. To get one or more of the scales just type the letter of that scale (A through G). Then type an "N" if it is natural, an "S" if it is sharp, or an "F" if it is flat. You may continue this procedure on the same line for up to 36 keys. There is no need to separate the keys by any type of character.

**SPECIAL CONSIDERATIONS:** The Aardvark and Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

**ACKNOWLEDGEMENTS:** Aardvark and Company  
2130 Bell Court  
Lakewood, Colorado 80215



CONTRIBUTED PROGRAM **BASIC**MUSIC2  
36276

**TITLE:** TRIAD SOLVING PROGRAM

**DESCRIPTION:** This program prints major, minor, diminished, or augmented triads on a staff.

**INSTRUCTIONS:** The instructions are self-explanatory. However, concerning the output "6" is the symbol for a flat, and "#" is the symbol for a sharp.

**SPECIAL CONSIDERATIONS:** The Aardvark and Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

**ACKNOWLEDGEMENTS:** John C. Ridges  
Aardvark and Company  
2130 Bell Court  
Lakewood, Colorado 80215

RUN

RUN  
MUSIC2

THIS PROGRAM PRINTS TRIADS ON A STAFF.  
M=MAJOR N=MINOR A=AUGMENTED D=DIMINISHED  
N=NATURAL F=FLAT S=SHARP  
EACH TRIAD HAS 3 LETTERS EXAMPLE:  
AFA=A FLAT AUGMENTED  
THE NUMBER OF TRIADS MUST BE BETWEEN 1 AND 30  
EXAMPLE: AFNDNMGSD  
WHAT TRIADS DO YOU WANT?AFAAFNDNMGSD

```
-----  
  0  60  
-----0-----  
  0  60  
-----0-----  
 60  60  0  
-----#0-----  
                #0  
-----  
                0
```

DONE

CONTRIBUTED PROGRAM **BASIC**

MUSIC5  
36259

**TITLE:**

FINDS DOMINANT SEVENTHS

**DESCRIPTION:**

This program finds the dominant sevenths of any key.

**INSTRUCTIONS:**

Run the program. Input the keys you want (without commas) and it will print out the sevenths.

**SPECIAL  
CONSIDERATIONS:**

The Aardvark and Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

**ACKNOWLEDGEMENTS:**

Aardvark and Company  
2130 Bell Court  
Lakewood, Colorado 80215



**RUN**

RUN  
MUSIC5

FINDS DOMINATE SEVENTHS.

'X'=DOUBLE SHARP, 'S'=SHARP, 'N'=NATURAL,  
'F'=FLAT, AND 'D'=DOUBLE FLAT.

'M'=MAJOR, 'A'=AEOLIAN MINOR, AND 'H'=HARMONIC MINOR.

INPUT KEY?CSMANAAFH

CSM

THE V7 OF I IS GS BS DS FS  
THE V7 OF II IS AS CX ES GS  
THE V7 OF III IS BS DX FX AS  
THE V7 OF IV IS CS ES GS BN  
THE V7 OF V IS DS FX AS CS  
THE V7 OF VI IS ES GX BS DS  
THE V7 OF VII IS FS AS CS EN

ANA

THE V7 OF I IS EN GS BN DN  
THE V7 OF II IS FN AN CN EF  
THE V7 OF III IS GN BN DN FN  
THE V7 OF IV IS AN CS EN GN  
THE V7 OF V IS BN DS FS AN  
THE V7 OF VI IS CN EN GN BF  
THE V7 OF VII IS DN FS AN CN

AFH

THE V7 OF I IS EF GN BN DF  
THE V7 OF II IS FF AF CF ED  
THE V7 OF III IS GN BS DN FN  
THE V7 OF IV IS AF CN EF GF  
THE V7 OF V IS BN DN FN AF  
THE V7 OF VI IS CF EF GF BF  
THE V7 OF VII IS DF FN AF CF

DONE

SOCIAL SCIENCE (EDUCATION) (860)  
CONTRIBUTED PROGRAM **BASIC**

BALANC  
36328

**TITLE:**

BALANC: Trade and Payment Balances

**DESCRIPTION:**

This program demonstrates the distinction between "balance of trade" and "balance of payments." Also shown are the components that make up the "balance of payments" account, and their individual impacts.

OBJECTIVES:

- A. To emphasize the important distinction between "Balance of Trade", and "Balance of Payments".
- B. To demonstrate the impact of any specific foreign expenditure on our "Balance of Payments".

**INSTRUCTIONS:**

PRELIMINARY PREPARATION:

- A. Student must obtain data for components of balance of payments for a given year and country.
- B. Discussion of the concepts "balance of trade" and "balance of payments", would be helpful but are not necessary.

DISCUSSION:

- A. Student level - average
- B. Curriculum location - advanced economics: Unit on U. S. Economy in the world.
- C. This program may be used either as a group exercise, or for individual study.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
BALANC

THERE'S A DISTINCTION BETWEEN TRADE BALANCE AND  
BALANCE OF PAYMENTS.

TRADE BALANCE = EXPORTS-IMPORTS.

BALANCE OF PAYMENTS= ALL OVERSEAS EXCHANGES+  
ALL OVERSEAS EXPENDITURES.

WHEN INFORMATION IS REQUESTED, INPUT VALUES IN  
MILLIONS OF DOLLARS (E.G. 6 = 6 MILLION DOLLARS)

A.  
INPUT A FIGURE FIRST FOR ALL MILITARY AID, THEN  
FOR ALL OTHER AID TO OTHER NATIONS.  
?12,13

B.  
INPUT A FIGURE FIRST FOR EXPORTS, THEN FOR IMPORTS.  
?256,23

C.  
INPUT A FIGURE FIRST FOR FOREIGNERS TRAVELING IN  
YOUR COUNTRY, THEN FOR YOUR COUNTRYMEN TRAVELING  
ABROAD.  
?254,56

D.  
INPUT A FIGURE FIRST FOR INCOME FROM FOREIGN INVEST-  
MENTS, THEN FOR FOREIGN INVESTMENT ITSELF.  
?259,21

|                         |       |
|-------------------------|-------|
| A. FOREIGN AID =        | 25    |
| B. BALANCE OF TRADE =   | 233   |
| C. TRAVEL BALANCE =     | 198   |
| D. INVESTMENT BALANCE = | 238   |
| -----                   | ----- |
| BALANCE OF PAYMENTS =   | 644   |

(REMEMBER, IF A MINUS FIGURE APPEARS ABOVE, YOUR  
COUNTRY HAS A DEFICIT IN ITS BALANCE OF PAYMENTS)

HOPE YOU UNDERSTAND THE DISTINCTION BETWEEN THE  
BALANCE OF TRADE AND THE BALANCE OF PAYMENTS  
BETTER NOW.

DONE

**TITLE:**

BANK: Solves Financial Problems

**DESCRIPTION:**

This program solves financial problems concerning installment buying, long-term loans, and savings accounts. The program gives you a choice of these three types of problems, and asks for the information needed to do said problems.

OBJECTIVES:

- A. This program aids students in learning the terms used in certain financial problems.
- B. Student will hopefully be motivated to learn the mathematical logic behind the solution of these problems.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - A review of decimals and fractions would be helpful.
- B. Materials - A terminal, and a means by which to display the output to an entire class (e.g. overhead projector, closed circuit TV, etc.)

DISCUSSION:

A type of problem may be demonstrated through the use of the computer, then the mathematical logic behind the solution of the problem may be developed through the use of a flow chart similar to the one that follows.

Terminology may be taught when the computer asks for input (see sample run).

Since the execution time of one run is extremely short, many more problems may be demonstrated. Depending upon the ability of the class or student, a variety of relationships may be discovered.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
BANK

FINANCIAL PROBLEMS

THIS PROGRAM SOLVES THREE TYPES OF PROBLEMS:

- (1) INTEREST ON INSTALLMENT BUYING
- (2) PAYMENTS ON LONG TERM LOAN
- (3) BALANCE OF A SAVINGS ACCOUNT

WHICH PROBLEM WOULD YOU LIKE TO WORK WITH (TYPE 1, 2 OR 3)?1

\*\*\*\*\*

THIS SECTION WILL DETERMINE THE ACTUAL INTEREST YOU PAY  
WHEN YOU PURCHASE SOMETHING ON CREDIT.

WHAT IS THE CASH PRICE OF THE ARTICLE (\$)88.99  
DOWN PAYMENT (\$)10  
NUMBER OF PAYMENTS EXCLUDING THE DOWN PAYMENT?18  
NUMBER OF PAYMENTS PER MONTH?1  
AMOUNT PER PAYMENT (\$)4.85

THE RATE OF INTEREST CHARGED WAS 5.69 PERCENT.

\*\*\*\*\*

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1=YES, 0=NO)?1  
WHICH PROBLEM WOULD YOU LIKE TO WORK WITH (TYPE 1, 2 OR 3)?2

\*\*\*\*\*

THIS SECTION WILL DETERMINE PAYMENTS FOR A LONG TERM LOAN.

WHAT IS THE AMOUNT BORROWED (\$)3000  
INTEREST CHARGED (%)8  
INTERVAL BETWEEN PAYMENTS (MONTHS)?1  
TERM OF THE LOAN (YEARS)?2

DO YOU WISH TO SEE THE TOTALS ONLY - INSTEAD OF THE ENTIRE  
TABLE - (1=YES, 0=NO)?0

| PERIOD | OUTSTANDING<br>PRINCIPAL AT<br>BEGINNING<br>OF PERIOD | INTEREST DUE AT<br>END OF PERIOD | PRINCIPAL<br>REPAID AT<br>END OF PERIOD |
|--------|-------------------------------------------------------|----------------------------------|-----------------------------------------|
| 1      | 3000                                                  | 20                               | 115.68                                  |
| 2      | 2884.32                                               | 19.23                            | 116.45                                  |
| 3      | 2767.87                                               | 18.45                            | 117.23                                  |
| 4      | 2650.64                                               | 17.67                            | 118.01                                  |
| 5      | 2532.63                                               | 16.88                            | 118.8                                   |
| 6      | 2413.83                                               | 16.09                            | 119.59                                  |
| 7      | 2294.24                                               | 15.29                            | 120.39                                  |
| 8      | 2173.85                                               | 14.49                            | 121.19                                  |
| 9      | 2052.66                                               | 13.68                            | 122                                     |
| 10     | 1930.66                                               | 12.87                            | 122.81                                  |
| 11     | 1807.85                                               | 12.05                            | 123.63                                  |
| 12     | 1684.22                                               | 11.23                            | 124.45                                  |
| 13     | 1559.77                                               | 10.4                             | 125.28                                  |
| 14     | 1434.49                                               | 9.56                             | 126.12                                  |
| 15     | 1308.37                                               | 8.72                             | 126.96                                  |
| 16     | 1181.41                                               | 7.88                             | 127.8                                   |
| 17     | 1053.61                                               | 7.02                             | 128.66                                  |
| 18     | 924.95                                                | 6.17                             | 129.51                                  |
| 19     | 795.44                                                | 5.3                              | 130.38                                  |
| 20     | 665.06                                                | 4.43                             | 131.25                                  |
| 21     | 533.81                                                | 3.56                             | 132.12                                  |
| 22     | 401.69                                                | 2.68                             | 133                                     |
| 23     | 268.69                                                | 1.79                             | 133.89                                  |
| 24     | 134.8                                                 | .9                               | 134.78                                  |
| TOTALS |                                                       | 256.34                           | 3000                                    |

YOUR MONTHLY PAYMENT IS \$ 135.68      AND TOTALS \$ 3256.34

\*\*\*\*\*

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)?1  
WHICH PROBLEM WOULD YOU LIKE TO WORK WITH (TYPE 1, 2 OR 3)?3

\*\*\*\*\*

THIS SECTION CALCULATES THE BALANCE OF A SAVINGS ACCOUNT  
IN WHICH DEPOSITS ARE MADE REGULARLY.

WHAT IS THE AMOUNT DEPOSITED PER INTEREST PERIOD (\$)??10000  
HOW OFTEN IS THE INTEREST COMPOUNDED (MONTHS)?3  
WHAT IS THE RATE OF INTEREST PAID (%)?5  
FOR HOW LONG WILL YOU DEPOSIT MONEY (YEARS)?5

THE BALANCE OF YOUR ACCOUNT AFTER 5      YEARS WILL BE \$ 238450.

\*\*\*\*\*

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)?0

DONE



SOCIAL SCIENCE (EDUCATION) (860)  
CONTRIBUTED PROGRAM **BASIC**

CHARGE  
36604

**TITLE:**

CHARGE ACCOUNT SIMULATION

**DESCRIPTION:**

CHARGE is a simulation game based on the external reality of using charge accounts.

With built-in roles stating set financial conditions, CHARGE provides opportunity to purchase goods and services during a simulated twelve-month period and to add to or begin a Savings Account. The computer assigns positive and negative unexpected events. The program gives experience in fitting income to life style by requiring wise use of credit, adjustments between savings and expenditures, figuring monthly finance charges, and absorbing penalties for unwise use of money.

**INSTRUCTIONS:**

Before beginning the game each student should be provided with:

1. Set of rules
2. Role Sheet
3. Item Selection Sheets (4)

The game can be played most effectively with groups of ten or fewer. After the instructional session a group of ten students will be able to complete a one-year run in less than two hours.

Copyright to the instructional materials is held by Paul S. Amidon & Associates, Inc. Complete documentation, including Teacher Guide and Student Worksheets may be obtained for \$15.00 from: Paul S. Amidon & Associates, Inc., 5408 Chicago Avenue South, Minneapolis, Minnesota.

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES

Because of the various skills and judgments inherent in the game, it easily fits into such disciplines from Grades 9 through 12 as Business Mathematics, General Mathematics, General Business, Home and Family Living, and Social Studies sections dealing with management of personal income.

**ACKNOWLEDGEMENTS:**

Paul S. Amidon and Associates  
Minneapolis, Minnesota



RUN

RUN  
CHARGE

PLEASE ENTER ROLE NUMBER, COMMA, AND MONTH.?1,1  
FIRST OF ALL, HOW MANY ITEMS (INCLUDING SAVINGS) THIS MONTH?4  
CHOICE 1 --?9,10.20  
CHOICE 2 --?26,15.00  
CHOICE 3 --?42,22.41  
CHOICE 4 --?40,47.39  
----UNEXPECTED EVENTS----  
YOU DAMAGED EQUIPMENT AT WORK WHICH YOU HAD TO REPLACE  
AT A COST OF \$19.

THANK YOU FOR SHOPPING COMPU.  
YOUR TOTAL POINTS THIS MONTH WERE 10

PLEASE ENTER ROLE NUMBER, COMMA, AND MONTH.?1,2  
FIRST OF ALL, HOW MANY ITEMS (INCLUDING SAVINGS) THIS MONTH?4  
CHOICE 1 --?9,10.20  
CHOICE 2 --?12,22.50  
CHOICE 3 --?42,22.41  
CHOICE 4 --?40,39.89  
----UNEXPECTED EVENTS----  
NO GOODIES OR BADDIES THIS MONTH.

THANK YOU FOR SHOPPING COMPU.  
YOUR TOTAL POINTS THIS MONTH WERE 11

PLEASE ENTER ROLE NUMBER, COMMA, AND MONTH.?1,3  
FIRST OF ALL, HOW MANY ITEMS (INCLUDING SAVINGS) THIS MONTH?5  
CHOICE 1 --?9,10.20  
CHOICE 2 --?32,9.86  
CHOICE 3 --?37,32.50  
CHOICE 4 --?42,22.41  
CHOICE 5 --?40,20.03  
----UNEXPECTED EVENTS----  
YOUR SHARE OF YOUR MOTHER'S BIRTHDAY PRESENT WAS \$10.

THANK YOU FOR SHOPPING COMPU.  
YOUR TOTAL POINTS THIS MONTH WERE 8

PLEASE ENTER ROLE NUMBER, COMMA, AND MONTH.?1,4  
FIRST OF ALL, HOW MANY ITEMS (INCLUDING SAVINGS) THIS MONTH?5  
CHOICE 1 --?15,22.95  
CHOICE 2 --?32,9.86  
CHOICE 3 --?33,25.88  
CHOICE 4 --?42,22.41  
CHOICE 5 --?40,13.90  
----UNEXPECTED EVENTS----  
THINGS DULL THIS MONTH. NO UNEXPECTED EVENTS.

THANK YOU FOR SHOPPING COMPU.  
YOUR TOTAL POINTS THIS MONTH WERE 9

PLEASE ENTER ROLE NUMBER, COMMA, AND MONTH.?1,5  
FIRST OF ALL, HOW MANY ITEMS (INCLUDING SAVINGS) THIS MONTH?4  
CHOICE 1 --?32,9.86  
CHOICE 2 --?33,25.88  
CHOICE 3 --?42,22.41  
CHOICE 4 --?40,36.85  
----UNEXPECTED EVENTS----  
YOU LOST YOUR WALLET. IT HAD \$23 IN IT.

THANK YOU FOR SHOPPING COMPU.  
YOUR TOTAL POINTS THIS MONTH WERE 9

PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,6  
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?3  
CHOICE 1 --?33,25.88  
CHOICE 2 --?42,22.41  
CHOICE 3 --?40,46.71  
----UNEXPECTED EVENTS----  
NO GOODIES OR BADDIES THIS MONTH.

THANK YOU FOR SHOPPING COMPU.  
YOUR TOTAL POINTS THIS MONTH WERE 9

PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,7  
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?2  
CHOICE 1 --?33,25.88  
CHOICE 2 --?40,69.12  
----UNEXPECTED EVENTS----  
NO GOODIES OR BADDIES THIS MONTH.

THANK YOU FOR SHOPPING COMPU.  
YOUR TOTAL POINTS THIS MONTH WERE 11

PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?0,8--1,8  
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?4  
CHOICE 1 --?22,5.56  
CHOICE 2 --?23,19.96  
CHOICE 3 --?33,25.88  
CHOICE 4 --?40,43.60  
----UNEXPECTED EVENTS----  
YOU LOST YOUR CREDIT CARD AND DIDN'T KNOW ABOUT THE LOSS  
UNTIL YOU WANTED TO USE IT. YOU DON'T HAVE INSURANCE  
AGAINST LOSS OF CREDIT CARDS. YOUR CARD HAS BEEN USED BY  
SOMEONE TO MAKE PURCHASES OF \$10 AND \$15. YOU MUST PAY \$25.

THANK YOU FOR SHOPPING COMPU.  
YOUR TOTAL POINTS THIS MONTH WERE 9

PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,9  
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?2  
CHOICE 1 --?33,25.88  
CHOICE 2 --?40,69.12  
----UNEXPECTED EVENTS----  
BUSINESS GOOD THIS MONTH. YOUR BOSS GAVE YOU A \$35 BONUS.

THANK YOU FOR SHOPPING COMPU.  
YOUR TOTAL POINTS THIS MONTH WERE 11



**TITLE:**

CONSM: Depression/Equilibrium

**DESCRIPTION:**

This program simulates economic depression and equilibrium as effects of consumption.

OBJECTIVES:

- A. Depression or recession results when consumption drops below the capacity to produce.
- B. Equilibrium results when consumption equals the capacity to produce.
- C. One cause for "over-production" is a time lag in discovering a drop in consumption.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

## A. Student - terms to define and explain:

- |                      |                        |
|----------------------|------------------------|
| 1. Depression        | 6. Investment          |
| 2. Recession         | 7. Savings             |
| 3. Equilibrium       | 8. GNP                 |
| 4. Under-consumption | 9. Productive Services |
| 5. Overproduction    |                        |

B. Materials - Introduce this program with the Circular Flow model of goods, services and money.DISCUSSION:A. Operational Suggestions

1. Student level - above average
2. Curriculum location - advanced economics unit on economic growth and stability.

B. Suggested Follow-up

## Discussion topics:

1. Consider possible causes for a drop in consumption.
2. With advanced students, discuss the (Keynesian) concept of "equilibrium at less than full employment."

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
CONSM

THIS PROGRAM SIMULATES THE EFFECTS OF CONSUMPTION ON THE  
GNP. IT PRINTS OUT THE VALUES FOR THE COMPONENTS OF THE  
CIRCULAR FLOW MODEL OF GOODS, SERVICES AND MONEY.

ASSUME GNP IS 100 BILLION.  
TYPE IN A VALUE FOR PROPENSITY TO CONSUME.  
MAKE THE VALUE BETWEEN 0 AND .75  
?.69  
IF STARTING ,TYPE 100(GNP);IF NOT  
STARTING,TYPE VALUE OF RETURN GNP.  
?100

ORIGINAL GNP- 100

PROPENSITY TO  
CONSUME- .69

CONSUMPTION- 69

VALUE- 69

SAVINGS- 31

INVESTMENT BY PERIODS:  
1-3MONTHS 5  
4-6MONTHS 4.925  
7-9MONTHS 4.85  
10-12MONTHS 4.775  
END OF 12TH MONTH 4.7  
TOTAL FOR YEAR 24.25

OVER-INVESTMENT

LABOR:  
1-3MONTHS- .15  
4-6MONTHS- .147  
7-9MONTHS- .144  
10-12MONTHS- .141  
END OF 12MONTH- .138  
TOTAL FOR YEAR- .72

GNP:  
1-3MONTHS- 14.8  
4-6MONTHS- 14.785  
7-9MONTHS- 14.77  
10-12MONTHS- 14.755  
END OF 12 MONTH- 14.74  
TOTAL FOR YEAR- 93.25

RECESSION  
INVENTORY OVERPRODUCED- 22.75  
TYPE DECIMAL VALUE FOR PROPENSITY TO  
CONSUME  
?.50  
IF STARTING ,TYPE 100(GNP);IF NOT  
STARTING,TYPE VALUE OF RETURN GNP.  
?70

ORIGINAL GNP- 100

PROPENSITY TO  
CONSUME- .5

CONSUMPTION- 35

VALUE- 35

SAVINGS- 35

GNP- 37.25  
TYPE DECIMAL VALUE FOR PROPENSITY TO  
CONSUME  
?  
DONE



CONTRIBUTED PROGRAM **BASIC**ELECT  
36798**TITLE:**

CAMPAIGN STRATEGY AND ELECTIONS

**DESCRIPTION:**

The ELECT package contains three separate simulation programs, focusing on campaign decision making and electoral politics. ELECT1 and ELECT2 focus on the study of campaign strategy in 14 American presidential elections of the past. ELECT3 is a role-playing game which can be used in the classroom to simulate a campaign and election. In the case of all simulations, the computer simulates the behavior of the electorate as it decides which candidate to support.

**INSTRUCTIONS:**ELECT1 and ELECT2

The computer programs ELECT1 and ELECT2 contain simulated voter attitudes for each of 14 past presidential elections. (The elections of 1828, 1840, 1844, 1868, 1876, 1884, 1896, 1920, 1928, 1932, 1948, 1952, 1960, and 1968 have been included.) Information about voter attitudes toward the candidates, the parties, and the issues is stored for each of these elections. The basic question facing the students using ELECT1-2 is how each candidate should allocate his political resources among the three areas of voter attitudes. In other words, how much emphasis should the candidate place on his image, on the party, and on the issues. Once these strategies have been determined, they are entered and the computer then indicates how the election would have turned out if these student-developed strategies had, in fact, been adopted by the candidates. It then gives the actual election results so that students can compare the two and attempt to explain the differences. For each election, a brief description of the political climate of the country prior to the election has been included to help students make their strategy decision. Also included is a brief explanation of how the election actually turned out and why.

ELECT3

ELECT3 is based on the same model as is ELECT1 and ELECT2. That is, the program simulates voter-attitudes toward candidates, parties and issues. ELECT3 has been designed as a role-playing game which can be used in the classroom to simulate a campaign and election. Students playing the roles of campaign managers, media specialists, candidates, speechwriters, etc. make decisions which change the attitudes of the electorate. The class may be divided into two camps, each representing a candidate and his campaign staff. The basic objective of the campaign is to use resources in such a way as to increase the candidate's chances of winning on election day. The campaign is conceived of as a series of actions taking place along a time continuum that begins several months before the election and culminates in the aggregate decision of the voters on the day of the election. Each group is given periodic poll results and information regarding the success of their campaign strategies to aid them in planning future campaign strategy.

Continued on the next page.

**SPECIAL  
CONSIDERATIONS:**

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                  |        |                   |        |
|------------------|--------|-------------------|--------|
| Student Workbook | \$ .30 | Resource Handbook | \$ .50 |
| Teachers Guide   | \$ .30 |                   |        |

**ACKNOWLEDGEMENTS:**

Huntington II Project  
State University of New York



INSTRUCTIONS: Continued.

Attempts to reach and change the attitudes of voters within the electorate is hampered by message and media distortion. Finally, a turnout rate, which can be influenced by the candidates, helps to determine the final outcome of the election.

RUN

RUN  
ELECT1

ELECT1

HISTORICAL ELECTIONS - 19TH CENTURY

NEED INSTRUCTIONS?YES

YOUR GOAL WILL BE TO CHOOSE THE OPTIMUM STRATEGY FOR CANDIDATES IN AN HISTORICAL ELECTION. EACH CANDIDATE'S STRATEGY VECTOR CONSISTS OF 3 NUMBERS. THE FIRST REPRESENTS THE AMOUNT OF EMPHASIS TO BE PLACED ON THE CANDIDATE'S IMAGE, THE SECOND REPRESENTS THE AMOUNT OF EMPHASIS ON PARTY AFFILIATION, AND THE THIRD IS THE AMOUNT OF EMPHASIS ON CAMPAIGN ISSUES. EACH OF THESE NUMBERS IS BETWEEN 10 AND 80, WITH A HIGHER NUMBER REPRESENTING MORE EMPHASIS. THE TOTAL OF EACH STRATEGY VECTOR MUST EQUAL 100!

THE COMPUTER WILL FIRST ASK 'ELECTION YEAR?'  
CHOOSE THE YEAR FROM THE FOLLOWING LIST:  
1828 1840 1844 1868 1876 1884 1896

ELECTION YEAR?1868

ELECTION OF 1868

| CANDIDATE | PARTY      |
|-----------|------------|
| SEYMOUR   | DEMOCRAT   |
| GRANT     | REPUBLICAN |

SEYMOUR - STRATEGY (3 NUMBERS, 10 <= I <= 80, TOTAL = 100)?50,20,30  
GRANT - STRATEGY (3 NUMBERS, 10 <= I <= 80, TOTAL = 100)?20,50,30

THE RESULT OF YOUR STRATEGY IS:

|         |      |   |
|---------|------|---|
| SEYMOUR | 47.5 | X |
| GRANT   | 52.5 | X |

THE VOTE FOR THE TWO MAJOR CANDIDATES IN THE ACTUAL ELECTION WAS:

|         |      |   |
|---------|------|---|
| SEYMOUR | 47.3 | X |
| GRANT   | 52.7 | X |

ANOTHER RUN?NO

DONE

GET-ELECT2  
RUN  
ELECT2

ELECT2

HISTORICAL ELECTIONS - 20TH CENTURY

NEED INSTRUCTIONS?YES

YOUR GOAL WILL BE TO CHOOSE THE OPTIMUM STRATEGY FOR CANDIDATES IN AN HISTORICAL ELECTION. EACH CANDIDATE'S STRATEGY VECTOR CONSISTS OF 3 NUMBERS. THE FIRST REPRESENTS THE AMOUNT OF EMPHASIS TO BE PLACED ON THE CANDIDATE'S IMAGE, THE SECOND REPRESENTS THE AMOUNT OF EMPHASIS ON PARTY AFFILIATION, AND THE THIRD IS THE AMOUNT OF EMPHASIS ON CAMPAIGN ISSUES. EACH OF THESE NUMBERS IS BETWEEN 10 AND 80, WITH A HIGHER NUMBER REPRESENTING MORE EMPHASIS. THE TOTAL OF EACH STRATEGY VECTOR MUST EQUAL 100!

THE COMPUTER WILL FIRST ASK 'ELECTION YEAR?'  
CHOOSE THE YEAR FROM THE FOLLOWING LIST:  
1920 1928 1932 1948 1952 1960 1968

ELECTION YEAR?1948

ELECTION OF 1948

| CANDIDATE | PARTY      |
|-----------|------------|
| TRUMAN    | DEMOCRAT   |
| DEWEY     | REPUBLICAN |

TRUMAN - STRATEGY (3 NUMBERS, 10 <= I <= 80, TOTAL = 100)?20,50,30  
DEWEY - STRATEGY (3 NUMBERS, 10 <= I <= 80, TOTAL = 100)?30,40,30

THE RESULT OF YOUR STRATEGY IS:

|        |    |   |
|--------|----|---|
| TRUMAN | 55 | % |
| DEWEY  | 45 | % |

THE VOTE FOR THE TWO MAJOR CANDIDATES IN THE ACTUAL ELECTION WAS:

|        |      |   |
|--------|------|---|
| TRUMAN | 52.4 | % |
| DEWEY  | 47.6 | % |

ANOTHER RUN?NO

DONE

GET-ELECT3

RUN  
ELECT3

PER?1  
RES UNITS R,D?300,300  
INPUT FACTORS (1=YES, 0=NO)?0  
INPUT MATRIX (1=YES, 0=NO)?0

MEDIA DISTORTION: R - 6 PC D - 4 PC

ALLOC RESOURCES - MIN. 20 PC FOR EACH AREA - TO  
IMAGE, PARTY, AND ISSUES

ALLOC. R (MAX = 300 )?140,60,100  
ALLOC. D (MAX = 300 )?60,140,100

TO HELP IMAGE -  
STRESS EXP, ABIL, OR PERS  
R - HAS 140 UNITS - ALLOC.?40,50,50  
NO EQUAL ALLOCATIONS! ALLOC.?40,49,51  
D - HAS 60 UNITS - ALLOC.?10,30,20  
NO ALLOC < 20 PC! ALLOC.?12,30,18  
TO PUBLICIZE ISSUES -  
STRESS ECO, DOMEST, OR FOR POL  
R - HAS 100 UNITS - ALLOC.?30,31,39  
D - HAS 100 UNITS - ALLOC.?39,30,31

UPDATE -  
TURNOUT: 47 PC  
IMPROVING IMAGE:  
R IS NOT AND D IS  
STRESSING RIGHT ISSUE:  
R IS NOT AND D IS

D HAS A DECIDED ADVANTAGE IN IMAGE  
D HAS A SLIGHT ADVANTAGE WITH ISSUES

D HAS CHOSEN CORRECT ISSUE AND IMAGE  
AND THIS SHOULD HELP HIM

TURNOUT HINDERS R

THE LATEST POLL SHOWS D LEADING WITH 52.3 PC OF THE VOTE  
AND HIS OPPONENT WITH 47.6 PC

|          |      |     |   |   |   |      |      |
|----------|------|-----|---|---|---|------|------|
| FAC 1.22 | 3.23 | 1   | 2 | 1 | 1 | 3.15 | 4.22 |
| .475     | .06  | .04 |   |   |   |      |      |
| CTRS 0   | 1    | 0   | 1 |   |   |      |      |
| MAT:     |      |     |   |   |   |      |      |
| CELL 1   | --   | 1   |   |   |   |      |      |
| CELL 2   | --   | 3   |   |   |   |      |      |
| CELL 3   | --   | 2   |   |   |   |      |      |
| CELL 4   | --   | 3   |   |   |   |      |      |
| CELL 5   | --   | 3   |   |   |   |      |      |
| CELL 6   | --   | 4   |   |   |   |      |      |
| CELL 7   | --   | 3   |   |   |   |      |      |
| CELL 8   | --   | 4   |   |   |   |      |      |
| CELL 9   | --   | 2   |   |   |   |      |      |

DONE

RUN  
ELECT3

PER72  
RES UNITS R,D7350,310  
INPUT FACTORS (1=YES, 0=NO)?1  
FAC71.22,3.23,1,2,1,1,3.15,4.22,.475,.06,.04  
CTRS70,1,0,1  
INPUT MATRIX (1=YES, 0=NO)?1  
CELL 1 --- 71  
CELL 2 --- 73  
CELL 3 --- 72  
CELL 4 --- 73  
CELL 5 --- 73  
CELL 6 --- 74  
CELL 7 --- 73  
CELL 8 --- 74  
CELL 9 --- 72

MEDIA DISTORTION: R - 6 PC D - 4 PC

ALLOC RESOURCES - MIN. 20 PC FOR EACH AREA - TO  
IMAGE, PARTY, AND ISSUES

ALLOC. R (MAX = 350 )?150,100,100  
ALLOC. D (MAX = 310 )?70,130,110

TO HELP IMAGE -  
STRESS EXP, ABIL, OR PERS  
R - HAS 150 UNITS - ALLOC.730,40,80  
D - HAS 70 UNITS - ALLOC.730,25,15  
TO PUBLICIZE ISSUES -  
STRESS ECO, DOMEST, OR FOR POL  
R - HAS 100 UNITS - ALLOC.750,30,20  
D - HAS 110 UNITS - ALLOC.729,50,31

UPDATE -  
TURNOUT: 50 PC  
IMPROVING IMAGE:  
R IS NOT AND D IS NOT  
STRESSING RIGHT ISSUE:  
R IS AND D IS NOT

D HAS A DECIDED ADVANTAGE IN IMAGE  
NO ONE HAS ADVANTAGE WITH ISSUES

TURNOUT HAS NO EFFECT

THE LATEST POLL SHOWS D LEADING WITH 51.2 PC OF THE VOTE  
 AND HIS OPPONENT WITH 48.7 PC

FAC .98                    2.99                    1                    2                    1                    1                    3.85                    3.98  
 .5                    .06                    .04

CTRS 0                    0                    1                    0

MAT:

CELL 1                    -- 1

CELL 2                    -- 3

CELL 3                    -- 2

CELL 4                    -- 3

CELL 5                    -- 3

CELL 6                    -- 4

CELL 7                    -- 3

CELL 8                    -- 4

CELL 9                    -- 3

DONE



SOCIAL SCIENCE (EDUCATION) (860)  
CONTRIBUTED PROGRAM **BASIC**

POLICY  
36649

**TITLE:** STUDENTS FORMULATE NATIONAL POLICY

**DESCRIPTION:** POLICY is a simulation of the interest group process. Specifically, it focuses attention on the impact these interest groups have on the kind of public policy the government enacts.

**INSTRUCTIONS:** Players of this simulation become members of one of six interest groups: Business, Labor, Civil Rights, Military, Internationalists and Nationalists. Each group has a set of goals which reflects the interests of similar groups in real life. The object of the game for each group is to maximize its own set of goals. This is accomplished by organizing support for policies so as to secure their adoption, and by opposing the adoption of policies which are unfavorable to their group. Each interest group has a certain number of "influence points" which it can use to support or oppose proposals. Policies are considered "adopted by government" when they have accumulated a predetermined number of positive influence points and "rejected by the government" when they have accumulated a predetermined number of negative influence points.

**SPECIAL  
CONSIDERATIONS:**

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                   |        |
|-------------------|--------|
| Student Workbook  | \$ .30 |
| Teachers Guide    | .30    |
| Resource Handbook | .50    |

**ACKNOWLEDGEMENTS:** Huntington II Project  
State University of New York

**RUN**

RUN  
POLICY

HOW MANY PERIODS?3

INITIAL AMOUNTS:

| INDICATOR | CURRENTLY | INCREASE | PCT. INC. |
|-----------|-----------|----------|-----------|
| 101       | 976.5     |          |           |
| 102       | 197       |          |           |
| 103       | 80        |          |           |
| 104       | 18.2      |          |           |
| 105       | 3         |          |           |
| 106       | 82        |          |           |
| 107       | 54        |          |           |
| 108       | 3         |          |           |
| 109       | 140       |          |           |
| 110       | 4.5       |          |           |
| 111       | 25        |          |           |
| 112       | 8.2       |          |           |
| 113       | 30        |          |           |
| 114       | 116.3     |          |           |
| 115       | 142       |          |           |
| 116       | 5568      |          |           |
| 117       | 20        |          |           |
| 118       | 0         |          |           |

TAPE?(1=YES,0=NO)?0

**BUSINESS**

TOTAL POINTS REMAINING : 100  
MAXIMUM MINUS POINTS : 50  
INPUT POLICY NO.,POINTS

?4,40  
?3,20  
?15,0

TOTAL POINTS REMAINING : 40  
MAXIMUM MINUS POINTS : 40  
INPUT POLICY NO.,POINTS

?6,-20  
?14,6  
?15,0

TOTAL POINTS REMAINING : 14  
MAXIMUM MINUS POINTS : 14  
INPUT POLICY NO.,POINTS

?7,10  
?8,-20

TOTAL POINTS REMAINING : 4  
MAXIMUM MINUS POINTS : 4  
INPUT POLICY NO.,POINTS

?0,0

**LABOR**

TOTAL POINTS REMAINING : 100  
MAXIMUM MINUS POINTS : 50  
INPUT POLICY NO.,POINTS

?4,60  
?4,1  
?15,0

TOTAL POINTS REMAINING : 39  
MAXIMUM MINUS POINTS : 39  
INPUT POLICY NO.,POINTS

?7,39

## CIVIL RIGHTS

TOTAL POINTS REMAINING : 100  
 MAXIMUM MINUS POINTS : 50  
 INPUT POLICY NO.,POINTS

?9,100

## MILITARY

TOTAL POINTS REMAINING : 100  
 MAXIMUM MINUS POINTS : 50  
 INPUT POLICY NO.,POINTS

?14,-50

?12,-3

TOTAL POINTS REMAINING : 50  
 MAXIMUM MINUS POINTS : 0  
 INPUT POLICY NO.,POINTS

?12,50

## NATIONALISTS

TOTAL POINTS REMAINING : 100  
 MAXIMUM MINUS POINTS : 50  
 INPUT POLICY NO.,POINTS

?14,100

## INTERNATIONALISTS

TOTAL POINTS REMAINING : 100  
 MAXIMUM MINUS POINTS : 50  
 INPUT POLICY NO.,POINTS

?11,94

?15,0

TOTAL POINTS REMAINING : 6  
 MAXIMUM MINUS POINTS : 6  
 INPUT POLICY NO.,POINTS

?0,0

PASSED : 4

## END OF PERIOD 1

| INDICATOR | CURRENTLY | INCREASE | PCT. INC. |
|-----------|-----------|----------|-----------|
| 101       | 1015.56   | 39.05    | 3.99      |
| 102       | 201       | 4        | 2.03      |
| 103       | 81        | 1        | 1.25      |
| 104       | 18.01     | -.19     | -1.05     |
| 105       | 2.7       | -.31     | -10.34    |
| 106       | 82        | 0        | 0         |
| 107       | 54        | 0        | 0         |
| 108       | 3.03      | .03      | 1         |
| 109       | 140       | 0        | 0         |
| 110       | 4.5       | 0        | 0         |
| 111       | 24.75     | -.25     | -1        |
| 112       | 10.2      | 2        | 24.39     |
| 113       | 33        | 3        | 10        |
| 114       | 120.95    | 4.65     | 3.99      |
| 115       | 156.19    | 14.19    | 9.99      |
| 116       | 6570.24   | 1002.24  | 18        |
| 117       | 20        | 0        | 0         |
| 118       | 0         | 0        | 0         |

TAPE? (1=YES,0=NO)?0

## BUSINESS



TOTAL POINTS REMAINING : 100  
 MAXIMUM MINUS POINTS : 50  
 INPUT POLICY NO.,POINTS

?13,100

LABOR

TOTAL POINTS REMAINING : 100  
 MAXIMUM MINUS POINTS : 50  
 INPUT POLICY NO.,POINTS

?13,20  
 ?0,0

CIVIL RIGHTS

TOTAL POINTS REMAINING : 100  
 MAXIMUM MINUS POINTS : 50  
 INPUT POLICY NO.,POINTS

?5,100

MILITARY

TOTAL POINTS REMAINING : 100  
 MAXIMUM MINUS POINTS : 50  
 INPUT POLICY NO.,POINTS

?5,100

NATIONALISTS

TOTAL POINTS REMAINING : 100  
 MAXIMUM MINUS POINTS : 50  
 INPUT POLICY NO.,POINTS

?5,-40  
 ?15,0

TOTAL POINTS REMAINING : 60  
 MAXIMUM MINUS POINTS : 10  
 INPUT POLICY NO.,POINTS

?0,0

INTERNATIONALISTS

TOTAL POINTS REMAINING : 100  
 MAXIMUM MINUS POINTS : 50  
 INPUT POLICY NO.,POINTS

?0,0

PASSED : 5 13

END OF PERIOD 2

| INDICATOR | CURRENTLY | INCREASE | PCT. INC. |
|-----------|-----------|----------|-----------|
| 101       | 1037.56   | 22       | 2.16      |
| 102       | 204       | 3        | 1.49      |
| 103       | 80.19     | -.81     | -1        |
| 104       | 17.83     | -.19     | -1.06     |
| 105       | 2.42      | -.27     | -10       |
| 106       | 88        | 6        | 7.31      |
| 107       | 58        | 4        | 7.4       |
| 108       | 3.06      | .03      | .99       |
| 109       | 140       | 0        | 0         |
| 110       | 4.39      | -.11     | -2.45     |
| 111       | 24.7      | -.05     | -.21      |
| 112       | 9.2       | -1       | -9.81     |
| 113       | 30        | -3       | -9.1      |
| 114       | 116.95    | -4       | -3.31     |
| 115       | 171.81    | 15.61    | 9.99      |
| 116       | 6520.24   | -50      | -.77      |
| 117       | 20        | 0        | 0         |
| 118       | 0         | 0        | 0         |

TAPE?(1=YES,0=NO)?1

310DATA 1037.56 , 204 , 80.19 , 17.8378 , 2.43 , 88  
315DATA 58 , 3.0603 , 140 , 4.4 , 24.7 , 9.2  
320DATA 30 , 116.952 , 171.82 , 6520.24 , 20 , 0

DONE

SOCIAL SCIENCE (EDUCATION) (860)  
CONTRIBUTED PROGRAM **BASIC**

POLSYS  
36640

**TITLE:** SIMULATION OF CITY COUNCIL

**DESCRIPTION:**

This program is a simulation attempting to duplicate the processes which individuals and groups undergo when they attempt to influence "City Hall".

POLSYS was developed by the Huntington II Project at the Polytechnic Institute of Brooklyn under the direction of L. Braun. This work was partially supported by the National Science Foundation, Grant GW-5883.

**INSTRUCTIONS:**

The users assume the role of citizens engaged in political activity. An issue is presented, and the teams enter values for publicity (PBU), knowledge (KU), and support (SU) according to the roles played. The strategy used by the teams is evaluated and decisions made.

**SPECIAL  
CONSIDERATIONS:**

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                   |        |
|-------------------|--------|
| Student Workbook  | \$ .30 |
| Teachers Guide    | .30    |
| Resource Handbook | .50    |

**ACKNOWLEDGEMENTS:**

Huntington II Project  
State University of New York

RUN

RUN  
POLSYS

ENTER ISSUE NUMBER ?1  
ENTER ROUND?1

TEAM 1 (PRO)  
TOTAL RES.,PUBLICITY(PBU),SUPPORT(SU),KNOWLEDGE(KU)?820,310,57

TEAM 2 (CON)  
TOTAL RES.,PUBLICITY(PBU),SUPPORT(SU),KNOWLEDGE(KU)?680,400,53

TEAM 1 (PRO)  
REMAINING RESOURCES (PBU,SU,KU)  
820 310 57

PBU RES. TO BE USED?220

PBU X PBU ?50  
PBU X SU ?14  
PBU X KU ?10

SU RES. TO BE USED?150

SU X PBU ?250  
SU X SU ?50  
SU X KU ?25

KU RES. TO BE USED?30

KU X PBU ?100  
KU X SU ?20  
KU X KU ?10

TEAM 2 (CON)  
REMAINING RESOURCES (PBU,SU,KU)  
680 400 53

PBU RES. TO BE USED?250

PBU X PBU ?100  
PBU X SU ?20  
PBU X KU ?5

SU RES. TO BE USED?170

SU X PBU ?250  
SU X SU ?20  
SU X KU ?50

KU RES. TO BE USED?23

KU X PBU ?130  
KU X SU ?10  
KU X KU ?5

CITY COUNCIL WILL CONSIDER DEMAND.  
PROCEED TO ROUND 2  
STRATEGY QUALITY POINTS=-60  
ANOTHER RUN(YES=1,NO=0)?0  
RES. GROUP 1      RES. GROUP 2  
600 160 27      430 230 30  
END OF ROUND 1

DONE

**TITLE:**

SURVEY ANALYSIS PROGRAM

**DESCRIPTION:**

The sample survey is one of the most valuable tools used by the social scientist to learn more about the world around him. Americans are constantly being exposed to the results of survey research. The Gallup and Harris polls continually report the popularity of public figures, and advertising bombards individuals with the results of one survey or another. In order to be able to critically evaluate the results of such surveys, or in order to undertake similar studies of one's own, it is necessary for a person to understand the elements of survey design, sampling procedures, and statistical analysis of results. It is also important to have a sense of the nature and limitations of generalizations that are based on sample survey data. One effective means by which students can achieve such an understanding is actual participation in a survey research project from start to finish. This unit is designed to facilitate such an experience, both for the teacher and the student.

**INSTRUCTIONS:**What the Program Will Do

After you have entered your data, you can have the computer do several things with it. The computer will:

1. Compute the mean and standard deviation for any variable. (With OPTIONS 1 through 5 you have a Recode Option.)
2. Construct a table of observed frequencies for any two variables, compute chi square, degrees of freedom (df), and allow the user to calculate the correlation coefficient gamma if desired.
3. Construct a table of observed frequencies by row percentages for any two variables.
4. Construct a table of observed frequencies by column percentages for any two variables.
5. Construct a table of expected frequencies for any two variables.
6. Stop the program.

**SPECIAL  
CONSIDERATIONS:**

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                   |        |
|-------------------|--------|
| Student Workbook  | \$ .30 |
| Teachers Guide    | .30    |
| Resource Handbook | .50    |

**ACKNOWLEDGEMENTS:**

Huntington II Project  
State University of New York

RUN

RUN  
SAP

SURVEY ANALYSIS PROGRAM

HOW MANY VARIABLES?3

OPTION ?1

VARIABLE?1  
NUMBER OF VALUES TO BE RECODED FOR VARIABLE 1 70

RANGE OF VAR. 1 ?1,4

| VALUE | NO. |
|-------|-----|
| 1     | 24  |
| 2     | 24  |
| 3     | 24  |
| 4     | 24  |

TOTAL 96

MEAN = 2.5  
S.D. = 1.1

OPTION ?2

VARIABLES ?1,2  
NUMBER OF VALUES TO BE RECODED FOR VARIABLE 1 70

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 2 70

RANGE OF VAR. 1 ?1,4  
RANGE OF VAR. 2 ?1,2

OBSERVED FREQUENCIES

(ROW: VAR. 1 , COLUMN: VAR. 2 )

|   | 1  | 2  | TOTALS |
|---|----|----|--------|
| 1 | 11 | 13 | 24     |
| 2 | 13 | 11 | 24     |
| 3 | 14 | 10 | 24     |
| 4 | 10 | 14 | 24     |

TOTALS

|    |    |    |
|----|----|----|
| 48 | 48 | 96 |
|----|----|----|

CHI SQUARE= 1.7      DF= 3  
CALCULATE GAMMA(1=YES, 0=NO)?1  
GAMMA = .03

OPTION ?1

VARIABLE?2  
NUMBER OF VALUES TO BE RECODED FOR VARIABLE 2 70

RANGE OF VAR. 2 ?1,2

| VALUE | NO. |
|-------|-----|
| 1     | 48  |
| 2     | 48  |

TOTAL 96

MEAN = 1.5  
S.D. = .5

OPTION ?1

VARIABLE?3  
 NUMBER OF VALUES TO BE RECODED FOR VARIABLE 3 ?0

RANGE OF VAR. 3 ?1,2

VALUE NO.  
 1 51  
 2 45  
 TOTAL 96

MEAN = 1.5  
 S.D. = .5

OPTION ?2

VARIABLES ?1,3  
 NUMBER OF VALUES TO BE RECODED FOR VARIABLE 1 ?0

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 3 ?0

RANGE OF VAR. 1 ?1,4  
 RANGE OF VAR. 3 ?1,2

OBSERVED FREQUENCIES

(ROW: VAR. 1 , COLUMN: VAR. 3 )

|        | 1  | 2  | TOTALS |
|--------|----|----|--------|
| 1      | 11 | 13 | 24     |
| 2      | 13 | 11 | 24     |
| 3      | 13 | 11 | 24     |
| 4      | 14 | 10 | 24     |
| TOTALS | 51 | 45 | 96     |

CHI SQUARE= .8 DF= 3  
 CALCULATE GAMMA(1=YES, 0=NO)?1  
 GAMMA = -.13

OPTION ?3

VARIABLES ?2,3  
 NUMBER OF VALUES TO BE RECODED FOR VARIABLE 2 ?0

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 3 ?0

RANGE OF VAR. 2 ?1,2  
 RANGE OF VAR. 3 ?1,2

OBSERVED FREQUENCIES BY ROW PERCENTAGES

(ROW: VAR. 2 , COLUMN: VAR. 3 )

|   | 1    | 2    | TOTALS |
|---|------|------|--------|
| 1 | 72.9 | 27.1 | 100    |
| 2 | 33.3 | 66.7 | 100    |

OPTION ?4

VARIABLES 72,3

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 2 70

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 3 70

RANGE OF VAR. 2 71,2

RANGE OF VAR. 3 71,2

OBSERVED FREQUENCIES BY COLUMN PERCENTAGES

(ROW: VAR. 2 , COLUMN: VAR. 3 )

|   | 1    | 2    |
|---|------|------|
| 1 | 68.6 | 28.9 |
| 2 | 31.4 | 71.1 |

TOTALS

100 100

OPTION 75

VARIABLES 72,3

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 2 70

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 3 70

RANGE OF VAR. 2 71,2

RANGE OF VAR. 3 712

EXPECTED FREQUENCIES

(ROW: VAR. 2 , COLUMN: VAR. 3 )

|   | 1    | 2    | TOTALS |
|---|------|------|--------|
| 1 | 25.5 | 22.5 | 48     |
| 2 | 25.5 | 22.5 | 48     |

TOTALS

51 45 96

OPTION 71

VARIABLE 71

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 1 72

RECODED NEW VALUE 71

OLD VALUE 71

OLD VALUE 72

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 1 71-2

RECODED NEW VALUE 72

OLD VALUE 73

OLD VALUE 74

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 1 70

RANGE OF VAR. 1 71,2

VALUE NO.

1 48  
2 48

TOTAL 96

MEAN = 1.5

S.D. = .5



OPTION ?1

VARIABLE?1

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 1 ?3

RECODED NEW VALUE?1

OLD VALUE?1

OLD VALUE?2

OLD VALUE?3

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 1 ?1

RECODED NEW VALUE?2

OLD VALUE?4

NUMBER OF VALUES TO BE RECODED FOR VARIABLE 1 ?0

RANGE OF VAR. 1 ?1,2

VALUE NO.

1 72

2 24

TOTAL 96

MEAN = 1.3

S.D. = .4

OPTION ?6

DONE



CONTRIBUTED PROGRAM **BASIC****TITLE:**

STOCK: Stock Market Simulation

STOCK  
36331**DESCRIPTION:**

This program simulates the stock market. Each student is given \$10,000 with which he may buy and/or sell shares in five fictitious issues.

OBJECTIVES:

- A. To give the student a simple understanding of the operations of the stock market.
- B. To motivate the student to reinforce his basic arithmetic skills.
- C. To give an example of the use of everyday mathematics and economics in everyday life.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

- A. Student - no special preparation
- B. Materials - possibly graph paper

DISCUSSION:

This program can be used as a good motivation device in the teaching of basic stock-market concepts, and the basic mathematical skills involved. The computer starts each student with \$10,000, and allows him to buy and/or sell shares. Precautionary tests are included for the student who tries to purchase more shares than he has money for, or to sell more shares than he actually owns. The program continues for as many trading days as the student desires.

The stock values rise and fall on a semi-random basis. On each trading day all stocks undergo a small random price change, a trend change (based on a random trend), and the possibility--on a random basis--of a large price change. The structure of the formula is:

$$\text{new price} = \text{old price} + (\text{trend} \times \text{old price}) + (\text{small random price change}) + (\text{possible large price change})$$

The trend is a random number between -.1 and +.1. It remains constant for a random number of days, at which time the trend is changed randomly. The trend affects all stocks equally, and attempts to simulate general market trends. The small random change ranges between -3 and +3 points. It occurs every day to every stock. The possible large price change is either +10 or -10 points. The + and - changes each occur at random day intervals, and to random stocks. That is, there may be no large change on some trading days, only a +10 change on others, a -10 change on still others, and both large and small changes on others. In all large-change cases, the change affects only one random stock when it occurs.

Because of the random generation of stock values and their fluctuations, the program does not exactly simulate the real market. It does, however, provide a simplified view of what does happen, and familiarizes the student with the basic functions involved. This should be explained to the students, along with some real causes of stock-market fluctuations.

Graph paper might be used to plot the daily stock values and the exchange average. In this way, the trend will become evident.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

RUN  
STOCK

THE STOCK MARKET

DO YOU WANT THE INSTRUCTIONS (YES-TYPE 1, NO-TYPE 0)?1

THIS PROGRAM PLAYS THE STOCK MARKET. YOU WILL BE GIVEN \$10,000 AND MAY BUY OR SELL STOCKS. THE STOCK PRICES WILL BE GENERATED RANDOMLY AND THEREFORE THIS MODEL DOES NOT REPRESENT EXACTLY WHAT HAPPENS ON THE EXCHANGE. A TABLE OF AVAILABLE STOCKS, THEIR PRICES, AND THE NUMBER OF SHARES IN YOUR PORTFOLIO WILL BE PRINTED. FOLLOWING THIS, THE INITIALS OF EACH STOCK WILL BE PRINTED WITH A QUESTION MARK. HERE YOU INDICATE A TRANSACTION. TO BUY A STOCK TYPE +NNN, TO SELL A STOCK TYPE -NNN, WHERE NNN IS THE NUMBER OF SHARES. A BROKERAGE FEE OF 1% WILL BE CHARGED ON ALL TRANSACTIONS. NOTE THAT IF A STOCK'S VALUE DROPS TO ZERO IT MAY REBOUND TO A POSITIVE VALUE AGAIN. YOU HAVE \$10,000 TO INVEST. USE INTEGERS FOR ALL YOUR INPUTS. (NOTE: TO GET A 'FEEL' FOR THE MARKET RUN FOR AT LEAST 10 DAYS)

-----GOOD LUCK!-----

| STOCK                       | INITIALS | PRICE/SHARE |
|-----------------------------|----------|-------------|
| INT. BALLISTIC MISSILES     | IBM      | 94.5        |
| RED CROSS OF AMERICA        | RCA      | 79.5        |
| LICHTENSTEIN, BUMRAP & JOKE | LBJ      | 152.25      |
| AMERICAN BANKRUPT CO.       | ABC      | 137.75      |
| CENSURED BOOKS STORE        | CBS      | 98          |

NEW YORK STOCK EXCHANGE AVERAGE: 112.4

TOTAL STOCK ASSETS ARE \$ 0  
 TOTAL CASH ASSETS ARE \$ 10000  
 TOTAL ASSETS ARE \$ 10000

WHAT IS YOUR TRANSACTION IN  
 IBM?+10  
 RCA?+15  
 LBJ?+5  
 ABC?+5  
 CBS?+10

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE   | NET CHANGE |
|-------|-------------|----------|---------|------------|
| IBM   | 100         | 10       | 1000    | 5.5        |
| RCA   | 85.25       | 15       | 1278.75 | 5.75       |
| LBJ   | 157.25      | 5        | 786.25  | 5          |
| ABC   | 141         | 5        | 705     | 3.25       |
| CBS   | 103.5       | 10       | 1035    | 5.5        |

NEW YORK STOCK EXCHANGE AVERAGE: 117.4      NET CHANGE: 5

TOTAL STOCK ASSETS ARE \$ 4805  
 TOTAL CASH ASSETS ARE \$ 5386.82  
 TOTAL ASSETS ARE \$ 10191.8

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN  
 IBM?-10  
 RCA?+5  
 LBJ?-5  
 ABC?0  
 CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 106.25      | 0        | 0      | 6.25       |
| RCA   | 91          | 20       | 1820   | 5.75       |
| LBJ   | 162.5       | 0        | 0      | 5.25       |
| ABC   | 145.25      | 5        | 726.25 | 4.25       |
| CBS   | 105.75      | 10       | 1057.5 | 2.25       |

NEW YORK STOCK EXCHANGE AVERAGE: 122.15                      NET CHANGE: 4.75

TOTAL STOCK ASSETS ARE    \$ 3603.75  
TOTAL CASH ASSETS ARE    \$ 6724.69  
TOTAL ASSETS ARE            \$ 10328.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?+5  
LBJ?+10  
ABC?0  
CBS?+10

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 107.25      | 0        | 0      | 1          |
| RCA   | 92.5        | 25       | 2312.5 | 1.5        |
| LBJ   | 170         | 10       | 1700   | 7.5        |
| ABC   | 149.5       | 5        | 747.5  | 4.25       |
| CBS   | 113         | 20       | 2260   | 7.25       |

NEW YORK STOCK EXCHANGE AVERAGE: 126.45                      NET CHANGE: 4.3

TOTAL STOCK ASSETS ARE    \$ 7020  
TOTAL CASH ASSETS ARE    \$ 3555.81  
TOTAL ASSETS ARE            \$ 10575.8

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?0  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 109.25      | 0        | 0      | 2          |
| RCA   | 97          | 25       | 2425   | 4.5        |
| LBJ   | 178.25      | 10       | 1782.5 | 8.25       |
| ABC   | 167.75      | 5        | 838.75 | 18.25      |
| CBS   | 114.5       | 20       | 2290   | 1.5        |

NEW YORK STOCK EXCHANGE AVERAGE: 133.35                      NET CHANGE: 6.9

TOTAL STOCK ASSETS ARE    \$ 7336.25  
TOTAL CASH ASSETS ARE    \$ 3555.81  
TOTAL ASSETS ARE            \$ 10892.1

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?+5  
LBJ?0  
ABC?+5  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 111.25      | 0        | 0      | 2          |
| RCA   | 99          | 30       | 2970   | 2          |
| LBJ   | 184.75      | 10       | 1847.5 | 6.5        |
| ABC   | 170.75      | 10       | 1707.5 | 3          |
| CBS   | 106.75      | 20       | 2135   | -7.75      |

NEW YORK STOCK EXCHANGE AVERAGE: 134.5                      NET CHANGE: 1.15

TOTAL STOCK ASSETS ARE    \$ 8660  
 TOTAL CASH ASSETS ARE    \$ 2218.82  
 TOTAL ASSETS ARE            \$ 10878.8

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
 RCA?0  
 LBJ?0  
 ABC?0  
 CBS?-20

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 118.75      | 0        | 0      | 7.5        |
| RCA   | 101.75      | 30       | 3052.5 | 2.75       |
| LBJ   | 195         | 10       | 1950   | 10.25      |
| ABC   | 166.25      | 10       | 1662.5 | -4.5       |
| CBS   | 113.5       | 0        | 0      | 6.75       |

NEW YORK STOCK EXCHANGE AVERAGE: 139.05                      NET CHANGE: 4.55

TOTAL STOCK ASSETS ARE    \$ 6665  
 TOTAL CASH ASSETS ARE    \$ 4332.47  
 TOTAL ASSETS ARE            \$ 10997.5

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?+5  
 RCA?0  
 LBJ?0  
 ABC?0  
 CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 122.25      | 5        | 611.25 | 3.5        |
| RCA   | 117         | 30       | 3510   | 15.25      |
| LBJ   | 206.25      | 10       | 2062.5 | 11.25      |
| ABC   | 172.25      | 10       | 1722.5 | 6          |
| CBS   | 121.25      | 0        | 0      | 7.75       |

NEW YORK STOCK EXCHANGE AVERAGE: 147.8                      NET CHANGE: 8.75

TOTAL STOCK ASSETS ARE    \$ 7906.25  
 TOTAL CASH ASSETS ARE    \$ 3732.78  
 TOTAL ASSETS ARE            \$ 11639.

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
 RCA?-20  
 LBJ?0  
 ABC?0  
 CBS?+10

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 130.75      | 5        | 653.75 | 8.5        |
| RCA   | 120.5       | 10       | 1205   | 3.5        |
| LBJ   | 215.75      | 10       | 2157.5 | 9.5        |
| ABC   | 184         | 10       | 1840   | 11.75      |
| CBS   | 128.75      | 10       | 1287.5 | 7.5        |

NEW YORK STOCK EXCHANGE AVERAGE: 155.95      NET CHANGE: 8.15

TOTAL STOCK ASSETS ARE    \$ 7143.75  
TOTAL CASH ASSETS ARE    \$ 4824.75  
TOTAL ASSETS ARE        \$ 11968.5

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1  
WHAT IS YOUR TRANSACTION IN  
IBM?0  
RCA?0  
LBJ?0  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 138.5       | 5        | 692.5  | 7.75       |
| RCA   | 127         | 10       | 1270   | 6.5        |
| LBJ   | 227         | 10       | 2270   | 11.25      |
| ABC   | 194.75      | 10       | 1947.5 | 10.75      |
| CBS   | 137.5       | 10       | 1375   | 8.75       |

NEW YORK STOCK EXCHANGE AVERAGE: 164.95      NET CHANGE: 9

TOTAL STOCK ASSETS ARE    \$ 7555  
TOTAL CASH ASSETS ARE    \$ 4824.75  
TOTAL ASSETS ARE        \$ 12379.7

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1  
WHAT IS YOUR TRANSACTION IN  
IBM?0  
RCA?0  
LBJ?0  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 145.75      | 5        | 728.75 | 7.25       |
| RCA   | 145         | 10       | 1450   | 18         |
| LBJ   | 241.75      | 10       | 2417.5 | 14.75      |
| ABC   | 205.25      | 10       | 2052.5 | 10.5       |
| CBS   | 146.25      | 10       | 1462.5 | 8.75       |

NEW YORK STOCK EXCHANGE AVERAGE: 176.8      NET CHANGE: 11.85

TOTAL STOCK ASSETS ARE    \$ 8111.25  
TOTAL CASH ASSETS ARE    \$ 4824.75  
TOTAL ASSETS ARE        \$ 12936

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1  
WHAT IS YOUR TRANSACTION IN  
IBM?0  
RCA?0  
LBJ?0  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 150.75      | 5        | 753.75 | 5          |
| RCA   | 149         | 10       | 1490   | 4          |
| LBJ   | 241.75      | 10       | 2417.5 | 0          |
| ABC   | 212.75      | 10       | 2127.5 | 7.5        |
| CBS   | 150.25      | 10       | 1502.5 | 4          |

NEW YORK STOCK EXCHANGE AVERAGE: 180.9                      NET CHANGE: 4.1

TOTAL STOCK ASSETS ARE    \$ 8291.25  
TOTAL CASH ASSETS ARE     \$ 4824.75  
TOTAL ASSETS ARE            \$ 13116

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?-10  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 155.5       | 5        | 777.5  | 4.75       |
| RCA   | 151         | 10       | 1510   | 2          |
| LBJ   | 249.25      | 0        | 0      | 7.5        |
| ABC   | 217.5       | 10       | 2175   | 4.75       |
| CBS   | 157.25      | 10       | 1572.5 | 7          |

NEW YORK STOCK EXCHANGE AVERAGE: 186.1                      NET CHANGE: 5.2

TOTAL STOCK ASSETS ARE    \$ 6035  
TOTAL CASH ASSETS ARE     \$ 7218.07  
TOTAL ASSETS ARE            \$ 13253.1

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?0  
ABC?0  
CBS?-10

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 157.5       | 5        | 787.5  | 2          |
| RCA   | 156.75      | 10       | 1567.5 | 5.75       |
| LBJ   | 256.25      | 0        | 0      | 7          |
| ABC   | 217         | 10       | 2170   | -.5        |
| CBS   | 159         | 0        | 0      | 1.75       |

NEW YORK STOCK EXCHANGE AVERAGE: 189.3                      NET CHANGE: 3.2

TOTAL STOCK ASSETS ARE    \$ 4525  
TOTAL CASH ASSETS ARE     \$ 8774.84  
TOTAL ASSETS ARE            \$ 13299.8

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?+5  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING



| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 160.75      | 5        | 803.75 | 3.25       |
| RCA   | 160.5       | 10       | 1605   | 3.75       |
| LBJ   | 263         | 5        | 1315   | 6.75       |
| ABC   | 235.25      | 10       | 2352.5 | 18.25      |
| CBS   | 165.75      | 0        | 0      | 6.75       |

NEW YORK STOCK EXCHANGE AVERAGE: 197.05                      NET CHANGE: 7.75

TOTAL STOCK ASSETS ARE    \$ 6076.25  
TOTAL CASH ASSETS ARE    \$ 7480.78  
TOTAL ASSETS ARE            \$ 13557.

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?0  
ABC?-10  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 163.25      | 5        | 816.25 | 2.5        |
| RCA   | 166         | 10       | 1660   | 5.5        |
| LBJ   | 267.5       | 5        | 1337.5 | 4.5        |
| ABC   | 242         | 0        | 0      | 6.75       |
| CBS   | 167.25      | 0        | 0      | 1.5        |

NEW YORK STOCK EXCHANGE AVERAGE: 201.2                      NET CHANGE: 4.15

TOTAL STOCK ASSETS ARE    \$ 3813.75  
TOTAL CASH ASSETS ARE    \$ 9809.75  
TOTAL ASSETS ARE            \$ 13623.5

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?0  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE   | NET CHANGE |
|-------|-------------|----------|---------|------------|
| IBM   | 169.75      | 5        | 848.75  | 6.5        |
| RCA   | 172         | 10       | 1720    | 6          |
| LBJ   | 274.75      | 5        | 1373.75 | 7.25       |
| ABC   | 246.25      | 0        | 0       | 4.25       |
| CBS   | 170.25      | 0        | 0       | 3          |

NEW YORK STOCK EXCHANGE AVERAGE: 206.6                      NET CHANGE: 5.4

TOTAL STOCK ASSETS ARE    \$ 3942.5  
TOTAL CASH ASSETS ARE    \$ 9809.75  
TOTAL ASSETS ARE            \$ 13752.2

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?+5  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 173.75      | 5        | 868.75 | 4          |
| RCA   | 185         | 10       | 1850   | 13         |
| LBJ   | 283.25      | 10       | 2832.5 | 8.5        |
| ABC   | 252.5       | 0        | 0      | 6.25       |
| CBS   | 173.5       | 0        | 0      | 3.25       |

NEW YORK STOCK EXCHANGE AVERAGE: 213.6                      NET CHANGE: 7

TOTAL STOCK ASSETS ARE    \$ 5551.25  
TOTAL CASH ASSETS ARE     \$ 8422.26  
TOTAL ASSETS ARE            \$ 13973.5

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?+5  
LBJ?0  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE   | NET CHANGE |
|-------|-------------|----------|---------|------------|
| IBM   | 170.5       | 5        | 852.5   | -3.25      |
| RCA   | 169.75      | 15       | 2546.25 | -15.25     |
| LBJ   | 255.5       | 10       | 2555    | -27.75     |
| ABC   | 229.75      | 0        | 0       | -22.75     |
| CBS   | 148.75      | 0        | 0       | -24.75     |

NEW YORK STOCK EXCHANGE AVERAGE: 194.85                      NET CHANGE: -18.75

TOTAL STOCK ASSETS ARE    \$ 5953.75  
TOTAL CASH ASSETS ARE     \$ 7488.01  
TOTAL ASSETS ARE            \$ 13441.8

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?0  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE   | NET CHANGE |
|-------|-------------|----------|---------|------------|
| IBM   | 153.75      | 5        | 768.75  | -16.75     |
| RCA   | 156.75      | 15       | 2351.25 | -13        |
| LBJ   | 234.25      | 10       | 2342.5  | -21.25     |
| ABC   | 217.75      | 0        | 0       | -12        |
| CBS   | 133         | 0        | 0       | -15.75     |

NEW YORK STOCK EXCHANGE AVERAGE: 179.1                      NET CHANGE: -15.75

TOTAL STOCK ASSETS ARE    \$ 5462.5  
TOTAL CASH ASSETS ARE     \$ 7488.01  
TOTAL ASSETS ARE            \$ 12950.5

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?-5  
RCA?-15  
LBJ?-10  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE | NET CHANGE |
|-------|-------------|----------|-------|------------|
| IBM   | 143         | 0        | 0     | -10.75     |
| RCA   | 139.25      | 0        | 0     | -17.5      |
| LBJ   | 215.25      | 0        | 0     | -19        |
| ABC   | 200         | 0        | 0     | -17.75     |
| CBS   | 121.5       | 0        | 0     | -11.5      |

NEW YORK STOCK EXCHANGE AVERAGE: 163.8                      NET CHANGE: -15.3

TOTAL STOCK ASSETS ARE    \$ 0  
TOTAL CASH ASSETS ARE    \$ 12895.9  
TOTAL ASSETS ARE            \$ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE | NET CHANGE |
|-------|-------------|----------|-------|------------|
| IBM   | 127.75      | 0        | 0     | -15.25     |
| RCA   | 123.75      | 0        | 0     | -15.5      |
| LBJ   | 195.75      | 0        | 0     | -19.5      |
| ABC   | 182.75      | 0        | 0     | -17.25     |
| CBS   | 110.25      | 0        | 0     | -11.25     |

NEW YORK STOCK EXCHANGE AVERAGE: 148.05                      NET CHANGE: -15.75

TOTAL STOCK ASSETS ARE    \$ 0  
TOTAL CASH ASSETS ARE    \$ 12895.9  
TOTAL ASSETS ARE            \$ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE | NET CHANGE |
|-------|-------------|----------|-------|------------|
| IBM   | 104.75      | 0        | 0     | -23        |
| RCA   | 114.25      | 0        | 0     | -9.5       |
| LBJ   | 176.5       | 0        | 0     | -19.25     |
| ABC   | 167.75      | 0        | 0     | -15        |
| CBS   | 103         | 0        | 0     | -7.25      |

NEW YORK STOCK EXCHANGE AVERAGE: 133.25                      NET CHANGE: -14.8

TOTAL STOCK ASSETS ARE    \$ 0  
TOTAL CASH ASSETS ARE    \$ 12895.9  
TOTAL ASSETS ARE            \$ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE | NET CHANGE |
|-------|-------------|----------|-------|------------|
| IBM   | 93.25       | 0        | 0     | -11.5      |
| RCA   | 104.75      | 0        | 0     | -9.5       |
| LBJ   | 163         | 0        | 0     | -13.5      |
| ABC   | 160.5       | 0        | 0     | -7.25      |
| CBS   | 93.5        | 0        | 0     | -9.5       |

NEW YORK STOCK EXCHANGE AVERAGE: 123      NET CHANGE: -10.25

TOTAL STOCK ASSETS ARE    \$ 0  
TOTAL CASH ASSETS ARE    \$ 12895.9  
TOTAL ASSETS ARE         \$ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE | NET CHANGE |
|-------|-------------|----------|-------|------------|
| IBM   | 87          | 0        | 0     | -6.25      |
| RCA   | 97          | 0        | 0     | -7.75      |
| LBJ   | 147         | 0        | 0     | -16        |
| ABC   | 156.25      | 0        | 0     | -4.25      |
| CBS   | 87.75       | 0        | 0     | -5.75      |

NEW YORK STOCK EXCHANGE AVERAGE: 115      NET CHANGE: -8

TOTAL STOCK ASSETS ARE    \$ 0  
TOTAL CASH ASSETS ARE    \$ 12895.9  
TOTAL ASSETS ARE         \$ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE | NET CHANGE |
|-------|-------------|----------|-------|------------|
| IBM   | 84.25       | 0        | 0     | -2.75      |
| RCA   | 94.25       | 0        | 0     | -2.75      |
| LBJ   | 148.75      | 0        | 0     | 1.75       |
| ABC   | 157.25      | 0        | 0     | 1          |
| CBS   | 84.75       | 0        | 0     | -3         |

NEW YORK STOCK EXCHANGE AVERAGE: 113.85      NET CHANGE: -1.15

TOTAL STOCK ASSETS ARE    \$ 0  
TOTAL CASH ASSETS ARE    \$ 12895.9  
TOTAL ASSETS ARE         \$ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?10

RCA?10

LBJ?10

ABC?10

CBS?10

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 84.75       | 10       | 847.5  | .5         |
| RCA   | 93          | 10       | 930    | -1.25      |
| LBJ   | 149.5       | 10       | 1495   | .75        |
| ABC   | 155.75      | 10       | 1557.5 | -1.5       |
| CBS   | 86.25       | 10       | 862.5  | 1.5        |

NEW YORK STOCK EXCHANGE AVERAGE: 113.85      NET CHANGE: 0

TOTAL STOCK ASSETS ARE    \$ 5692.5  
TOTAL CASH ASSETS ARE    \$ 7146.45  
TOTAL ASSETS ARE         \$ 12838.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 84.75       | 10       | 847.5  | 0          |
| RCA   | 89          | 10       | 890    | -4         |
| LBJ   | 137.5       | 10       | 1375   | -12        |
| ABC   | 151.25      | 10       | 1512.5 | -4.5       |
| CBS   | 86          | 10       | 860    | -.25       |

NEW YORK STOCK EXCHANGE AVERAGE: 109.7      NET CHANGE: -4.15

TOTAL STOCK ASSETS ARE    \$ 5485  
TOTAL CASH ASSETS ARE    \$ 7146.45  
TOTAL ASSETS ARE         \$ 12631.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?

??1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE | NET CHANGE |
|-------|-------------|----------|-------|------------|
| IBM   | 84.75       | 10       | 847.5 | 0          |
| RCA   | 88.25       | 10       | 882.5 | -.75       |
| LBJ   | 135.5       | 10       | 1355  | -2         |
| ABC   | 148.5       | 10       | 1485  | -2.75      |
| CBS   | 84          | 10       | 840   | -2         |

NEW YORK STOCK EXCHANGE AVERAGE: 108.2      NET CHANGE: -1.5

TOTAL STOCK ASSETS ARE    \$ 5410  
TOTAL CASH ASSETS ARE    \$ 7146.45  
TOTAL ASSETS ARE         \$ 12556.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 85.5        | 10       | 855    | .75        |
| RCA   | 89          | 10       | 890    | .75        |
| LBJ   | 134.25      | 10       | 1342.5 | -1.25      |
| ABC   | 157.25      | 10       | 1572.5 | 8.75       |
| CBS   | 86.5        | 10       | 865    | 2.5        |

NEW YORK STOCK EXCHANGE AVERAGE: 110.5      NET CHANGE: 2.3

TOTAL STOCK ASSETS ARE \$ 5525  
 TOTAL CASH ASSETS ARE \$ 7146.45  
 TOTAL ASSETS ARE \$ 12671.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 86.75       | 10       | 867.5  | 1.25       |
| RCA   | 89          | 10       | 890    | 0          |
| LBJ   | 129.25      | 10       | 1292.5 | -5         |
| ABC   | 156.5       | 10       | 1565   | -.75       |
| CBS   | 84.5        | 10       | 845    | -2         |

NEW YORK STOCK EXCHANGE AVERAGE: 109.2      NET CHANGE: -1.3

TOTAL STOCK ASSETS ARE \$ 5460  
 TOTAL CASH ASSETS ARE \$ 7146.45  
 TOTAL ASSETS ARE \$ 12606.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 87.5        | 10       | 875    | .75        |
| RCA   | 79.5        | 10       | 795    | -9.5       |
| LBJ   | 129         | 10       | 1290   | -.25       |
| ABC   | 157.75      | 10       | 1577.5 | 1.25       |
| CBS   | 81.75       | 10       | 817.5  | -2.75      |

NEW YORK STOCK EXCHANGE AVERAGE: 107.1      NET CHANGE: -2.1

TOTAL STOCK ASSETS ARE \$ 5355  
 TOTAL CASH ASSETS ARE \$ 7146.45  
 TOTAL ASSETS ARE \$ 12501.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0

RCA?0

LBJ?0

ABC?0

CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 86.25       | 10       | 862.5  | -1.25      |
| RCA   | 80          | 10       | 800    | .5         |
| LBJ   | 128.25      | 10       | 1282.5 | -.75       |
| ABC   | 145.75      | 10       | 1457.5 | -12        |
| CBS   | 81.25       | 10       | 812.5  | -.5        |

NEW YORK STOCK EXCHANGE AVERAGE: 104.3      NET CHANGE: -2.8

TOTAL STOCK ASSETS ARE \$ 5215  
TOTAL CASH ASSETS ARE \$ 7146.45  
TOTAL ASSETS ARE \$ 12361.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?0  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 83.25       | 10       | 832.5  | -3         |
| RCA   | 79.75       | 10       | 797.5  | -.25       |
| LBJ   | 136         | 10       | 1360   | 7.75       |
| ABC   | 145.25      | 10       | 1452.5 | -.5        |
| CBS   | 80          | 10       | 800    | -1.25      |

NEW YORK STOCK EXCHANGE AVERAGE: 104.85      NET CHANGE: .55

TOTAL STOCK ASSETS ARE \$ 5242.5  
TOTAL CASH ASSETS ARE \$ 7146.45  
TOTAL ASSETS ARE \$ 12388.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?0  
ABC?0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 82.75       | 10       | 827.5  | -.5        |
| RCA   | 79.25       | 10       | 792.5  | -.5        |
| LBJ   | 134.25      | 10       | 1342.5 | -1.75      |
| ABC   | 144.25      | 10       | 1442.5 | -1         |
| CBS   | 79.75       | 10       | 797.5  | -.25       |

NEW YORK STOCK EXCHANGE AVERAGE: 104.05      NET CHANGE: -.8

TOTAL STOCK ASSETS ARE \$ 5202.5  
TOTAL CASH ASSETS ARE \$ 7146.45  
TOTAL ASSETS ARE \$ 12348.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
RCA?0  
LBJ?0  
ABC?GJ,9L0\  
0  
CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 79.5        | 10       | 795    | -3.25      |
| RCA   | 78.75       | 10       | 787.5  | -.5        |
| LBJ   | 127.5       | 10       | 1275   | -6.75      |
| ABC   | 138.25      | 10       | 1382.5 | -6         |
| CBS   | 78          | 10       | 780    | -1.75      |

NEW YORK STOCK EXCHANGE AVERAGE: 100.4      NET CHANGE: -3.65

TOTAL STOCK ASSETS ARE    \$ 5020  
 TOTAL CASH ASSETS ARE    \$ 7146.45  
 TOTAL ASSETS ARE         \$ 12166.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1

WHAT IS YOUR TRANSACTION IN

IBM?0  
 RCA?0  
 LBJ?0  
 ABC?0  
 CBS?0

\*\*\*\*\* END OF DAY'S TRADING

| STOCK | PRICE/SHARE | HOLDINGS | VALUE  | NET CHANGE |
|-------|-------------|----------|--------|------------|
| IBM   | 75          | 10       | 750    | -4.5       |
| RCA   | 72.75       | 10       | 727.5  | -6         |
| LBJ   | 118.5       | 10       | 1185   | -9         |
| ABC   | 134.75      | 10       | 1347.5 | -3.5       |
| CBS   | 64          | 10       | 640    | -14        |

NEW YORK STOCK EXCHANGE AVERAGE: 93      NET CHANGE: -7.4

TOTAL STOCK ASSETS ARE    \$ 4650  
 TOTAL CASH ASSETS ARE    \$ 7146.45  
 TOTAL ASSETS ARE         \$ 11796.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?0

HOPE YOU HAD FUN!!

DONE



SOCIAL SCIENCE (EDUCATION) (860)  
CONTRIBUTED PROGRAM **BASIC**

WHEELS  
36187

**TITLE:**

AUTO PURCHASE AND MAINTENANCE SIMULATION

**DESCRIPTION:**

WHEELS simulation model is designed to provide students with a simulated experience in purchasing and maintaining a car successfully for one year. It may be used with an entire class, as an individual student assignment, or an out-of-class activity. Experiences include the purchase of a car, the selection of a method of financing, the choice of insurance, and a provision for tracking expenses. The computer randomly assigns accidents, major repairs, unexpected events and calculates expenses.

**INSTRUCTIONS:**

Hewlett-Packard does not have documentation for this package but users instructions are contained in literature distributed by Paul S. Amidon & Associates, Inc., 5408 Chicago Avenue South, Minneapolis, Minnesota.

It is distributed in two packages:

- 1 teacher's manual
- 3 sets of student roles
- 35 participant manuals
- Activity sheet tablet

Sample Set . . . .

- 1 teacher's manual
- 1 set of student roles
- 1 participant manual
- Activity sheet tablet

**SPECIAL  
CONSIDERATIONS:**

Copyright to the instructional materials are held by Paul S. Amidon & Associates, Inc.

**INSTRUCTIONAL PURPOSES**

The program is useful in High school business courses, economics classes, or individual assignment.

No student background required.

The program is very effective for teaching private budgeting, installment purchasing or monetary responsibility.

A teacher would utilize the materials and programs as a class unit or as an activity for individual students to do in conjunction with class activity.

**ACKNOWLEDGEMENTS:**

Paul S. Amidon & Associates, Inc.

**RUN**

RUN  
WHEELS

CODE? A<sup>C</sup>U<sup>C</sup>T<sup>C</sup>O<sup>C</sup>  
TYPE MONTH NUMBER 1-12?1  
WELCOME TO THE QUICKIE COMPUTER CAR CHOOSING PARLOR  
\*\*\*\*\*

SO YOU WANT TO BUY A CAR. WELL, MAYBE I CAN HELP YOU TO  
MAKE A GOOD CHOICE.  
DO YOU NEED INSTRUCTIONS? TYPE 1 FOR YES, 0 FOR NO.?1  
YOU SHOULD HAVE BEEN GIVEN A ROLE NUMBER  
FROM 1 TO 15 AND ALSO A CAR DESCRIPTION  
SHEET. WHEN I ASK YOU, ENTER YOUR ROLE  
NUMBER FOLLOWED BY A COMMA AND THEN THE  
CAR NUMBER OF YOUR CHOICE.  
ENTER ROLE NUMBER, COMMA AND CAR CHOICE NOW. ?8,21

ROLE NUMBER 8 CAR NUMBER 21  
REPORT FOR MONTH NUMBER 1

YOU DROVE 997 MILES THIS MONTH.  
RUNNING EXPENSES (GAS, OIL, WEAR, ETC.) AMOUNT TO \$ 72

MAJOR REPAIRS REPORT  
\*\*\*\*\*  
NO MAJOR REPAIRS THIS MONTH.

ACCIDENT REPORT  
\*\*\*\*\*  
NO ACCIDENTS.THANK GOODNESS.

UNEXPECTED EVENTS  
\*\*\*\*\*  
YOU HAVE ENCOUNTERED EVENT NUMBER..... 29  
CHECK TO SEE WHAT HAPPENED.

TRY HARDER NEXT MONTH. GOOD-BYE FOR NOW.

TYPE MONTH NUMBER 1-12?2  
ENTER ROLE NUMBER, COMMA AND CAR CHOICE NOW. ?8,21

ROLE NUMBER 8 CAR NUMBER 21  
REPORT FOR MONTH NUMBER 2

YOU DROVE 970 MILES THIS MONTH.  
RUNNING EXPENSES (GAS, OIL, WEAR, ETC.) AMOUNT TO \$ 70

MAJOR REPAIRS REPORT  
\*\*\*\*\*  
NOTHING NEEDS FIXING. THINGS O.K. THIS MONTH.

ACCIDENT REPORT  
\*\*\*\*\*  
NO ACCIDENTS.THANK GOODNESS.

UNEXPECTED EVENTS  
\*\*\*\*\*  
YOU HAVE ENCOUNTERED EVENT NUMBER..... 8  
CHECK TO SEE WHAT HAPPENED.

TRY HARDER NEXT MONTH. GOOD-BYE FOR NOW.

TYPE MONTH NUMBER 1-1273  
ENTER ROLE NUMBER, COMMA AND CAR CHOICE NOW. 78,21

ROLE NUMBER 8 CAR NUMBER 21  
REPORT FOR MONTH NUMBER 3

YOU DROVE 830 MILES THIS MONTH.  
RUNNING EXPENSES (GAS, OIL, WEAR, ETC.) AMOUNT TO \$ 60

MAJOR REPAIRS REPORT  
\*\*\*\*\*  
TRANSMISSION ON BUM. BILL AMOUNTS TO \$ 182

ACCIDENT REPORT  
\*\*\*\*\*  
IT MUST BE YOUR CAREFUL DRIVING OR LUCK. NO ACCIDENTS.

UNEXPECTED EVENTS  
\*\*\*\*\*  
NONE THIS MONTH

TRY HARDER NEXT MONTH. GOOD-BYE FOR NOW.



TYPE MONTH NUMBER 1-1274  
ENTER ROLE NUMBER, COMMA AND CAR CHOICE NOW. 78,21

ROLE NUMBER 8 CAR NUMBER 21  
REPORT FOR MONTH NUMBER 4

YOU DROVE 835 MILES THIS MONTH.  
RUNNING EXPENSES (GAS, OIL, WEAR, ETC.) AMOUNT TO \$ 60

MAJOR REPAIRS REPORT  
\*\*\*\*\*  
NO MAJOR REPAIRS THIS MONTH.

ACCIDENT REPORT  
\*\*\*\*\*  
YOU HAD AN ACCIDENT WITH DAMAGE \$ 126  
YOUR INSURANCE RATE GOES UP 25 PER CENT

UNEXPECTED EVENTS  
\*\*\*\*\*  
YOU HAVE ENCOUNTERED EVENT NUMBER..... 8  
CHECK TO SEE WHAT HAPPENED.

TRY HARDER NEXT MONTH. GOOD-BYE FOR NOW.

TYPE MONTH NUMBER 1-12?  
DONE



CONTRIBUTED PROGRAM **BASIC**VOCAB  
36880**TITLE:**

CAI IN WORD USAGE

**DESCRIPTION:**

This package contains 4 CAI programs in English word usage. FLASH assists in word recollection and spelling; GROOT is a drill in the use of greek roots; PREFIX is a drill in the use of prefixes; and VOCAB assists in the learning of synonyms.

**INSTRUCTIONS:**FLASH

A word is read from the DATA list, is printed and is blacked out immediately after which the user must type in that word. The program is ready to run with 19 words. Present DATA statements run from statement 500 through to statement 540 in steps of 10. More words may be added between statements 540 and 9000. Each word consists of one string in a DATA statement consisting of that word.

GROOT

A list of greek roots is given after which a word or phrase is printed. The user is called upon to enter the greek root which is defined by that word or phrase. The program is ready to run with 20 greek roots. Present DATA statements run from statement 460 through to 510 in steps of 10. More greek roots may be added between statements 510 and 9000. Each prefix consists of two strings in DATA statements. The first string is the greek root and the second is the word or phrase which corresponds to or defines that greek root. For example,

460 DATA"ASTRON","STAR"

PREFIX

A list of prefixes is given after which a word or phrase is printed. The user is called upon to enter the prefix which is defined by that word or phrase.

Continued on next page.

**SPECIAL  
CONSIDERATIONS:**

New data for each of the 4 programs may be added or existing data modified. There are two things to note: as long as the words (or prefixes or sentences) are added or deleted in the correct manner the program will automatically compute the number of words (or prefixes or sentences) and hence the user can use as many as he wishes; also a randomness feature has been incorporated so that the order in which the words are printed out will vary from run to run.

**ACKNOWLEDGEMENTS:**

University of Lethbridge  
Alberta, Canada

INSTRUCTIONS: Continued.

The program is ready to run with 18 prefixes. Present DATA statements run from statement 480 through to 550 in steps of 10. More prefixes may be added between statements 550 and 9000. Each prefix consists of two strings in DATA statements. The first string is the prefix and the second is the word or phrase which corresponds to or defines that prefix. For example,

480 DATA"PRE-","BEFORE"

VOCAB

The sentence is given with one word marked. Then a list of words follows from which the user is required to pick a synonym to the marked word. The program is ready to run with 15 sentences. Present DATA statements run from statement 350 through to statement 790 in steps of 10. More sentences may be added between statements 790 and 9000. Each question consists of 3 strings and a number in DATA statements. The first two strings are the sentence (there must be two), the third string is the list of answers and the number is the number of the correct answer. For example,

350 DATA"WHEN THE NEWS CAME/RADIANT/"  
360 DATA"FACES REPLACED GLOOMY ONES"  
370 DATA"1 FROWNING 2 OVERHEATED 3 LONG 4 SHINING", 4

RUN

RUN  
FLASH

WELCOME TO THE PROGRAM CALLED 'FLASH'. THIS PROGRAM IS DESIGNED  
TO HELP WITH THE RECALL OF WORDS. A WORD WILL BE TYPED AND YOU  
WILL BE CALLED UPON TO TYPE BACK THAT WORD.

READY....

#####  
WHAT WAS THE WORD?PRINCIPAL  
CORRECT  
#####  
WHAT WAS THE WORD?IRRITATING  
CORRECT  
#####  
WHAT WAS THE WORD?AFFECT  
CORRECT  
#####  
WHAT WAS THE WORD?ELICIT  
CORRECT  
#####  
WHAT WAS THE WORD?CONTEMPTIBLE  
CORRECT  
#####  
WHAT WAS THE WORD?IMMIGRANT  
CORRECT  
#####  
WHAT WAS THE WORD?IMPLIED  
CORRECT  
#####  
WHAT WAS THE WORD?COMPLIMENTS  
INCORRECT ... THE CORRECT ANSWER IS: COMPLEMENTS  
#####  
WHAT WAS THE WORD?FEASIBLE  
CORRECT

\*\*\*\*\*  
WHAT WAS THE WORD?STATIONERY  
CORRECT

\*\*\*\*\*  
WHAT WAS THE WORD?VENAL  
CORRECT

\*\*\*\*\*  
WHAT WAS THE WORD?VOCATION  
CORRECT

\*\*\*\*\*  
WHAT WAS THE WORD?CREDIBLE  
CORRECT

\*\*\*\*\*  
WHAT WAS THE WORD?ADVISED  
CORRECT

\*\*\*\*\*  
WHAT WAS THE WORD?INGENIOUS  
CORRECT

\*\*\*\*\*  
WHAT WAS THE WORD?EXCEEDINGLY  
CORRECT

\*\*\*\*\*  
WHAT WAS THE WORD?ORDNANCE

INCORRECT ... THE CORRECT ANSWER IS: ORDINANCE

\*\*\*\*\*  
WHAT WAS THE WORD?UNINTERESTED  
CORRECT

\*\*\*\*\*  
WHAT WAS THE WORD?COUNSEL  
CORRECT

\*\*\*\*\*  
WHAT WAS THE WORD?PRACTICABLE  
CORRECT

OUT OF 20 YOU GOT 18 CORRECT.  
THAT IS 90 PERCENT.

YOU GOT COMPLEMENTS INCORRECT.  
YOU GOT ORDINANCE INCORRECT.

DONE

GET-GROOT  
RUIN  
GROOT

HI, I'M GLAD YOU LIKE THIS WAY OF LEARNING, TOO  
WHAT IS YOUR NAME ??SAM  
THESE GREEK ROOTS ARE FOUND IN MANY SCIENTIFIC TERMS.  
YOU WILL BE ASKED TO GIVE A ONE WORD MEANING FOR EACH  
ROOT. 10 POINTS FOR EACH CORRECT ANSWER. THE COMPUTER  
WILL KEEP SCORE. GOOD LUCK, SAM

- ASTRON
- AUTOS
- BIOS
- CHRONOS
- DECA
- DEMOS
- GE
- GRAPHO
- LITHOS
- METRON
- MONOS
- ORTHOS
- PHILOS
- PHONE
- POLYS
- SCOPOS
- TELE
- THERMA
- ZOON
- ANTHROPOS

WHICH PREFIX MEANS HEAT

?THERMA

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS WRITE

?PHILOS

SORRY, YOU MISSED THAT ONE, SAM, THE RIGHT ANSWER IS, GRAPHO

WHICH PREFIX MEANS TIME

?CHRONOS

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS MEASURE

?METRON

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS LIFE

?BIOS

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS ANIMAL

?ZOOON

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS SELF

?AUTOS

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS MANY

?POLYS

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS STAR

?ASTRON

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS PEOPLE

?ANTHROPOS

SORRY, YOU MISSED THAT ONE, SAM, THE RIGHT ANSWER IS, DEMOS

WHICH PREFIX MEANS TEN

?DECA

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS STONE

?GE

SORRY, YOU MISSED THAT ONE, SAM, THE RIGHT ANSWER IS, LITHOS

WHICH PREFIX MEANS ONE

?MONOS

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS SOUND

?PHONE

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS EARTH

?GE

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS FAR

?TELE

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS MAN

?PHILOS

SORRY, YOU MISSED THAT ONE, SAM, THE RIGHT ANSWER IS, ANTHROPOS

WHICH PREFIX MEANS WATCHER

?SCOPOS

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS RIGHT

?ORTHOS

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

WHICH PREFIX MEANS LOVING

?PHILOS

VERY GOOD, YOUR ANSWER IS CORRECT, SAM

YOUR SCORE IS 16 OUT OF 20 CORRECT OR 80 %.

DONE



GET-PREFIX  
 RI/N  
 PREFIX

HI, I'M GLAD YOU LIKE THIS WAY OF LEARNING, TOO.  
 DID YOU KNOW THAT THE PREFIXES THAT YOU WILL LEARN IN  
 THIS PROGRAM WILL GIVE YOU KEYS TO UNLOCK THE MEANINGS  
 OF OVER 14,000 COMMONLY USED WORDS?

WHAT IS YOUR FIRST NAME?

?KIMBERLY

IN THIS PROGRAM YOU WILL BE ASKED TO GIVE A ONE WORD  
 MEANING FOR EACH PREFIX THAT YOU ARE ASKED TO  
 DEFINE. YOU WILL RECEIVE 10 POINTS FOR EACH  
 CORRECT ANSWER. THE COMPUTER WILL KEEP SCORE.

GOOD LUCK, KIMBERLY

PRE-  
 DE-  
 MONO-  
 INTER-  
 UN-  
 RE-  
 TRANS-  
 PRO-  
 NON-  
 EPI-  
 MIS-  
 OB-  
 EX-  
 DIS-  
 IN-  
 COM-  
 SUB-  
 AD-

WHICH PREFIX MEANS AGAIN OR BACK

?RE

SORRY, YOU MISSED THAT ONE, KIMBERLY, THE RIGHT ANSWER IS, RE-  
 WHICH PREFIX MEANS UPON OR OVER

?COM-

SORRY, YOU MISSED THAT ONE, KIMBERLY, THE RIGHT ANSWER IS, EPI-  
 WHICH PREFIX MEANS DOWN

?DE-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY  
 WHICH PREFIX MEANS TOGETHER OR WITH

?COM-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY  
 WHICH PREFIX MEANS BETWEEN

?INTER-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY  
 WHICH PREFIX MEANS APART OR NOT

?NON-

SORRY, YOU MISSED THAT ONE, KIMBERLY, THE RIGHT ANSWER IS, DIS-  
 WHICH PREFIX MEANS NOT OR ABSENCE OF SOMETHING

?NON-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY  
 WHICH PREFIX MEANS ACROSS OR BEHIND

?TRANS-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY  
 WHICH PREFIX MEANS BEHIND OR AGAINST

?OB-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY  
 WHICH PREFIX MEANS NOT OR INTENSIFIES A VERB

?UN-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY  
 WHICH PREFIX MEANS BEFORE

?PRE-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY  
 WHICH PREFIX MEANS OUT

?EX-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY  
 WHICH PREFIX MEANS ONE

?MONO-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY  
 WHICH PREFIX MEANS WRONG

?MIS-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY

WHICH PREFIX MEANS UNDER

?SUB-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY

WHICH PREFIX MEANS INTO OR NOT

?IN-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY

WHICH PREFIX MEANS IN FAVOR OF OR FORWARD

?PRO-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY

WHICH PREFIX MEANS TO OR TOWARD

?AD-

VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY

YOUR SCORE IS 15 OUT OF 18 WHICH IS 83.3333 %.

YOU COULD PRACTICE A LITTLE MORE KIMBERLY

DONE

GET-VOCAB

RUN

VOCAB

IN THIS EXERCISE YOU WILL FIRST BE GIVEN A SENTENCE WITH ONE OF THE WORDS SEPARATED FROM THE REST BY / MARKS. AFTER THAT YOU WILL BE GIVEN FOUR WORDS. YOU ARE TO TYPE IN THE NUMBER OF THE WORD THAT IS NEAREST IN MEANING TO THE WORD IN THE SENTENCE.

A NEW SET OF SENTENCES WAS ENTERED INTO THE COMPUTER ON TUESDAY JULY 22, 1969

WHEN THE NEWS CAME / RADIANT /  
FACES REPLACED GLOOMY ONES.

1 FROWNING 2 OVERHEATED 3 LONG 4 SHINING

?4

CORRECT

/ COMPASSION / FOR THE LESS FORTUNATE IS  
ONE MARK OF A GENTLEMAN.

1 ENVY 2 DISLIKE 3 SYMPATHY 4 SCORN

?3

CORRECT

SINCE THEY ALREADY OWNED TWO TELEVISION SETS, THE  
SET THEY WON WAS / SUPERFLUOUS /.

1 WELCOME 2 MORE THAN NEEDED 3 SUPERIOR 4 ESPECIALLY NEEDED

?2

CORRECT

SHE POSSESSED MANY QUALITIES / REQUISITE /  
FOR LEADERSHIP.

1 USELESS 2 HARMFUL 3 NOT IMPORTANT 4 NECESSARY

?4

CORRECT

THE / PLAINTIVE / BARKING OF A HOMELESS  
DOG MADE THE CHILDREN UNHAPPY/

1 STACCATO 2 LOUD 3 HIGH-PITCHED 4 MOURNFUL

?4

CORRECT

HE WAS SO / VOLUBLE / THAT HIS SPEECH  
RAN BEYOND THE ALLOTTED TIME.

1 TALKATIVE 2 BRIEF 3 INTERESTING 4 UPSET

?1

CORRECT

IN THE WINTER SHE WAS ENERGETIC, BUT IN  
AUGUST SHE WAS / INDOLENT/ .  
1 OVERHEATED 2 LAZY 3 EAGER 4 DEPRESSED  
?2  
CORRECT

WHEN THE SENATOR MISPLACED HIS SPEECH, HE  
HAD TO / IMPROVISE / HIS TALK.  
1 CANCEL 2 CUT SHORT 3 MAKE UP ON SPUR OF THE MOMENT  
?3  
CORRECT

HIS REASONING WAS SO / FALLACIOUS /  
THAT HIS CONCLUSIONS WERE ALWAYS WRONG.  
1 UNSOUND 2 UNINTERESTING 3 ACUTE 4 SKILLFUL  
?1  
CORRECT

THE ECONOMIC INDEPENDENCE THEY NOW ENJOY IS  
THE RESULT OF A LIFE OF / FRUGALITY /.  
1 WASTE 2 THRIFT 3 ENJOYMENT 4 PURPOSE  
?2  
CORRECT

DRIVING SUCH A BIG CAR GIVES HIM A CHANCE  
TO BE / PRETENTIOUS /.  
1 SHOWY 2 SPEEDY 3 HUMBLE 4 PRACTICAL  
?1  
CORRECT

BEING HUMAN, WE MAY  
BE / FALLIBLE / IN OUR JUDGMENTS.  
1 CORRECT 2 SUPERNATURAL 3 LIKELY TO ERR 4 FAIR  
?3  
CORRECT

HE HAD BECOME SO / OBESE / THAT HE COULD NOT  
BEND DOWN TO TIE HIS SHOES.  
1 LAZY 2 STIFF 3 FAT 4 TALL  
?3  
CORRECT

MEMBERS OF THE BASEBALL TEAM CARRIED SO MUCH/IMPEDIMENTA /WITH  
THEM THAT WE THOUGHT THEY WERE GOING FOR A MONTH TOUR.  
1 MONEY 2 CORRESPONDENCE 3 FOOD 4 BAGGAGE  
?4  
CORRECT

EVEN BEFORE HE RECEIVED NEWS OF THE ACCIDENT, HE HAD A  
/PREMONITION/THAT SOMETHING WOULD HAPPEN.  
1 PROMISE 2 HOPE 3 FOREWARNING 4 LETTER  
?3  
CORRECT

YOU GOT 15 OUT OF 15 FOR 100 %.  
CONGRATULATIONS, YOU GOT THEM ALL CORRECT.

DONE



CONTRIBUTED PROGRAM **BASIC**

**TITLE:** COMPUTER-ASSISTED REVIEW LESSONS ON SYNTAX FOR SPANISH II CARLOS  
36175

**DESCRIPTION:** CARLOS (Computer-Assisted Review Lessons On Syntax) was conceived and developed at Dartmouth College by Dr. Robert C. Turner under an NSF grant during the school year 1967-1968, and was updated during the spring of 1970 at Dartmouth College. The data base was implemented on the HP 2000C in March 1971. These are written grammar drill lessons for Spanish II. Ideally a student may use CARLOS any time in the school year for the preparation of an assignment, for extra curricular review, for final examination, or for review during higher-level Spanish Courses where he is expected to have already mastered the material. The student may repeatedly write the same drills until he has mastered the materials without needing to feel that he is bothering his instructor with "stupid mistakes", which may occur because of a shallow or too distant background. Any mistakes the student makes are entirely private and, of course, are instantly corrected for him.

**INSTRUCTIONS:**

1. GET-\$CARLOS
2. RUN
3. The user will answer the questions which are presented to him on the terminal.

**SPECIAL CONSIDERATIONS:** Turner, Ronald C., CARLOS: CAI in Spanish at Dartmouth College, Dartmouth College, Hanover, N.H., 1968

The data base is contained in the file, CAR1, on the system library. It contains a directory and 15 lessons.

**ACKNOWLEDGEMENTS:** Richard E. McIntire  
Hewlett-Packard/Data Systems



CONTRIBUTED PROGRAM **BASIC**BNKSIM  
36713**TITLE:**SIMULATES ONE YEAR'S DEPOSIT AND WITHDRAWAL ACTIVITIES  
OF A SMALL BANK**DESCRIPTION:**

This program simulates one year's deposit and withdrawal activities of a small bank. It is assumed that the probability for deposits and withdrawals are normally distributed.

**INSTRUCTIONS:**

In this program you have a choice of the type of simulation to be run. By entering a 1 all balances will be started at \$100. In this manner the user can easily see the effects on the account balances from month to month. By entering a 2 larger random numbers are set for beginning balances.

In addition, the user must also select values for the following:

- the number of customers used in the simulation
- the yearly interest rate (in decimal form)
- the probability of a customer entering the bank during one month. The bank is open 20 days per month, thus 2 days of of 20 would be a probability of .10.
- the standard deviation of the transactions in dollars
- the probability that a withdrawal is made when a customer enters the bank.

These questions are all asked at the beginning of the program's execution.

A maximum of 50 customers may be used in the simulation.

**ACKNOWLEDGEMENTS:**

Babson College  
Babson Park, Massachusetts





| CUSTOMER | BALANCE | QUARTER 1<br>INTEREST |
|----------|---------|-----------------------|
| 1        | 1289.93 | 7.8679                |
| 2        | 0       | 0                     |
| 3        | 645.31  | 4.95567               |
| 4        | 303.43  | 3.74604               |
| 5        | 679.93  | 7.14532               |
| 6        | 647.71  | 6.55871               |
| 7        | 878.69  | 10.848                |
| 8        | 380.46  | 2.36836               |
| 9        | 305.81  | 2.46117               |
| 10       | 642.53  | 7.93248               |

TOTAL IN BANK 5773.81  
 TOTAL CUMULATIVE INTEREST 53.8836

|          |         | MONTH 4 |          |         |
|----------|---------|---------|----------|---------|
| CUSTOMER | BALANCE |         | CUSTOMER | BALANCE |
| 1        | 1289.93 |         | 6        | 960.08  |
| 2        | 0       |         | 7        | 787.13  |
| 3        | 413.24  |         | 8        | 380.46  |
| 4        | 204.12  |         | 9        | 486.65  |
| 5        | 679.93  |         | 10       | 539.63  |

TOTAL 5741.17

|          |         | MONTH 5 |          |         |
|----------|---------|---------|----------|---------|
| CUSTOMER | BALANCE |         | CUSTOMER | BALANCE |
| 1        | 1192.65 |         | 6        | 752.53  |
| 2        | 91.53   |         | 7        | 699.73  |
| 3        | 610.31  |         | 8        | 380.46  |
| 4        | 90.57   |         | 9        | 783.44  |
| 5        | 755.72  |         | 10       | 736.84  |

TOTAL 6093.76

| CUSTOMER | BALANCE | QUARTER 2<br>INTEREST |
|----------|---------|-----------------------|
| 1        | 1321.59 | 14.9081               |
| 2        | 78.7    | 0                     |
| 3        | 512.37  | 5.16553               |
| 4        | 126.71  | 1.13211               |
| 5        | 864.88  | 8.49914               |
| 6        | 664.01  | 7.04137               |
| 7        | 603.9   | 7.4556                |
| 8        | 282.29  | 3.48507               |
| 9        | 761.07  | 3.82261               |
| 10       | 707.87  | 6.74539               |

TOTAL IN BANK 5923.39  
 TOTAL CUMULATIVE INTEREST 112.139

|          |         | MONTH 7 |          |         |
|----------|---------|---------|----------|---------|
| CUSTOMER | BALANCE |         | CUSTOMER | BALANCE |
| 1        | 1022    |         | 6        | 953.9   |
| 2        | 78.7    |         | 7        | 369.5   |
| 3        | 405.49  |         | 8        | 269.66  |
| 4        | 398.83  |         | 9        | 856.74  |
| 5        | 901.81  |         | 10       | 510.66  |

TOTAL 5767.3

|          |         | MONTH 8 |          |         |
|----------|---------|---------|----------|---------|
| CUSTOMER | BALANCE |         | CUSTOMER | BALANCE |
| 1        | 925.63  |         | 6        | 1026.08 |
| 2        | 388.39  |         | 7        | 369.5   |
| 3        | 368.57  |         | 8        | 359.22  |
| 4        | 596.51  |         | 9        | 976.52  |
| 5        | 940.46  |         | 10       | 510.66  |

TOTAL 6461.55

| CUSTOMER | BALANCE | QUARTER 3<br>INTEREST |
|----------|---------|-----------------------|
| 1        | 937.04  | 11.4125               |
| 2        | 279.59  | 0                     |
| 3        | 502.71  | 3.39219               |
| 4        | 483.6   | 1.58393               |
| 5        | 949.36  | 8.89901               |
| 6        | 828.02  | 8.3001                |
| 7        | 694.61  | 4.6188                |
| 8        | 559.76  | 3.37072               |
| 9        | 890.04  | 9.51334               |
| 10       | 619.98  | 6.3833                |

TOTAL IN BANK 6744.71  
 TOTAL CUMULATIVE INTEREST 169.612

|          |         | MONTH 10 |         |
|----------|---------|----------|---------|
| CUSTOMER | BALANCE | CUSTOMER | BALANCE |
| 1        | 1149.56 | 6        | 848.08  |
| 2        | 363.85  | 7        | 686.82  |
| 3        | 617.42  | 8        | 683.33  |
| 4        | 483.6   | 9        | 890.04  |
| 5        | 772.15  | 10       | 715.23  |

TOTAL 7210.1

|          |         | MONTH 11 |         |
|----------|---------|----------|---------|
| CUSTOMER | BALANCE | CUSTOMER | BALANCE |
| 1        | 1264.51 | 6        | 1321.69 |
| 2        | 556.98  | 7        | 584.64  |
| 3        | 650.09  | 8        | 678.07  |
| 4        | 483.6   | 9        | 889.63  |
| 5        | 877.34  | 10       | 690.63  |

TOTAL 7997.18

| CUSTOMER | BALANCE | QUARTER 4<br>INTEREST |
|----------|---------|-----------------------|
| 1        | 1441.84 | 11.713                |
| 2        | 555.34  | 3.49487               |
| 3        | 626.3   | 6.28392               |
| 4        | 543.37  | 5.19864               |
| 5        | 886.33  | 9.49642               |
| 6        | 1453.22 | 10.3502               |
| 7        | 607.74  | 6.19956               |
| 8        | 775.65  | 6.99701               |
| 9        | 791.48  | 8.70058               |
| 10       | 798.11  | 7.74975               |

TOTAL IN BANK 8479.37  
 TOTAL CUMULATIVE INTEREST 245.796

THE FINAL ACCOUNT BALANCES FOR THE YEAR ARE

| CUSTOMER | BALANCE | CUSTOMER | BALANCE |
|----------|---------|----------|---------|
| 1        | 1441.84 | 6        | 1453.22 |
| 2        | 555.34  | 7        | 607.74  |
| 3        | 626.3   | 8        | 775.65  |
| 4        | 543.37  | 9        | 791.48  |
| 5        | 886.33  | 10       | 798.11  |

TOTAL 8479.37

DONE

CONTRIBUTED PROGRAM **BASIC****TITLE:**CASES IN COMPUTER AND MODEL ASSISTED MARKETING:  
PLANNINGCASE1  
3679C**DESCRIPTION:**

There are five programs in this package: ADBUDG, NIK1, NIK2, PLAN and MAXIMA.

ADBUDG presents Castle Coffee Company cases. Castle's share of market had slipped badly during the past decade, although brand share had recently stabilized. A major concern of the advertising manager was the fact that the increased advertising budget he had obtained the previous year had been cut back in mid year because of management's dissatisfaction with the results. In addition, it seemed vital to begin to increase Castle's share so as not to lose distribution.

The Advertising Manager of Castle Coffee is now faced with the problem of preparing and justifying an advertising budget for the coming fiscal year.

After the painful experience of the previous year's advertising budget cutback, the Advertising Manager is contemplating the use of an abridged version of J.D.C. Little, "Models and Managers: The Concept of a Decision Calculus," Management Science: Applications, (April 1970.) The case provides some baseline judgements from Castle's Advertising Manager and presents the ADBUDG II model and Little's concept of a "decision calculus".

Continued on following page.

**INSTRUCTIONS:**

Complete instructions for use of this material is found in "Cases in Computer and Model Assisted Marketing: Vol. I Planning, by George S. Day, Gerald J. Eskin, David B. Montgomery and Charles B. Weinberg. For information write:

Hewlett-Packard Computer Curriculum Project  
Scientific Press  
1629 Channing Ave.  
Palo Alto, California 94303

**SPECIAL  
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Business School Marketing Courses

**ACKNOWLEDGEMENTS:**

Graduate School of Business  
Stanford University

DESCRIPTION continued

NIK1 Nikoll Electronics, a multi-divisional producer of electronic equipment, has developed a relatively simple competitive bidding model which provides their management with a tool to examine the likelihood of winning and the expected payoffs from alternative bids in bidding situations. The model allows for intangibles as well as competitive advantage (disadvantage).

An opportunity to use the model in a concrete bidding situation occurs when Nikoll has the opportunity to bid on several options on a large oscillator contract. The contract is quite important to Nikoll since it represents a substantial amount of business and the opportunity to gain and hold leadership for this type of product.

NIK2 In this case the Nikoll Electronics Company modifies its bidding model to better reflect the oscillator bidding situation. The revised model considers the fact that competitor's bids on various options might be related. The model also considers the impact of winning various options on overhead billing arrangements on government contracts.

PLAN The case presents a situation in which a computer based macro planning model was proposed as a way of doing strategic planning for two lines of grocery products. From a product point of view the case can be considered a life cycle problem where one product has matured while the other still has growth potential. The implications of this become clear as the model is used to "optimize" sales and profits. From a technical point of view the case raises issues concerning appropriate factors to consider in the planning process and how to represent these in a quantitative way. The model uses "response coefficients" to deal with the "best" strategy question. This raises the issue of sources of information (i.e., experiments, use of historical data, marketing information systems, etc.).

MAXIMA Maxim Case

General Foods must develop a marketing plan for a new product - freeze dried coffee. Based on an extensive set of data on consumer and product research, decisions on product positioning, advertising, price, promotion, etc. must be made. Alternatively, General Foods can decide to stop development of the project if it does not appear to be sufficiently profitable.

MAXIMA is a computer program designed to help the marketing decision maker analyze the profit potential of a number of alternative new product marketing programs. It is a decision-making aid that compares alternatives based on net present value. The program is in two parts. The first section uses a simple 3-equation model (the Ayer model, discussed in H.J. Claycamp and L.E. Liddy, "Prediction of New Product Performance: An Analytical Approach", Journal of Marketing Research, November 1969) to predict the first year market share as a function of the marketing mix. The second section uses this, plus cost data, to prepare profit-and-loss and cash-flow statements. Sub models help to perform sensitivity analysis on the marketing programs.

CONTRIBUTED PROGRAM **BASIC**

**TITLE:** CASES IN COMPUTER AND MODEL ASSISTED MARKETING: CASE2  
DATA ANALYSIS 36841

**DESCRIPTION:** There are 8 programs and 1 file in this package: FALLON, FALFIL (file), NEWA, NEWB, NEWC1, NEWC2, NEWD, HINB1 and HINB2.

**FALLON** The Fallon Company programs present 2 cases. The (A) case presents sales and advertising expenditure data for thirty-eight geographic areas. The problem is how to extract from this data information on the responsiveness of the market to advertising expenditures. The (B) case presents a special purpose regression program for analyzing this problem. (Note: An instructor could use any canned regression program for this assignment.) This is an excellent case to use to introduce regression. The authors would recommend that it be used prior to the Newfood (B) assignment in order to prepare the students to make a better analysis of that case. The (B) case includes a brief technical appendix on regression analysis.

**FALFIL** presents sales and advertising expenditure data for thirty-eight geographic areas. The problem is how to extract from this data information on the responsiveness of the market to advertising expenditures. The (B) case presents a special purpose regression program for analyzing this problem. (Note: An instructor could use any canned regression program for this assignment.) This is an excellent case to use to introduce regression. The authors would recommend that it be used prior to the Newfood (B) assignment in order to prepare the students to make a better analysis of that case. The (B) case includes a brief technical appendix on regression analysis.

**(FILE)**

**NEWFOOD.** The Newfood series covers an integrated series of problems encountered in the early planning, test marketing, and the final planning prior to national introduction of a new specialty product. The (A) case considers the issue of whether or not to test market at all. The (B) and (C) cases present some actual test market results that require analysis and interpretation. In (B) outcomes of a controlled experiment (involving price, location and advertising level) are presented. In (C) summaries of consumer panel data are presented that should aid in forecasting eventual sales levels. The (D) case is an integrative exercise requiring use of the research information (from the (B) and (C) cases) and prior knowledge (from the (A) case). This information should be exploited to develop a final plan for the national introduction of the product.

Continued on following page.

**INSTRUCTIONS:** Complete instructions for use of this material is found in "Cases in Computer and Model Assisted Marketing: Vol. II Data Analysis", by Professors Gerald J. Eskin and David B. Montgomery. For information write:

Hewlett-Packard Computer Curriculum Project  
Scientific Press  
1629 Channing Ave.  
Palo Alto, California 94303

**SPECIAL CONSIDERATIONS:** FOR INSTRUCTIONAL PURPOSES  
Suitable Courses: Business School Marketing Courses

**ACKNOWLEDGEMENTS:** Graduate School of Business  
Stanford University

DESCRIPTION continued

- NEWA Part I is a problem statement and Part II gives a solution and related computer program. The situation involves a new product pre test market situation in which a GO-NOGO decision is required or alternatively a decision to test market can be made. This raises the value of information question. Part I provides material to set up a formal decision analysis model. Many issues arise from the process including:
- whose priors to use
  - appropriateness of the expected value criteria
  - length of planning process and discounting
  - can the problem be "completely" modeled
- In the Part II case the actual solution used is presented. It involves many simplifying assumptions and is only a partial solution. This leads to discussion of the role of simplifying assumptions and partial solution and the usefulness of complex models. With the computer program many of the key assumptions can be tested for sensitivity.
- NEWB Outcomes of a controlled store audit experiment involving a factorial arrangement of price (3 levels), advertising (2 levels) and location within store (2 levels) are given and a number of regression runs on the data is provided to aid in interpretation. A computer program to perform further regression analysis is provided.
- The case provides an opportunity to use correlation and regression to help understand data as opposed to the more usual forecasting use. Using these techniques it is possible to see to what extent the experiment is out of control, ways of adjusting for this and the magnitude of various experimental effects.
- The case raises many other issues such as:
- appropriate measures of advertising inputs
  - treatment of experimental effects over time
  - role of interactions
  - the use of dummy variables
  - specification errors in regression models.
- NEWC1 Part I presents various summary measures that come out of consumer panel data and sets up the problem of forecasting new product sales for products that may have a short life cycle.
- NEWC2 Part II presents several forecasting techniques, resulting forecasts, and computer programs for this purpose. One model is a simulation model to assess uncertainty in a sales forecast based on component uncertainty in variables such as Trial and Repeat. The second model is a dynamic micro forecasting model based on time between purchase and repurchase rate data.
- NEWD Here a translation must be made from the various test situations to a national introduction. All previously developed knowledge about the product must be integrated into a general plan. A planning model is presented and the student is encouraged to reuse previously introduced programs to reevaluate the situation based on new environmental information.
- HINB1 The (A) case describes a situation in which a cake manufacturer who has just introduced a new product some 6 months ago is faced with new competitive entries that are similar but not the same as his product. The firm must decide if it should compete directly by introducing a product like the competitive one and/or dropping its previous entry which is doing only moderately well. These decisions must be made before share data are available on the market performance of the competitive products. The only available market research data involve protocols obtained from group interviews covering consumer needs in the cake mix area.
- HINB2 The case provides an opportunity for students to construct flow charts of probable consumer behaviour as a first step in understanding need segments in this market. The (B) case discusses the forecasting technique used to estimate the size of these segments. It involves the use of a micro behavioral simulation model. A flow chart, trace runs, computer program, forecasts and some validation data are included.

CONTRIBUTED PROGRAM **BASIC**GSPMG  
36502**TITLE:** STANFORD PORTFOLIO MANAGEMENT GAME**DESCRIPTION:**

The Stanford Portfolio Management System is made up of a set of programs and files for use on the Graduate School of Business' Hewlett-Packard 2000C computer. It allows students in the second-year MBA course on Investments to make transactions with an "automated broker" and manage portfolios. The system is an outgrowth of earlier work reported in Technical Report No. 4, "Stanford Portfolio Management Game," by John G. McDonald and Donald C. Baron. The present version differs somewhat from the one described in that report, but the basic philosophy is the same.

GSPMG consists of 7 programs: GBRKR, GQUOTE, GPMS1, GPMS2, GPMS3, GPMS4, GPMS5.

**INSTRUCTIONS:**

The use of this program is described in GSB #13, "The Stanford Portfolio Management System" by William F. Sharpe, which comprises this documentation.

Accounts Utilized

Three accounts are normally utilized for the system. All programs are maintained in the public library (account A000) and referenced by preceding the program name with a dollar sign. Some of the programs contain a mask for encoding and decoding information written on file ACCTS (see below). These programs are protected -- they may be used but not listed. This makes it impossible for a user to alter the contents of file ACCTS directly; he must use the authorized programs.

The prices and dividends for securities covered in the system are maintained on file SPRDIV. This is usually maintained in account C100 (the course library account). The instructor's assistant typically updates the file once each day during the quarter. The file may be read (but not written) from any account between C101 and C199 by preceding the name with an asterisk.

Instructions continued on next page.

**SPECIAL  
CONSIDERATIONS:**

The specific documentation listed here which references account numbers etc., has been left intact to provide a model for other users. Attempts to generalize this material would lose the integrity of the contributor's scheme.

**ACKNOWLEDGEMENTS:** Graduate School of Business  
Stanford University

Students in the course generally enter transactions, get reports, etc., using the instructor's course account. This will be an account with a number between C101 and C199 assigned to the instructor for such use. Students are expected to use the account only for this purpose. The composition of each team's portfolio is maintained on a file named ACCTS in this account. Students access this file and alter it with program \$GBRKR. The instructor's assistant may also access the file using programs of his own or those maintained in the public library to prepare summary reports, etc.

#### FILE ACCTS

The composition of each team's portfolio is maintained on this file. Team 1's portfolio is on records 1 and 2, team 2's portfolio on records 3 and 4, etc. For each team, the following information is stored (in the order shown):

```
password
time of last update
  - year
  - day
  - hour
  - minute
amount of cash
for each security covered
  - number of shares held (positive if long, negative if short)
```

Before students may use the system, the instructor's assistant must OPEN this file, then initialize the information with program \$GPMS2. The initialization process includes the assignment of a password for each team. Subsequently, no student can access or alter a team's portfolio unless he gives the precise password entered earlier by the instructor's assistant.

File ACCTS is read and written through a mask, so every piece of information must be encoded and decoded. The mask is entered via the initialization of variable M\$ in programs \$GBRKR and \$GPMS2, both of which are protected and hence cannot be listed by the user. The mask must also be entered by the user of program \$GPMS5.

#### FILE SPRDIV

This file, usually maintained on account C100, includes current data on all securities considered "eligible" for the portfolio management system. For each eligible security, the file contains:

- the ticker symbol (in a coded format)
- the price per share
- the most recent dividend paid per share
- the time at which the most recent dividend was posted to the file

In addition, the file includes:

- the number of eligible securities
- the time the information on the file was last updated

Each security's ticker symbol is coded into a numeric equivalent. The symbol is first converted to a four-character symbol (with trailing blanks to the right, as needed). Each character is converted to a numeric equivalent with "A" = 1, "B" = 2 ... "Z" = 26, and blank = 27. Let  $S_1$  represent the numeric equivalent of the first (left-most) character,  $S_2$  the equivalent of the second, etc. Then the code for the entire ticker symbol is:

$$S_1 * 30^3 + S_2 * 30^2 + S_3 * 30 + S_4$$

This coding procedure (and/or an inverse decoding procedure) is used in other programs in the Portfolio Management System.

The time at which a dividend was posted to the file is also entered in coded form. Letting  $T_3$  = the year (71 = 1971),  $T_2$  = the day of the year,  $T_1$  = the hour of the day, and  $T_0$  = the minute of the hour, the code is:

$$[(T_3 - 71) * 365] + [T_1 / 24] + [T_0 / (24 * 60)]$$

This expresses time as the number of days since the beginning of 1971. A similar procedure is used in other programs in the system.



The format of the file is as follows:

- year of last update
- day of last update
- hour of last update
- minute of last update
- number of securities on eligible list



For each security:

- code for ticker symbol
- price per share
- most recent dividend per share
- code for time when last dividend posted

Before any other programs are used, this file must be CREATED, then initialized using program GPMS1.

#### PROGRAM GBRKR

This program is used to enter transactions for a team's account and to obtain reports on its status. The account is maintained in file ACCTS in the instructor's course account. Security prices and dividends are obtained by the program from file SPRDIV in the course library (account C100). Program \$GBRKR is protected so the user is unable to alter the contents of file ACCTS except via this program.

The program begins by asking:

TEAM NUMBER?

The user responds with the appropriate number.

The program then asks:

PASSWORD?

The user must give the exact password entered previously by the instructor for his team. If there is any discrepancy, the program terminates. Otherwise, the program continues by asking:

DO YOU WANT TO ENTER A TRANSACTION, GET A REPORT, OR QUIT?

The user responds with:

T (or TRANSACTION)

R (or REPORT)

Q (or QUIT)

The REPORT option provides a portfolio status report as of the moment of inquiry. After a summary of the cash position, etc., the program asks:

HOLDINGS?

If a list of holdings is desired, the user responds YES (or simply Y). If not, he responds NO (or simply N).

If the TRANSACTION option is selected, the program asks:

STOCK?

The user responds with the ticker symbol of the security in question. The program next asks:

BUY OR SELL?

The user responds with B (or BUY) or S (or SELL), depending on the desired action. The program then asks:

NUMBER OF SHARES?

And the user responds with the number desired.

If the transaction is allowed, the program will indicate the brokerage fee in dollars, then ask:

O.K.?

If the transaction is acceptable, the user responds Y (or YES), the the program will indicate:

CONFIRMED

If the transaction is not acceptable, the user responds N (or NO), and the program will indicate:

REQUEST CANCELLED

If the QUIT option is selected, the program will terminate after updating the ACCTS file.

#### PROCEDURES

The program maintains an up-to-the-minute valuation of the user's account. All long positions (positive holdings) are valued at the current market prices on file SPRDIV; the total is reported as LONG POSITION AT MARKET. Similarly, all short positions (negative holdings) are valued at current market prices and the total reported as SHORT POSITION AT MARKET. The figure reported for CASH ON HAND indicates liquid interest-earning assets if the value is positive; if the value is negative, it indicates debt owed to the broker. NET WORTH is calculated as follows:

$$\text{NET WORTH} = \text{CASH ON HAND} + \text{LONG POSITION AT MARKET} - \text{SHORT POSITION AT MARKET}$$

The status of the account depends on its current margin, calculated as follows:

$$\text{CURRENT MARGIN} = \frac{\text{NET WORTH}}{\text{LONG POSITION AT MARKET} + \text{SHORT POSITION AT MARKET}}$$

Whenever the current margin for the account exceeds .70, any type of transaction is allowed unless it will reduce the current margin to a value below .70. In the latter case, a message will be printed and the transaction request will be denied by the program.

Whenever the current margin for the account falls below .70, the account is restricted. Only transactions that will increase the current margin are allowed. Any transaction not meeting this requirement is rejected by the program.

The program adds interest to the amount of cash on hand at an annual rate of 6%, compounded continuously. If the cash on hand is positive, it will be increased. If the cash on hand is negative, its absolute value will be increased (i.e., the amount of debt will be increased). For purpose of interest calculations, the cash on hand is reduced by the value of the short positions (e.g., no interest is paid on the proceeds from a short sale). The program automatically adds interest any time the user requests a report -- (i.e., the appropriate amount to cover the time period since the last report is added).

Dividends are also added to or subtracted from the account. When the user requests the first report since a dividend was posted to the SPRDIV file, the program automatically (1) adds dividends to his cash position for long positions and (2) subtracts them for short positions.

Brokerage charges are those charged by the New York Stock Exchange in April, 1972. A sample run follows.

```
GET-GBRKR
RUN
GBRKR
```

```
TEAM NUMBER?1
PASSWORD?BUY LOW, SELL HIGH
DO YOU WANT TO ENTER A TRANSACTION, GET A REPORT, OR QUIT?T
STOCK?IBM
BUY OR SELL?BUY
NUMBER OF SHARES1200
BROKERAGE FEE IS 130
O.K.?Y
CONFIRMED.
```

```
DO YOU WANT TO ENTER A TRANSACTION, GET A REPORT, OR QUIT?R
```

PORTFOLIO STATUS REPORT  
AUG 21 1972 12: 1 A.M.

CASH ON HAND: 31160.02  
LONG POSITION AT MARKET: 69000.00  
SHORT POSITION AT MARKET: 0.00  
NET WORTH: 100160.03  
CURRENT MARGIN: 1.452

## HOLDINGS?Y

| STOCK | SHARES | L/S   | PRICE   | TOTAL VALUE |
|-------|--------|-------|---------|-------------|
| ----- | -----  | ----- | -----   | -----       |
| IBM   | 200    | LONG  | 345.000 | 69000.00    |

DO YOU WANT TO ENTER A TRANSACTION, GET A REPORT, OR QUIT?Q

DONE

PROGRAM GQUOTE

This program may be used to obtain a quotation from the list of security prices maintained on file SPRDIV on account C100.

The user may type the ticker symbol for the stock in which he is interested. The program then prints its current price as listed on file SPRDIV. If the symbol is not on the eligible list, an appropriate message is printed. In either event, the user is then asked for another symbol.

At any time, the user may respond to the request SYMBOL? with DONE. This will cause termination of the program.

At any time, the user may respond to the request SYMBOL? with ALL. The program will list the ticker symbol and current price of every security on the eligible list, then terminate.

A sample run follows.

RUN  
GQUOTE

WHEN ASKED, TYPE TICKER SYMBOL, 'ALL' OR 'DONE'.

SYMBOL?WFG  
PRICE: 45.750

SYMBOL?ALL

|     |         |
|-----|---------|
| T   | 46.250  |
| GM  | 37.000  |
| HWP | 77.000  |
| IBM | 345.000 |
| WFG | 45.750  |

DONE

PROGRAM \$GPMS1

This program is used to set up file SPRDIV in account C100 for use in the Stanford Portfolio Management System. The user first indicates the number of securities on the "eligible" list, then their ticker symbols (preferably, but not necessarily, in alphabetic order). After each symbol is input, the program reprints the information and then asks "OK?". If the reply is Y, the program will continue. If the reply is N, the program will ask for the symbol again.

When all symbols have been input and verified, the program will set up file SPRDIV in the format described above. For each security, price, dividend and time of entry of the last dividend will be set to zero. Any previous contents of the file will be lost.

Before this program is run, file SPRDIV must be opened. The number of records must be at least:

$$\frac{5 + 4N}{128}$$

where N = the number of eligible securities, and the formula is assumed to be rounded up to the nearest integer.

Limitations imposed by file ACCTS require:

$$N < 251 + \frac{P}{4}$$

Where P = length of the longest team password.

A sample run follows.

```

RUN
GPMS1

NUMBER OF SECURITIES ON THE ELIGIBLE LIST?5
TICKER SYMBOLS --
1      ?T
T
OK?Y
2      ?GN
GN
OK?N
2      ?GM
GM
OK?Y
3      ?HWP
HWP
OK?Y
4      ?IBM
IBM
OK?Y
5      ?WFG
WFG
OK?Y

DONE

```

PROGRAM GPMS2

This program is used by the instructor's assistant to open the accounts of the teams. Before the program is run, a file named ACCTS should be opened with twice as many records as there are teams. The program will request the password for each team, terminating when the user responds YES to the inquiry "DONE?". This program cannot be run before GPMS1.

A sample run follows.

```

GET-GPMS2
RUN
GPMS2

DONE?N
TEAM 1      -- PASSWORD?BUY LOW, SELL HIGH

DONE?N
TEAM 2      -- PASSWORD?EFFICIENT MARKET

DONE?Y

DONE

```

PROGRAM GPMS3

This program is used to update the dividends in file SPRDIV. It can only be used in the account in which file SPRDIV is maintained (usually account C100). Dividends are normally posted within a day of the time at which the stock goes ex-dividend. In general, the dividend should be entered at the same time as the last price prior to the ex-dividend price is entered.

The program asks for the ticker symbol(s) of securities for which dividends are to be entered. The Portfolio Management System does not provide for stock dividends or splits. The recommended procedure is to assume that any stock dividend or split is converted into cash. In other words, the market value is simply entered as a cash dividend.

When all changes have been entered, the data are entered into file SPRDIV. Both the dividend and the time at which it was entered into the file are recorded. This latter information is used when portfolios are updated to be certain that dividends are credited only once to an account.

```

GET-GPMS3
RUN
GPMS3

SYMBOL OR 'DONE'?IBM
DIVIDEND?1.45
SYMBOL OR 'DONE'?DONE

DONE

```

PROGRAM GPMS4

This program, used to update file SPRDIV, must be used on the account on which SPRDIV is stored (usually account C100). The file is normally updated daily, using closing prices posted as soon as possible after the market has closed.

The user may enter prices for selected securities by indicating the ticker symbol of each. If this option is chosen, the program prints the old price and requests the new one. At any time, the user may respond to the request for a ticker symbol with ALL. The program will then proceed through the eligible list in order, giving each ticker symbol and the old price, and requesting the new one.

When the user is finished, he should respond DONE when the program requests a ticker symbol. The revised information will then be entered on file SPRDIV and the program will terminate.

A sample run follows.

RUN  
GPMS4

TICKER SYMBOL (OR 'ALL' OR 'DONE')?WFG  
OLD PRICE 0  
NEW PRICE?45.5

TICKER SYMBOL (OR 'ALL' OR 'DONE')?ALL  
T 0  
PRICE?46.25

GM 0  
PRICE?37

HWP 0  
PRICE?77

IBM 0  
PRICE?345

WFG 45.5  
PRICE?45.75

TICKER SYMBOL (OR 'ALL' OR 'DONE')?DONE  
DONE

PROGRAM GPMS5

This program is used by the instructor to obtain a summary of the teams' current holdings. The program must be run in the account containing file ACCTS (usually the instructor's course account).

The program begins by asking:

CODE FOR FILE?

The user must respond with the code used to read and write file ACCTS. This is the code used in protected programs \$GBRKR and \$GPMS1. If the correct code is not given, the program will not operate correctly.

The program will then ask for the number of teams for which accounts exist on file ACCTS. It will then summarize and print the number of shares long and short for each stock. Only those stocks with non-zero positions will be shown.

A sample run follows.

GET-GPMS5  
RUN  
GPMS5

CODE FOR FILE?X3MLB/  
NUMBER OF TEAMS?2

| SECURITY | LONG  | SHORT |
|----------|-------|-------|
| -----    | ----- | ----- |
| IBM      | 200   | 0     |

DONE

CONTRIBUTED PROGRAM **BASIC**LABOR  
36233

## TITLE:

LABOR/MANAGEMENT BARGAINING

## DESCRIPTION:

This interactive collective bargaining simulation can be played by one or more groups for several periods. Each group of students will consist of two teams; one team will play the role of management and the other the role of labor. Each team will make decisions on a set of issues and will try to reach an agreement. If no agreement is reached, new decisions are inputted the following week. The computer has the following roles:

- create an economic environment
- play the role of arbitrator, if arbitration is requested by any one team

## INSTRUCTIONS:

The data statement in line 30 contains 4 values

```
30 DATA W5, C3, A, B
```

where: W5 tells the computer if the simulation is to work continuously (W5=0) or if it is to stop and a subsequent period be played later(W5=5).

C3 is the number of copies of the printout desired.

A, B must be between 0 and 9. Low values will generate a poor profit and high inflation environment; higher values will generate a better environment.

Currently the simulation is set up such that:

W5=5: the run stops at the end of each period and data are saved.

C3=1: 1 copy is required

A=5:

B=7:

See following pages for a detailed discussion of the theory and additional user procedures.

SPECIAL  
CONSIDERATIONS:

The only restriction to the number of firms that can play the game is the size of the file STRIKE. 2 sectors are needed per firm. This file must be opened by the user prior to the running of the simulation.

## ACKNOWLEDGEMENTS:

Francois P. Carlhian  
Babson College

DESCRIPTION OF THE ENVIRONMENT

In a hypothetical firm, the labor-management contract is expiring. Labor is dissatisfied with its terms and all efforts made towards Management to improve it have failed. Management claims that the contract is fair and does not want to modify it. Because of the stubborn position of Management, Labor has decided to go on strike.

Management and Labor are provided information concerning:

- the firm
- the last Labor-Management contract
- the economic environment

I. Information Concerning the Firm:

- profit increase: This is the percentage representing profit increase in the firm since the establishment of the last contract. Profit means net profit after taxes.
- productivity increase: Expressed in percent, this figure represents the increase of output per manhour. This productivity is mainly due to new equipment and machinery.
- last wage increase: Amount of hourly wage increase when the last contract was established.
- employment level: The firm's employment when the strike starts. A certain proportion of workers will quit during the strike.
- inventory level: Expressed in dollars, it is the amount of finished goods inventory ready for shipment and stored in warehouses which are not affected by the strike.
- strike fund: Labor has cash reserves which will be utilized to help the workers. It has been decided that every worker on strike will receive \$8 a week.
- last year's sales: Value of last year's gross sales expressed in millions of dollars.
- last year's profit: Net profit made after taxes in previous year.
- profit per worker: Dollar value of the net profit divided by the number of workers.

II. Information Concerning the Last Contract:

The Labor-Management contract consists of 9 issues:

- duration: in months
- wage rate: hourly wage rate in dollars
- guaranteed overtime: number of hours a week that a worker can work with an overtime wage rate
- vacation days per year: number of paid vacation days a year
- regular hours a week: number of hours a week worked at regular pay. It is used to compute the week's pay.
- days of sick leave: number of days that a worker is allowed to take (with pay) for sick leave
- bonus and insurance: the firm is paying \$250 per year for medical insurance for each worker, and gives a cash bonus every year at Christmas
- number of paid holidays: number of legal holidays: Christmas, Labor Day, Thanksgiving, etc. which are paid
- overtime wage rate: hourly wage rate for overtime



### III. General Information on the Economic Environment

- Consumer Price Index Increase (in percent)
- Average Wage Increase in Industry (in percent)
- Rate of Unemployment in Industry (in percent)
- Productivity Increase in Industry (in percent)

In addition to creating an environment, the computer will compute and print out the dollar amount representing the fringe benefits. The two teams are also informed that in view of the coming strike, it has been decided at the last meeting of the board of directors that the company would support an increase of the workers' payroll. The dollar amount indicated is the maximum amount of gross payroll and fringe benefits increase that Management will accept without bargaining at any point of time during the strike. This decision has been made at the top echelon by the board of directors and Management has to enforce it.

### DECISIONS AND RESULTS

Once the environment has been described, Management and Labor must reach decisions on the 9 issues involved in the contract. Then the two teams' decisions are typed in and the result of the contract proposal is printed out.

First provided is the cost of the proposed contract due to Labor's conditions and the cost of the proposed contract due to Management's offer. This cost is stated per worker. Therefore, the computer prints out the gross payroll increase, the fringe benefits' increase, and the total increase.

With the help of these figures, the two teams can see how far apart they are, and in which area they should concentrate their efforts in order to reach an agreement.

Then the two teams are given information on the current situation:

- current union membership: Some union members are sometimes not willing to go along with the strike or are not willing to take a loss of income, and quit both their job and the union. Therefore, there is a slow erosion of the union membership that the union leaders must be aware of. If the erosion is too high the Labor will be obliged to give up the strike.
- current strike fund: Labor's strike fund is utilized to distribute \$8 a week to each striking worker. This is not a great deal of money, but it helps and has an important psychological effect.
- inventory level: The per worker dollar figure of the current level of inventory is provided. This gives an indication of how long Management can go without any losses in sales.
- unfilled orders: Per dollar figures of losses in sales due to unfilled orders. This dollar figure can go quite high very quickly.
- Management expected cost of one more week of strike: This is the per worker basic cost of the strike for Management. This figure includes all fixed costs, expected cost of rehiring, wasted material, etc.

The overall goal for Labor and Management is to obtain the best deal at the least cost. This is difficult and competition between different groups or "firms" can show large differences. Starting at the second week, the computer will ask if one of the two teams desires arbitration. If this is the case, the computer will act as arbitrator and will decide the final contract. The use of an arbitrator will allow the negotiators to get out of a deadlock or to stop simulation. It is important to note that most of the parameters provided will influence the results of a set of decisions and they should be weighted carefully before a new contract is proposed.

The simulation is designed in such a way that the role of the computer is minimized. Its main function, besides providing an economic environment, is to compute the dollar value of the cost of proposed new contracts. Hence, the user can visualize the dollar impact of his decisions.

If no agreement is reached in a short period of time, pressure to end the strike is put on both Management and Labor. Losses due to unfilled orders and direct cost of the strike will force management to seek a settlement after a few weeks. On the other hand, union membership losses and an empty strike fund will force Labor to a settlement. Of course, the best way to end the strike is through a direct agreement between the two parties involved. The two teams are given the maximum opportunity to settle the strike without the computer's interference. But, if a deadlock develops during the negotiations, or if the strike goes on for too long, the computer will take over and play the role of outside pressure: Board of Directors, strike fund, treasurer, etc. In addition, starting in week 2, there will be an option for either of the two teams to call for arbitration. The rule is that if either Labor or Management wants arbitration, the other party has to submit and accept arbitration. If this is the case the computer

will play the role of arbitrator and will issue the final contract. Because the arbitrator's decision is final, both parties have to accept it, and the simulation is ended.

#### INSTRUCTIONS FOR USING LABOR

##### Teacher's Instructions:

Prior to running the simulation, the instructor has to choose a few parameters.

There are two options on how to use the simulation. The first one is to have the simulation go on continuously up to the time an agreement is reached. The second option allows users to play 1 period at a time. The computer retains the necessary data and players can input their decisions for the current period at a later time.

The second parameter to be decided is the number of printout copies desired. There is no limit on that number.

The last thing is to choose the economic environment. It is based on two numbers between 0 and 9. If the values of those numbers are high (e.g., 8 and 9) there will be a good economic environment. On the other hand, if those values are low, they will generate a bad environment -- high inflation, poor profit, low wages, etc.

Those values are to be inserted in line 30 of the program by typing:

```
30 DATA 5,1,5,7
```

Then type:

```
RUN
```

to start the simulation.

5 means that the option chosen is to have the computer stop at the end of each period, saving the data. The user will come back later to play a subsequent period. In order to get the other option of having the simulation go on continuously, the value should be a zero.

1, the second piece of data, indicates that the user wants only 1 copy of the printout.

5 and 7, the third and fourth pieces of data, are the two values that will generate the economic environment.

##### Student's Instructions:

During the course of the simulation, the computer will ask:

```
ENTER FIRM NUMBER?
```

The firm number identifying the team must be entered.

Then the computer will require the entering of Labor's 9 decisions and Management's 9 decisions on the contract's 9 issues. The first 9 pieces of data (concerning Labor) should be entered separated by commas (see example). The second set of 9 pieces of data must also be entered separated by commas.

If the operator types the wrong information, and if the error is caught before the computer is through typing the results for the period, the simulation can be stopped by pressing the BREAK key. By typing RUN again, the simulation will start at the current period and will give the operator a chance to enter the right data.

#### HOW TO SET UP THE GAME

The LABOR simulation, written in BASIC consists of one paper tape 4700 words long. After the tape is loaded on the computer a file called STRIKE must be opened by typing:

```
OPEN-STRIKE,20
```

20 is the number of sectors in the file. Each firm needs 2 sectors; therefore, in the above example, up to 10 teams can use the simulation simultaneously.

RUN

RUN  
LABOR

ENTER FIRM NUMBER?1

COLLECTIVE BARGINING SIMULATION

::::FIRM 1        ::::COPY # 1

THE LAST LABOR MANAGEMENT CONTRACT IS EXPIRING TONIGHT  
THE UNION IS EXTREMELY DISSATISFIED WITH IT AND HAS DECIDED  
TO GO ON

S  
T  
R  
I  
K  
E

\*\*\* INFORMATION CONCERNING :  
-----

| THE FIRM (SINCE LAST CONTRACT) |            | THE LAST CONTRACT      |         |
|--------------------------------|------------|------------------------|---------|
| PROFIT INCREASE                | % 3        | DURATION (MONTHS)      | 12      |
| PRODUCTIVITY INCREASE          | % 5.25     | WAGE RATE              | \$ 2.23 |
| LAST WAGE INCREASE             | \$ .14     | GUARANTEED OVERTIME    | 3       |
| EMPLOYMENT LEVEL               | 328        | VACATION DAYS PER YEAR | 10      |
| INVENTORY LEVEL                | \$ 182000. | REGULAR HOURS/WEEK     | 42      |
| STRIKE FUND                    | \$ 13120   | DAYS OF SICK LEAVE     | 6       |
| LAST YEAR SALES MILLIONS       | 8          | BONUS AND INSURANCE    | \$ 407  |
| LAST YEAR PROFIT               | \$ 745500. | # OF PAID HOLIDAYS     | 3       |
| RATIO: PROFIT /WORKER          | \$ 2272    | OVERTIME WAGE RATE     | \$ 3.35 |

GENERAL INFORMATION  
-----

|                                   |        |
|-----------------------------------|--------|
| CONSUMER PRICE INDEX INCREASE     | % 3.75 |
| AVERAGE WAGE INCREASE IN INDUSTRY | % 4.2  |
| RATE OF UNEMPLOYEMENT IN INDUSTRY | % 4.25 |
| PRODUCTIVITY INCREASE IN INDUSTRY | % 4.8  |

COST OF THE OLD CONTRACT -PER WORKER- :  
-----

|                 |          |
|-----------------|----------|
| GROSS PAYROLL   | \$ 9258  |
| FRINGE BENEFITS | \$ 1078  |
| TOTAL.....      | \$ 10336 |

IN VIEW OF THE COMING STRIKE, IT WAS DECIDED AT THE LAST  
MEETING OF THE BOARD OF DIRECTORS THAT THE COMPANY COULD SUPPORT  
AN INCREASE IN THE WORKERS' PAYROLL.  
DUE TO THE RELATIVELY IMPORTANT INFLATION RATE,  
THE MAXIMUM DOLLAR AMOUNT PROPOSED -PER WORKER-PER YEAR- IS: \$ 388

DONE

RUN  
LABOR

ENTER FIRM NUMBER?1

\*\*\*CONTRACT PROPOSAL: WEEK 1

.....  
 INPUT LABOR ' S 9 DECISIONS?12,2.4,5,14,40,6,500,7,3.6  
 INPUT MANAGEMENT 9 DECISIONS?12,2.3,4,10,42,6,450,3,3.45  
 .....

\*\*\*\*\*FIRM 1 COPY # 1 WEEK 1

\*\*\*\*\*BARGINING : CONTRACT PROPOSAL

COST OF THE NEW CONTRACT DUE TO LABOR'S CONDITIONS -PER WORKER- :

GROSS PAYROLL INCREASE \$ 560  
 FRINGE BENEFITS INCREASE \$ 587  
 TOTAL..... \$ 1147

COST OF THE NEW CONTRACT DUE TO MANAGEMENT'S OFFER -PER WORKER- :

GROSS PAYROLL INCREASE \$ 145  
 FRINGE BENEFITS INCREASE \$ 228  
 TOTAL..... \$ 373

\*\*\*INFORMATION ON THE CURRENT SITUATION :

-----  
 CURRENT UNION MEMBERSHIP 296 DOWN 10 %  
 CURRENT STRIKE FUND (\$) 10752 DOWN 18 %  
 INVENTORY LEVEL -PER WORKER- \$ 35  
 UNFILLED ORDERS PER WORKER \$ 0

MANAGEMENT EXPECTED COST OF ONE MORE WEEK OF STRIKE \$ 43

THE STRIKE HAS BEEN ON FOR 1 WEEK

|                     | LABOR | MANAGEMENT |              |
|---------------------|-------|------------|--------------|
| DURATION (MONTHS)   | 12    | 12         | ***AGREEMENT |
| WAGE RATE           | 2.4   | 2.3        |              |
| GUARANTEED OVERTIME | 5     | 4          |              |
| VACATION DAYS/YEAR  | 14    | 10         |              |
| REGULAR HOURS/WEEK  | 40    | 42         |              |
| DAYS OF RELIEF/YEAR | 6     | 6          | ***AGREEMENT |
| YEARLY BONUS        | 500   | 450        |              |
| PAID HOLIDAYS       | 7     | 3          |              |
| OVERTIME RATE       | 3.6   | 3.45       |              |

DONE

RUN  
LABOR

ENTER FIRM NUMBER?1

\*\*\*CONTRACT PROPOSAL: WEEK 2

.....  
 ....ARBITRATION ANYONE...?NO  
 INPUT LABOR ' S 9 DECISIONS?12,2.38,4,12,40,6,480,7,3.6  
 INPUT MANAGEMENT 9 DECISIONS?12,2.33,5,10,42,6,460,4,3.45  
 .....

\*\*\*\*\*FIRM 1 COPY # 1 WEEK 2

\*\*\*\*\*BARGINING : CONTRACT PROPOSAL

-----  
 COST OF THE NEW CONTRACT DUE TO LABOR'S CONDITIONS -PER WORKER- :

|                          |        |
|--------------------------|--------|
| GROSS PAYROLL INCREASE   | \$ 522 |
| FRINGE BENEFITS INCREASE | \$ 366 |
| TOTAL.....               | \$ 888 |

COST OF THE NEW CONTRACT DUE TO MANAGEMENT'S OFFER -PER WORKER- :

|                          |        |
|--------------------------|--------|
| GROSS PAYROLL INCREASE   | \$ 206 |
| FRINGE BENEFITS INCREASE | \$ 422 |
| TOTAL.....               | \$ 628 |

\*\*\*INFORMATION ON THE CURRENT SITUATION :

-----  
 CURRENT UNION MEMBERSHIP 264 DOWN 20 %  
 CURRENT STRIKE FUND (\$) 8640 DOWN 34 %

INVENTORY LEVEL -PER WORKER- \$ 0  
 UNFILLED ORDERS PER WORKER \$ 486

MANAGEMENT EXPECTED COST OF ONE MORE WEEK OF STRIKE \$ 43

THE STRIKE HAS BEEN ON FOR 2 WEEKS

|                     | LABOR | MANAGEMENT |              |
|---------------------|-------|------------|--------------|
| DURATION (MONTHS)   | 12    | 12         | ***AGREEMENT |
| WAGE RATE           | 2.38  | 2.33       |              |
| GUARANTEED OVERTIME | 5     | 5          | ***AGREEMENT |
| VACATION DAYS/YEAR  | 12    | 10         |              |
| REGULAR HOURS/WEEK  | 40    | 42         |              |
| DAYS OF RELIEF/YEAR | 6     | 6          | ***AGREEMENT |
| YEARLY BONUS        | 480   | 460        |              |
| PAID HOLIDAYS       | 7     | 4          |              |
| OVERTIME RATE       | 3.6   | 3.45       |              |

DONE

RUN  
LABOR

ENTER FIRM NUMBER? 1

\*\*\*CONTRACT PROPOSAL: WEEK 3

.....  
 ....ARBITRATION ANYONE...?NO  
 INPUT LABOR ' S 9 DECISIONS? 12,2.38,5,12,40,6,480,7,3.57  
 INPUT MANAGEMENT 9 DECISIONS? 12,2.33,5,10,42,6,460,4,3.50  
 .....

\*\*\*\*\*FIRM 1 COPY # 1 WEEK 3

\*\*\*\*\*BARGINING : CONTRACT PROPOSAL

-----  
COST OF THE NEW CONTRACT DUE TO LABOR'S CONDITIONS -PER WORKER- :

|                          |         |
|--------------------------|---------|
| GROSS PAYROLL INCREASE   | \$ 522  |
| FRINGE BENEFITS INCREASE | \$ 533  |
| TOTAL.....               | \$ 1055 |

COST OF THE NEW CONTRACT DUE TO MANAGEMENT'S OFFER -PER WORKER- :

|                          |        |
|--------------------------|--------|
| GROSS PAYROLL INCREASE   | \$ 206 |
| FRINGE BENEFITS INCREASE | \$ 434 |
| TOTAL.....               | \$ 640 |

\*\*\*INFORMATION ON THE CURRENT SITUATION :

|                          |      |         |   |
|--------------------------|------|---------|---|
| CURRENT UNION MEMBERSHIP | 232  | DOWN 29 | % |
| CURRENT STRIKE FUND (\$) | 6784 | DOWN 48 | % |

|                              |         |
|------------------------------|---------|
| INVENTORY LEVEL -PER WORKER- | \$ 0    |
| UNFILLED ORDERS PER WORKER   | \$ 1006 |

MANAGEMENT EXPECTED COST OF ONE MORE WEEK OF STRIKE \$ 43

THE STRIKE HAS BEEN ON FOR 3 WEEKS

|                     | LABOR | MANAGEMENT |              |
|---------------------|-------|------------|--------------|
| DURATION (MONTHS)   | 12    | 12         | ***AGREEMENT |
| WAGE RATE           | 2.38  | 2.33       |              |
| GUARANTEED OVERTIME | 5     | 5          | ***AGREEMENT |
| VACATION DAYS/YEAR  | 12    | 10         |              |
| REGULAR HOURS/WEEK  | 40    | 42         |              |
| DAYS OF RELIEF/YEAR | 6     | 6          | ***AGREEMENT |
| YEARLY BONUS        | 480   | 460        |              |
| PAID HOLIDAYS       | 7     | 4          |              |
| OVERTIME RATE       | 3.57  | 3.5        |              |

DONE

RUN  
LABOR

ENTER FIRM NUMBER?1

\*\*\*CONTRACT PROPOSAL: WEEK 4  
.....  
....ARBITRATION ANYONE...?YES

ARBITRATION IS REQUIRED BY ONE PARTY.....

THE ARBITRATOR  
DECISIONS ARE FINAL AND MUST BE ACCEPTED BY BOTH PARTIES...  
THE NEW CONTRACT IS  
\*\*\*\*\*

|                          |        |
|--------------------------|--------|
| DURATION (MONTHS)        | 12     |
| WAGE RATE                | 2.35   |
| GUARANTEED OVERTIME      | 5      |
| VACATION DAYS/YEAR       | 10     |
| REGULAR HOURS/WEEK       | 42     |
| DAYS OF RELIEF/YEAR      | 6      |
| YEARLY BONUS             | 464    |
| PAID HOLIDAYS            | 4      |
| OVERTIME RATE            | 3.53   |
| GROSS PAYROLL INCREASE   | \$ 248 |
| FRINGE BENEFITS INCREASE | \$ 446 |
| TOTAL.....               | \$ 694 |

THE STRIKE IS ENDED AFTER 4 WEEKS. CONGRATULATIONS !!!

THE STRIKE HAS BEEN EXPENSIVE!  
IT HAS COST MANAGEMENT \$ 43011. AND \$ 330022. IN UNFILLED ORDERS  
LABOR HAS PAID \$ 6336 AND HAS SUFFERED  
29 % OF MEMBERSHIP LOSSES....

DONE





MARKET  
36619**TITLE:**

TWO COMPANIES IN ONE-PRODUCT COMPETITION

**DESCRIPTION:**

This computer game allows two people or two groups to play the roles of two companies who are competing for the market for a particular product: for example, racing bicycles. At the start of the game, the computer informs the players of the fixed and the variable production costs involved in marketing the product and the number of items that will be sold, with no advertising, at a specific price. The computer then assigns to each company initial values for inventory (stock on hand), cash on hand, and total assets.

**INSTRUCTIONS:**

Each player is allowed to make marketing decisions quarterly and can specify the production level, the advertising budget, and the unit price of the product for his company. After these decisions have been made for a given quarter, the computer reports the results of these decisions by way of a marketing summary. For each company the report lists:

- a) profit
- b) percentage share of the market
- c) cash on hand
- d) number of units sold
- e) number of units in stock (inventory)
- f) total assets

Players make their decisions for the following quarter on the basis of these reports.

If the demand for one company's product turns out to be larger than the total of the production level and inventory (as of the start of a quarter), the company will sell out its stock. Any additional sales that could have been made will not be given to the other company by the computer.

The companies are penalized for overproduction. An inventory charge at the rate of 5% per quarter will be made for stock on hand at the end of a quarter. That is, 5% of the total value of the inventory (based on variable production cost) will be deducted from the company's cash on hand.

continued on following page

**SPECIAL  
CONSIDERATIONS:**

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

|                          |               |
|--------------------------|---------------|
| <b>Student Workbook</b>  | <b>\$ .30</b> |
| <b>Teachers Guide</b>    | <b>.30</b>    |
| <b>Resource Handbook</b> | <b>.50</b>    |

**ACKNOWLEDGEMENTS:**

Huntington II Project  
State University of New York

INSTRUCTIONS continued

It is possible for a company to have a negative value for cash on hand. This means that the company must go into debt for this amount, and an additional 5% charge will be made on the debt.

From time to time throughout the game, events will occur which will necessitate a change in strategy. In such cases, try to consider all consequences of the occurrence before deciding on a new strategy.

The game ends when one company goes bankrupt or accumulates 12 million dollars in total assets.

RUN

RUN  
MARKET

DO YOU WANT INSTRUCTIONS(TYPE 1 FOR YES, 0 FOR NO)?0

ARE YOU BEGINNING THE GAME OR CONTINUING  
(TYPE 1 FOR BEGINNING, 2 FOR CONTINUING)?1

FIXED PRODUCTION COST=\$ 250000. / QUARTER  
VARIABLE PRODUCTION COST=\$ 20 /UNIT  
WITH NO ADVERTISING AND A SELLING PRICE OF \$50/UNIT  
A COMPANY WILL SELL 25000 UNITS (PRINTED AS 25 )  
WAREHOUSE CHARGE FOR INVENTORY= 5 PER CENT  
INTEREST CHARGE ON BORROWED MONEY= 5 PER CENT

UNITS AND DOLLARS BELOW ARE IN THOUSANDS

QUARTER 0

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 0      | 0            | 5000         | 0           | 100       | 7000   |
| 0      | 0            | 5000         | 0           | 100       | 7000   |

COMPANY 1  
PRODUCTION LEVEL?25  
ADVERTISING BUDGET?0  
UNIT PRICE?50

COMPANY 2  
PRODUCTION LEVEL?25  
ADVERTISING BUDGET?0  
UNIT PRICE?50

QUARTER 1

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 400    | 50           | 5400         | 25          | 100       | 7400   |
| 400    | 50           | 5400         | 25          | 100       | 7400   |

COMPANY 1  
PRODUCTION LEVEL?0  
ADVERTISING BUDGET?0  
UNIT PRICE?50

COMPANY 2  
PRODUCTION LEVEL?0  
ADVERTISING BUDGET?0  
UNIT PRICE?50

QUARTER 2

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 425    | 50           | 6325         | 25          | 75        | 7825   |
| 425    | 50           | 6325         | 25          | 75        | 7825   |

COMPANY 1  
 PRODUCTION LEVEL?10  
 ADVERTISING BUDGET?500  
 UNIT PRICE?55

COMPANY 2  
 PRODUCTION LEVEL?10  
 ADVERTISING BUDGET?0  
 UNIT PRICE?50

QUARTER 3

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 785    | 64.28        | 7810         | 45          | 40        | 8610   |
| 440    | 35.71        | 7065         | 25          | 60        | 8265   |

COMPANY 1  
 PRODUCTION LEVEL?45  
 ADVERTISING BUDGET?500  
 UNIT PRICE?55

COMPANY 2  
 PRODUCTION LEVEL?25  
 ADVERTISING BUDGET?300  
 UNIT PRICE?50

QUARTER 4

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 641    | 50.61        | 8371         | 41          | 44        | 9251   |
| 605    | 49.38        | 7970         | 40          | 45        | 8870   |

NEW LABOR CONTRACT - VARIABLE PRODUCTION COST NOW= \$ 21 /UNIT

COMPANY 1  
 PRODUCTION LEVEL?40  
 ADVERTISING BUDGET?400  
 UNIT PRICE?53

COMPANY 2  
 PRODUCTION LEVEL?40  
 ADVERTISING BUDGET?350  
 UNIT PRICE?50

QUARTER 5

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 660    | 48.8         | 9008         | 41          | 43        | 9911   |
| 647    | 51.19        | 8635         | 43          | 42        | 9517   |

COMPANY 1  
 PRODUCTION LEVEL?70  
 ADVERTISING BUDGET?250  
 UNIT PRICE?53

COMPANY 2  
PRODUCTION LEVEL?50  
ADVERTISING BUDGET?325  
UNIT PRICE?50

QUARTER 6

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 505    | 44.15        | 8757         | 34          | 79        | 10416  |
| 620    | 55.84        | 9108         | 43          | 49        | 10137  |

COMPANY 1  
PRODUCTION LEVEL?40  
ADVERTISING BUDGET?300  
UNIT PRICE?53

COMPANY 2  
PRODUCTION LEVEL?45  
ADVERTISING BUDGET?400  
UNIT PRICE?51

QUARTER 7

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 514    | 45           | 9187         | 36          | 83        | 10930  |
| 617    | 55           | 9704         | 44          | 50        | 10754  |

A TRANSPORTATION STRIKE HAS OCCURED, AND YOU ARE UNABLE TO MOVE YOUR GOODS TO THE DISTRIBUTORS. NEGOTIATIONS HAVE BEGUN, BUT HOPE OF A SETTLEMENT LOOKS DIM.

COMPANY 1  
PRODUCTION LEVEL?40  
ADVERTISING BUDGET?300  
UNIT PRICE?55

COMPANY 2  
PRODUCTION LEVEL?45  
ADVERTISING BUDGET?370  
UNIT PRICE?53

QUARTER 8

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| -680   | 0            | 7667         | 0           | 123       | 10250  |
| -720   | 0            | 8039         | 0           | 95        | 10034  |

COMPANY 2 HAS BEEN THE VICTIM OF EMBEZZLEMENT BY THE VICE PRESIDENT OF THE COMPANY. YOUR CASH ON HAND IS NOW \$ 7839

NEW LABOR CONTRACT - VARIABLE PRODUCTION COST NOW= \$ 23 /UNIT  
TRANSPORTATION STRIKE SETTLED. NORMAL DELIVERIES RESUMED

COMPANY 1  
PRODUCTION LEVEL?70  
ADVERTISING BUDGET?300  
UNIT PRICE?60

COMPANY 2  
PRODUCTION LEVEL?70  
ADVERTISING BUDGET?300  
UNIT PRICE?58

## QUARTER 9

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 580    | 48.33        | 7058         | 29          | 164       | 10830  |
| 370    | 51.66        | 7322         | 31          | 134       | 10404  |

THE PRESIDENT HAS JUST IMPOSED A WAGE-PRICE FREEZE ON THE ECONOMY, AND YOU MAY NOT RAISE THE PRICE OF YOUR PRODUCT OVER THE NEXT 2 QUARTERS.

COMPANY 1  
 PRODUCTION LEVEL?70  
 ADVERTISING BUDGET?300  
 UNIT PRICE?60

COMPANY 2  
 PRODUCTION LEVEL?60  
 ADVERTISING BUDGET?350  
 UNIT PRICE?58

## QUARTER 10

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 249    | 46.66        | 6341         | 28          | 206       | 11079  |
| 333    | 53.33        | 7011         | 32          | 162       | 10737  |

COMPANY 1  
 PRODUCTION LEVEL?80  
 ADVERTISING BUDGET?300  
 UNIT PRICE?60

COMPANY 2  
 PRODUCTION LEVEL?60  
 ADVERTISING BUDGET?300  
 UNIT PRICE?58

## QUARTER 11

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 227    | 48.33        | 5395         | 29          | 257       | 11306  |
| 315    | 51.66        | 6659         | 31          | 191       | 11052  |

THE WAGE-PRICE FREEZE HAS ENDED

COMPANY 1  
 PRODUCTION LEVEL?80  
 ADVERTISING BUDGET?300  
 UNIT PRICE?62

COMPANY 2  
 PRODUCTION LEVEL?65  
 ADVERTISING BUDGET?300  
 UNIT PRICE?60

## QUARTER 12

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 146    | 48.21        | 4322         | 27          | 310       | 11452  |
| 261    | 51.78        | 6092         | 29          | 227       | 11313  |

NEW LABOR CONTRACT - VARIABLE PRODUCTION COST NOW= \$ 26 /UNIT

COMPANY 1  
PRODUCTION LEVEL?80  
ADVERTISING BUDGET?300  
UNIT PRICE?65

COMPANY 2  
PRODUCTION LEVEL?0  
ADVERTISING BUDGET?300  
UNIT PRICE?60

QUARTER 13

| PROFIT | MARKET SHARE | CASH ON HAND | NUMBER SOLD | INVENTORY | ASSETS |
|--------|--------------|--------------|-------------|-----------|--------|
| 840    | 45.28        | 2776         | 24          | 366       | 12292  |

|           |                                                       |      |    |     |       |
|-----------|-------------------------------------------------------|------|----|-----|-------|
| COMPANY 1 | *****<br>YOU HAVE REACHED 12 MILLION AND WON<br>***** |      |    |     |       |
| 859       | 54.71                                                 | 7024 | 29 | 198 | 12172 |

DO YOU WANT TO PLAY AGAIN(TYPE 1 FOR YES, 0 FOR NO)?0

DONE

CONTRIBUTED PROGRAM **BASIC**

MRKSIM  
36199

**TITLE:**

MARKETING SIMULATION

**DESCRIPTION:**

Multi-teams, multiperiod marketing simulation, MRKSIM is a package consisting of the following programs:

MARK : (inputs data)  
BARKSI : (performs computations)  
BARKPI : (prints out results)  
ANNUAL : (prints annual reports)  
MASK : (prints English headings)

and two parameter files PARAM and HISTRY

MARKSIM has been adapted in BASIC to fit the original MARKSIM, A Marketing Decision Simulation, by Greenlaw and Kniffin, International Textbook.

**INSTRUCTIONS:**

The following files have to be opened on the user's catalog.

MPRINT : 8 sectors  
DECIS : 10 sectors  
INDY#1 : 4 sectors  
INDY#2 : 4 sectors  
INDY#3 : 4 sectors  
USER : 1 sector

Two additional files, PARAM and HISTRY are provided as part of the program package.

The game can be run by two classes at the same time. Each one is identified by a user number which is either 1 or 2. Each class consists of a maximum of 3 industries and 3 firms. Each industry is independent from the others and is an independent unit.

The program MARK is provided so that the printing time of the game is minimized.

**ACKNOWLEDGEMENTS:**

Francois P. Carlhian  
Babson College

The following are excerpts from the book, MARKSIM, A Marketing Decision Simulation by Greenlaw and Kniffin, International Textbook.

An exciting new educational technique designed to provide business students with greater insight into and skills in dealing with managerial problems is business simulation, or business gaming, as it is often called. A business simulation is a sequential decision-making problem structured around a model of a business operation in which participants assume the role of managing a simulated firm. One purpose of this text is to prepare the reader for assuming such a managerial role in MARKSIM--a computerized marketing management simulation.

#### THE MARKSIM LEARNING EXPERIENCE

MARKSIM was created to provide the student with a planned learning experience in dealing with marketing management problems. Aiding him in gaining such experience are:

1. His instructor, who will be available for guidance when necessary,
2. This text, which will focus attention on numerous concepts, ideas, and analytical tools relative to marketing management, and their application to the simulation.
3. The MARKSIM model which is programmed on an electronic computer. This computer program provides a dynamic simulated marketing decision-making environment, from which operating data are fed back to participants periodically.

More specifically, the procedure followed in assuming the role of marketing manager in the simulation is as follows:

1. Participants familiarize themselves with the simulated environment in which they are to manage by studying the materials presented later in this text and perhaps also by discussing these materials in class.
2. They are next given an opportunity to analyze available data on their past operations and to make a set of decisions for the first period in which they will manage their firms.
3. When firm decisions are due for this period, they are handed in to the instructor or someone designated by him as a simulation administrator.
4. Then each firm's operating results for the period are calculated and printed out by the computer system, and this information is returned to its management.
5. This cycle of decision making, calculation, and feedback of results is repeated for a number of periods of play.



OPEN-MPRINT,8  
 OPEN-DECIS,10  
 OPEN-INDY#1,4  
 OPEN-INDY#2,4  
 OPEN-INDY#3,4  
 OPEN-USER,4  
 GET-MARK  
 RUN  
 MARK

\*\*\*\*\* MARKSIM \*\*\*\*\*  
 LAST FOR INSTRUCTIONS

ENTER USER NUMBER  
 ?1  
 ENTER INDUSTRY # AND PERIOD #:  
 ?2,1  
 ENTER DECISIONS FOR FIRM # 1 (12 DATA)  
 ?500000,300000,55,145,50000,30000,0,1,1,1,1,1  
 ENTER DECISIONS FOR FIRM # 2 (12 DATA)  
 ?500000,300000,55,145,50000,30000,0,1,1,1,1,1  
 ENTER DECISIONS FOR FIRM # 3 (12 DATA)  
 ?500000,300000,55,145,50000,30000,0,1,1,1,1,1  
 ENTER THE NAMES OF THE THREE FIRMS.ONE ON EACH LINE  
 ?THE BES ONES INC.  
 ?THE ASSOCIATES  
 ?THE BULLIES

=====GET AND RUN BARKSI=====

DONE

RUN

RUN  
 BARKSI

COMPUTATIONS COMPLETED : GET AND RUN BARKPI

DONE

RUN

GET-BARKPI  
 RUN  
 BARKPI

\*\*\*  
 M A R K S I M

THE BES ONES INC.

INDUSTRY # 2 FIRM # 1 PERIOD # 1

-----  
 \$ 5.75443E+06

2.75000E+06  
 385866. (ADD INCREASE IN INV.)  
 -3.13587E+06  
 -----

131275.  
 150000.  
 153804.  
 50815.  
 213098.  
 300000.  
 500000.  
 50000.  
 0  
 500000.  
 -2.04899E+06  
 -----  
 \$ 569574.

-----  
 \$ 5.95544E+06  
 2.63913E+06  
 -----

\$ 8.59458E+06  
 0  
 -----

\$ 8.59458E+06  
 -----

1.50000E+06  
 900000.  
 MARKET 1\*MARKET 2\*MARKET 3  
 30511 8628 5184  
 145000. 41000. 34000.  
 33 33 33

145  
 145  
 145  
 -----

30511 8628 5184  
 44323.  
 45000. AT \$ 55  
 53187.2 AT \$ 55

26255  
 26255  
 \$ 108.75  
 \$ 2.85522E+06  
 27000 AT \$ 55  
 31505.9 AT \$ 55

26255  
 26255  
 \$ 108.75  
 \$ 2.85522E+06  
 35000. AT \$ 55

30761  
 30761  
 \$ 94.25  
 \$ 2.89921E+06  
 30000  
 50000.  
 20000 AT \$ 55  
 9239.17 AT \$ 55  
 -----

\*\*\* TEAR HERE\*\*\*

\*\*\*

M A R K S I M

THE ASSOCIATES

INDUSTRY # 2      FIRM # 2      PERIOD # 1

-----  
 \$ 5.75443E+06  
 2.75000E+06  
 385866.      (ADD INCREASE IN INV.)  
              -3.13587E+06  
              -----

131275.  
 150000.  
 153804.  
 50815.  
 213098.  
 300000.  
 500000.  
 50000.  
 0  
 500000.  
              -2.04899E+06  
              -----  
 \$ 569574.

-----  
 \$ 5.95544E+06  
 2.63913E+06  
 -----  
 \$ 8.59458E+06  
 0  
 -----  
 \$ 8.59458E+06  
 -----

1.50000E+06  
 900000.  
 MARKET 1\*MARKET 2\*MARKET 3  
 30511      8628      5184  
 145000.      41000.      34000.  
 33      33      33

145  
 145  
 145  
 -----

30511      8628      5184  
 44323.  
 45000.      AT \$ 55  
 53187.2      AT \$ 55

26255  
 26255  
 \$ 108.75  
 \$ 2.85522E+06  
 27000      AT \$ 55  
 31505.9      AT \$ 55

26255  
 26255  
 \$ 108.75  
 \$ 2.85522E+06  
 35000.      AT \$ 55

30761  
 30761  
 \$ 94.25  
 \$ 2.89921E+06  
 30000  
 50000.

20000 AT \$ 55  
9239.17 AT \$ 55

-----  
\*\*\* TEAR HERE\*\*\*

\*\*\*  
M A R K S I M

THE BULLIES

INDUSTRY # 2 FIRM # 3 PERIOD # 1

-----  
\$ 5.75443E+06

2.75000E+06  
385866. (ADD INCREASE IN INV.)  
-3.13587E+06  
-----

131275.  
150000.  
153804.  
50815.  
213098.  
300000.  
500000.  
50000.  
0  
500000.  
-2.04899E+06  
-----  
\$ 569574.

-----  
\$ 5.95544E+06  
2.63913E+06  
-----

\$ 8.59458E+06  
0  
-----

\$ 8.59458E+06  
-----

1.50000E+06  
900000.  
MARKET 1\*MARKET 2\*MARKET 3  
30511 8628 5184  
145000. 41000. 34000.  
33 33 33

145  
145  
145  
-----

30511 8628 5184  
44323.  
45000. AT \$ 55  
53187.2 AT \$ 55

26255  
26255  
\$ 108.75  
\$ 2.85522E+06  
27000 AT \$ 55  
31505.9 AT \$ 55

26255  
26255  
\$ 108.75  
\$ 2.85522E+06

35000. AT \$ 55

30761  
 30761  
 \$ 94.25  
 \$ 2.89921E+06  
 30000  
 50000.  
 20000 AT \$ 55  
 9239.17 AT \$ 55

-----

\*\*\* TEAR HERE\*\*\*

DONE

RUN

GET-ANNUAL  
 RUN  
 ANNUAL

TYPE IN USER NUMBER  
 ?1  
 ENTER INDUSTRY # AND LATEST PERIOD #  
 ?2,1  
 -----

ANNUAL REPORT FOR INDUSTRY# 2  
 AS OF PERIOD 1

FIRMS: THE BES ONES INC. THE ASSOCIATES THE BULLIES

|                         |        |        |        |
|-------------------------|--------|--------|--------|
| CUMULATIVE RETAIL SALES |        |        |        |
| SINCE PERIOD 0          | 44323. | 44323. | 44323. |
| SINCE START             |        |        |        |
| OF GAME                 | 44323. | 44323. | 44323. |

|                       |         |         |         |
|-----------------------|---------|---------|---------|
| CUMULATIVE NET PROFIT |         |         |         |
| SINCE PERIOD 0        | 569574. | 569574. | 569574. |
| SINCE START           |         |         |         |
| OF GAME               | 569574. | 569574. | 569574. |

COMPARATIVE BALANCE SHEETS

|              |             |             |             |
|--------------|-------------|-------------|-------------|
| ASSETS       |             |             |             |
| CASH         | 5.95544E+06 | 5.95544E+06 | 5.95544E+06 |
| INVENTORY    | 2.63913E+06 | 2.63913E+06 | 2.63913E+06 |
|              | =====       | =====       | =====       |
| TOTAL ASSETS | 8.59458E+06 | 8.59458E+06 | 8.59458E+06 |

|             |             |             |             |
|-------------|-------------|-------------|-------------|
| LIABILITIES |             |             |             |
| DEBTS       | 0           | 0           | 0           |
|             |             |             |             |
| CAPITAL     |             |             |             |
| OWNER'S     |             |             |             |
| INVESTMENT  | 8.59458E+06 | 8.59458E+06 | 8.59458E+06 |

-----

DONE

RUN

GET-MASK  
RUN  
MASK

-----

MARKSIM \*\*\*

A MARKETING SIMULATION

INCOME STATEMENT-----  
COMPANY SALES.....

    COST OF PRODUCTION.....  
    CHANGE IN INVENTORY VALUE.....  
    COST OF GOODS SOLD.....

GROSS PROFIT.....

OPERATING AND ADMINISTRATIVE EXPENSES..:  
    TRANSPORTATION TO RETAILERS.....  
    TRANSPORTATION TO DISTR CENTERS....  
    TRANSPORTATION TO WHOLESALERS.....  
    INVENTORY COSTS AT FACTORY.....  
    INVENTORY COSTS AT DISTR CENTERS...  
    ADVERTISING ALLOWANCES TO RETAILERS  
    NATIONAL ADVERTISING EXPENDITURES..  
    MARKETING RESEARCH.....

INTEREST CHARGES.....  
 FIXED EXPENSES.....  
 LESS TOTAL O+A EXPENSES.....

NET PROFIT.....  
 FINANCIAL STATEMENT-----  
 ENDING CASH BALANCE.....  
 ENDING INVENTORY VALUE.....

TOTAL ASSETS.....  
 LESS DEBTS.....

OWNER'S INVESTMENT.....  
 MARKETING RESEARCH-----  
 TOTAL INDUSTRY NATIONAL ADVERTISING.....  
 TOTAL INDUSTRY ALLOWANCES TO RETAIL.....

POTENTIALS:  
 FOR COMPANY DURING THIS PERIOD....  
 FOR INDUSTRY TWO PERIODS HENCE.....  
 SHARE OF MARKET (IN PERCENT).....

PRICES OF COMPETITORS:  
 FIRM #1.....  
 FIRM #2.....  
 FIRM #3.....

SALES INFORMATION-----  
 RETAILERS:  
 RETAIL SALES IN UNITS.....  
 TOTAL RETAIL SALES IN UNITS.....  
 BEGINNING INVENTORY.....  
 ENDING INVENTORY.....

WHOLESALERS:  
 ORDERS FROM RETAILERS IN UNITS.....  
 DELIVERIES TO RETAILERS.....  
 SELLING PRICE TO RETAILERS.....  
 RECEIPTS FROM RETAILERS.....  
 BEGINNING INVENTORY.....  
 ENDING INVENTORY.....

DISTRIBUTION CENTERS:  
 ORDERS FROM RETAILERS IN UNITS.....  
 DELIVERIES TO RETAILERS.....  
 SELLING PRICE TO RETAILERS.....  
 COMPANY SALES TO RETAILERS.....  
 BEGINNING INVENTORY.....  
 ENDING INVENTORY.....

FACTORY WAREHOUSE:  
 ORDERS FROM WHOLESALERS IN UNITS...  
 DELIVERIES TO WHOLESALERS.....  
 SELLING PRICE TO WHOLESALERS.....  
 COMPANY SALES TO WHOLESALERS.....  
 SHIPMENTS TO DISTR CENTERS.....  
 PRODUCTION THIS PERIOD.....  
 BEGINNING INVENTORY.....  
 ENDING INVENTORY.....

-----  
 DONE





**TITLE:** MANAGEMENT SIMULATION GAME (For 2000C)

**DESCRIPTION:** This program allows three teams to act as business executives making periodic high level decisions for their firms.

A realistic business practice operating over a period of several years can be simulated in one day. Each team alternately makes decisions about their company and allows the computer to carry out interactions among the teams and to produce quarterly reports based on the strategies of all three teams.

The product is not specifically defined, therefore, the decisions made by the management teams must be based on general business principles and not on knowledge concerning a particular product. Naturally, some simplifications have been made to reduce a real-life business situation to one which is workable on a time-share system with young students. One of these is the requirement that each quarterly operation be financed from cash on hand.

Each team of participants may assume that it has been called in to take over the management of a company which has strong possibilities but which is not in very good financial position at the present time. As play progresses the participants should acquire a feel for the market and an understanding of their competitors which should further aid in their decision making. Each team may want to keep brief notes of the reasoning behind their decisions so these different strategies may be discussed later.

**INSTRUCTIONS:** See Page 2

**SPECIAL CONSIDERATIONS:** There are two tapes to this package -- SETUPC, and MANAGC.

**ACKNOWLEDGEMENTS:** TIES  
St. Paul, Minnesota

## MANAGEMENT SIMULATION GAME FOR THE HP 2000C

### INTRODUCTION

Management Simulation allows a group to be divided into three subgroups acting as teams of business executives making periodic high level decisions for their firms.

A realistic business practice operating over a period of several years can be simulated in one day. Each team alternately makes decisions about their company and allows the computer to carry out interactions among the teams and to produce quarterly reports based on the strategies of all three teams.

The product is not specifically defined, therefore, the decisions made by the management teams must be based on general business principles and not on knowledge concerning a particular product. Naturally, some simplifications have been made to reduce a real-life business situation to one which is workable on a time-share system with young students. One of these is the requirement that each quarterly operation be financed from cash on hand.

Each team of participants may assume that it has been called in to take over the management of a company which has strong possibilities but which is not in very good financial position at the present time. As play progresses, the participants should acquire a feel for the market and an understanding of their competitors which should further aid in their decision making. Each team may want to keep brief notes of the reasoning behind their decisions so these different strategies may be discussed later.

### GEOGRAPHICAL BREAKDOWN OF THE MARKET

The market is divided geographically into four areas. Any firm may sell its product in any area. Area 1 is the home area of firm 1, area 2 is the home area of firm 2, and area 3 is the home area of firm 3. Area 4 is an open market. Each firm has an advantage in its own area, in that there is no transportation charge applied to the units it sells there. Transportation charges are applied to units sold in competitors' areas, but a smaller transportation charge is applied to units sold in area 4. These charges are included in the unit delivered cost shown on each firm's confidential report.

### INITIAL REPORT

At the start of play each team will be given a report showing the economic condition of their company.

### AREA DECISIONS

After studying the initial report, each team makes a set of decisions. For each marketing area, it must decide the unit selling price and the amount of money to be spent on advertising. These have a direct and immediate effect on the amount of business each firm will get in each area.

The potential market in each area will vary as a function of selling price, amount spent on research, and the total marketing expenditure. There are no seasonal cycles built into this model.

### PLANT DECISIONS

In addition to the area decisions, a set of plant decisions must be made. Each management team must decide how much money to spend on production, research, and plant improvement.

Plant manufacturing capacity may be increased at a cost of \$20,000 for each 1,000 units. The new unit capacity can be calculated by dividing the plant value by \$20. If a plant is operated at less than full capacity, a penalty of higher unit cost is automatically assessed.

Research and development funds are applied over many periods. In this model they will yield a return greater than their cost in the long run. This is true of these funds only up to a reasonable percentage of sales income. R & D will help increase the potential market and decrease production costs.

CONFIDENTIAL REPORTSales Analysis

|                       |                                                                                                                                                                 |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Orders -              | The total number of orders received by your firm in the areas indicated during the period covered by the report.                                                |
| Shipments -           | The total number of units sold by your firm in the areas indicated for the period covered. If this figure is less than orders, your firm may be underproducing. |
| Marketing -           | The total amount your firm decided to spend on marketing in each area during the previous period.                                                               |
| Revenue -             | The total amount of money your firm received for the shipments it had in each of the areas.                                                                     |
| Delivered Unit Cost - | The unit cost of production plus the cost of delivering the units to the area.                                                                                  |

PRODUCTION REPORTProfit and Loss

|                      |                                                                                                                                   |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Current Income -     | The total amount of cash received from the sale of units.                                                                         |
| Cost of Goods Sold - | The production cost of the units sold. The cost of unsold units appears as inventory in the Cash Flow-Financial Analysis section. |
| Transportation -     | The cost of transporting units sold. This charge is \$1.00 per unit in area 4, and \$2.00 per unit in a competitors area.         |
| Marketing -          | The amount your firm decided to spend on marketing and advertising during the report period.                                      |
| Research -           | The amount your firm decided to spend on research.                                                                                |
| Depreciation -       | Computed at the rate of 2% during each period.                                                                                    |
| Net Profit -         | The difference between sales income and total expense.                                                                            |
| Taxes -              | Computed at the rate of 50% of profit before taxes.                                                                               |
| Profit after Taxes - | Net profit less taxes.                                                                                                            |

Cash Flow-Financial Analysis

|                 |                                                                                                                   |
|-----------------|-------------------------------------------------------------------------------------------------------------------|
| Receipts -      | The total amount of cash taken in from the sale of units during the report period.                                |
| Disbursements - | The total amount of cash spent by your firm during the report period.                                             |
| Net Flow -      | Receipts less disbursements.                                                                                      |
| New Balance -   | The amount of cash your firm now has with which to conduct business during the next period.                       |
| Cash -          | The new cash balance.                                                                                             |
| Inventory -     | The production costs of the units remaining unsold from the previous periods.                                     |
| Plant Value -   | The current value of your plant. To determine plant capacity for the coming period, divide this value by \$20.00. |
| Total Assets -  | The total value of all your assets.                                                                               |

Disbursement Allocation (\$ Value)

Transportation - See production report  
 Marketing - See production report  
 Research - See production report  
 Plant Improvement - The amount your firm decided to spend this period.  
 Production Cost - The amount your firm allocated for production this period.  
 Taxes - See production report

Inventory Allocation (No. of Items)

Beginning - Inventory from previous periods.  
 Produced - Number of items produced this period.  
 Shipped - Number of items shipped this period.  
 Balance - Number of items to be carried to next period as inventory.  
 Unit Cost - Inventory value divided by balance.

COMPANY STATUS

All companies begin with the same production capacities, assets, and cash balance. These amounts are:

|                     |                      |
|---------------------|----------------------|
| CASH                | \$7,602              |
| INVENTORY VALUE     | \$2,509 71 @ \$34.34 |
| PLANT VALUE         | \$5,200              |
| TOTAL ASSETS        | \$15,311             |
| PRODUCTION CAPACITY | 260 units            |

GENERAL OPERATING INSTRUCTIONS FOR THE MANAG GAME ON HP 2000C

The MANAG simulation is divided into two routines which are described below:

SETUPC - This routine is called and executed at the beginning of the game to initialize the program values for all the groups running the simulation.

MANAGC - This routine allows the three teams of a group to input their values for the unit selling price and advertising in each area and the amounts for production allocation, research and development and plant improvement. After these values are inputted, MANAG will perform the simulation, print out the confidential quarterly report and save the results.

SPECIFIC INSTRUCTIONS FOR RUNNING THE MANAGC GAME

Commands printed below entirely in uppercase are entered by the system user on the remote terminal. Lowercase statements are responses by the computer.

A. To initialize the program values for each group of three teams playing the simulation, it is necessary to use the system command OPEN-GAMEi,1 where i is the game number, an integer 1-10. There must be one such OPEN command for each group of three teams playing the simulation (limit 10).

1. GET-SETUPC
2. OPEN-GAMEi,1 i=1,2,3,...10

(If you get the message DUPLICATE ENTRY, use the next sequential integer unless you are starting the game over and want to reinitialize that game. In that case, proceed to STEP 3 below.)

3. RUN
4. setupc
5. game number?

(You should enter the integer used for i in the OPEN command given in STEP 2.)

6. done

Repeat Steps 1-6 for each game (set of three teams) to be initialized.

B. To run MANAGC for the first and all succeeding quarters:

1. GET-MANAGC
2. RUN
3. managc
4. game number? (Enter the game number for the group of three teams.)
5. for firm 1 enter area selling prices.?60,60,60,60
6. enter area advertising expenditures.?150,100,100,100
7. enter production, r and d, and plant improvement.?5000,500,500
8. enter firm 2 data using three lines as above.
9. ?60,60,60,60
10. ?100,150,100,100
11. ?5100,400,600
12. enter firm 3 data using three lines as above.
13. ?60,60,60,60
14. ?100,100,150,100
15. ?5200,500,300
16. do you want quarterly report printed?

If yes, the computer then prints the Confidential Report for all three firms.

(4-16 The question mark is a response from the computer. The data typed following the question mark is entered from WORK SHEETS.)

17. done

Typical Work Sheets for One Firm

WORK SHEET

FIRST QUARTER  
TEAM #1 \_\_\_\_\_

PART A

|                               |         |
|-------------------------------|---------|
| CASH _____                    | \$7,602 |
| PRODUCTION ALLOCATION _____   | 6,000   |
| SUB TOTAL _____               | 1,602   |
| RESEARCH & DEVELOPMENT _____  | 500     |
| SUB TOTAL _____               | 1,102   |
| PLANT IMPROVEMENT _____       | 100     |
| SUB TOTAL _____               | 1,002   |
| ADVERTISING EXPENDITURE _____ | 450     |
| CASH ON HAND _____            | 552     |

PART B

4 REGIONS

|                                 | <u>1</u>     | <u>2</u>     | <u>3</u>     | <u>4</u>     |
|---------------------------------|--------------|--------------|--------------|--------------|
| UNIT SELLING PRICE              | <u>\$60</u>  | <u>\$60</u>  | <u>\$60</u>  | <u>\$60</u>  |
| ADVERTISING DISTRIBUTED BY AREA | <u>\$150</u> | <u>\$100</u> | <u>\$100</u> | <u>\$100</u> |

PART C - REPEAT FIGURES FROM PART A

|                              |         |
|------------------------------|---------|
| PRODUCTION ALLOCATION _____  | \$6,000 |
| RESEARCH & DEVELOPMENT _____ | 500     |
| PLANT IMPROVEMENT _____      | 100     |

## WORK SHEET

SECOND QUARTER  
TEAM # 1PART A

|                         |                |
|-------------------------|----------------|
| CASH                    | <u>\$9,698</u> |
| PRODUCTION ALLOCATION   | <u>4,000</u>   |
| SUB TOTAL               | <u>5,698</u>   |
| RESEARCH & DEVELOPMENT  | <u>3,000</u>   |
| SUB TOTAL               | <u>2,698</u>   |
| PLANT IMPROVEMENT       | <u>100</u>     |
| SUB TOTAL               | <u>2,598</u>   |
| ADVERTISING EXPENDITURE | <u>540</u>     |
| CASH ON HAND            | <u>2,058</u>   |

PART B

|                                 | <u>4 REGIONS</u> |              |             |              |
|---------------------------------|------------------|--------------|-------------|--------------|
|                                 | <u>1</u>         | <u>2</u>     | <u>3</u>    | <u>4</u>     |
| UNIT SELLING PRICE              | <u>\$55</u>      | <u>\$55</u>  | <u>\$55</u> | <u>\$54</u>  |
| ADVERTISING DISTRIBUTED BY AREA | <u>\$150</u>     | <u>\$190</u> | <u>\$50</u> | <u>\$150</u> |

PART C - REPEAT FIGURES FROM PART A

|                        |                |
|------------------------|----------------|
| PRODUCTION ALLOCATION  | <u>\$4,000</u> |
| RESEARCH & DEVELOPMENT | <u>3,000</u>   |
| PLANT IMPROVEMENT      | <u>100</u>     |

## WORK SHEET

THIRD QUARTER  
TEAM # 1PART A

|                         |                 |
|-------------------------|-----------------|
| CASH                    | <u>\$11,547</u> |
| PRODUCTION ALLOCATION   | <u>6,000</u>    |
| SUB TOTAL               | <u>5,547</u>    |
| RESEARCH & DEVELOPMENT  | <u>2,000</u>    |
| SUB TOTAL               | <u>3,547</u>    |
| PLANT IMPROVEMENT       | <u>450</u>      |
| SUB TOTAL               | <u>3,097</u>    |
| ADVERTISING EXPENDITURE | <u>513</u>      |
| CASH ON HAND            | <u>2,584</u>    |

PART B

|                                 | <u>4 REGIONS</u> |              |              |              |
|---------------------------------|------------------|--------------|--------------|--------------|
|                                 | <u>1</u>         | <u>2</u>     | <u>3</u>     | <u>4</u>     |
| UNIT SELLING PRICE              | <u>\$55</u>      | <u>\$54</u>  | <u>\$56</u>  | <u>\$54</u>  |
| ADVERTISING DISTRIBUTED BY AREA | <u>\$150</u>     | <u>\$111</u> | <u>\$127</u> | <u>\$137</u> |

PART C - REPEAT FIGURES FROM PART A

|                        |                |
|------------------------|----------------|
| PRODUCTION ALLOCATION  | <u>\$6,000</u> |
| RESEARCH & DEVELOPMENT | <u>2,000</u>   |
| PLANT IMPROVEMENT      | <u>450</u>     |



RUN

OPEN-GAM1,1  
 RUN  
 SETUPC

GAME NUMBER?1

DONE

GET-MANAGC  
 RUN  
 MANAGC

GAME NUMBER?1  
 FOR FIRM 1 ENTER AREA SELLING PRICES.?60,60,60,60  
 ENTER AREA ADVERTISING EXPENDITURES.?150,100,100,100  
 ENTER PRODUCTION, R AND D, AND PLANT IMPROVEMENT.?5000,500,500  
 ENTER FIRM 2 DATA USING THREE LINES AS ABOVE.  
 ?60,60,60,60  
 ?100,150,100,100  
 ?5100,400,600  
 ENTER FIRM 3 DATA USING THREE LINES AS ABOVE.  
 ?60,60,60,60  
 ?100,100,150,100  
 ?5200,500,300  
 DO YOU WANT QUARTERLY REPORT PRINTED?YES

FIRM 1 PERIOD 1

SALES ANALYSIS

| AREA                | 1     | 2     | 3     | 4     | TOTAL |
|---------------------|-------|-------|-------|-------|-------|
| ORDERS              | 41    | 30    | 30    | 73    | 174   |
| SHIPMENTS           | 41    | 30    | 30    | 73    | 174   |
| MARKETING           | 150   | 100   | 100   | 100   | 450   |
| REVENUE             | 2460  | 1800  | 1800  | 4380  | 10440 |
| DLVRD UNIT COST(\$) | 36.67 | 38.67 | 38.67 | 37.67 |       |

PROFIT AND LOSS

|                    |       |
|--------------------|-------|
| CURRENT INCOME     | 10440 |
| COST OF GDS SLD    | 6381  |
| TRANSPORTATION     | 193   |
| MARKETING          | 450   |
| RESEARCH           | 500   |
| DEPRECIATION       | 104   |
| NET PROFIT         | 2812  |
| TAXES              | 1406  |
| PROFIT AFTER TAXES | 1406  |

CASH FLOW FINANCIAL ANALYSIS

|                 |       |
|-----------------|-------|
| RECEIPTS        | 10440 |
| DISBURSEMENTS   | 8049  |
| NET FLOW        | 2391  |
| NEW BALANCE     | 9993  |
| CASH            | 9993  |
| INVENTORY VALUE | 1128  |
| PLANT VALUE     | 5596  |
| TOTAL ASSETS    | 16717 |

DISBURSEMENT ALLOCATION(\$VALUE)

|                   |      |
|-------------------|------|
| TRANSPORTATION    | 193  |
| MARKETING         | 450  |
| RESEARCH          | 500  |
| PLANT IMPROVEMENT | 500  |
| PRODUCTION COST   | 5000 |
| TAXES             | 1406 |
| TOTAL             | 8049 |

INVENTORY ALLOCATION(NO. ITEMS)

|               |       |
|---------------|-------|
| BEGINNING     | 71    |
| PRODUCED      | 133   |
| SHIPPED       | 174   |
| BALANCE       | 30    |
| UNIT COST(\$) | 37.59 |

FIRM 2 PERIOD 1

SALES ANALYSIS

| AREA                | 1     | 2     | 3     | 4     | TOTAL |
|---------------------|-------|-------|-------|-------|-------|
| ORDERS              | 29    | 40    | 29    | 71    | 169   |
| SHIPMENTS           | 29    | 40    | 29    | 71    | 169   |
| MARKETING           | 100   | 150   | 100   | 100   | 450   |
| REVENUE             | 1740  | 2400  | 1740  | 4260  | 10140 |
| DLVRD UNIT COST(\$) | 38.43 | 36.43 | 38.43 | 37.43 |       |

PROFIT AND LOSS

|                    |       |
|--------------------|-------|
| CURRENT INCOME     | 10140 |
| COST OF GDS SLD    | 6157  |
| TRANSPORTATION     | 187   |
| MARKETING          | 450   |
| RESEARCH           | 400   |
| DEPRECIATION       | 104   |
| NET PROFIT         | 2842  |
| TAXES              | 1421  |
| PROFIT AFTER TAXES | 1421  |

CASH FLOW FINANCIAL ANALYSIS

|                 |       |
|-----------------|-------|
| RECEIPTS        | 10140 |
| DISBURSEMENTS   | 8158  |
| NET FLOW        | 1982  |
| NEW BALANCE     | 9584  |
| CASH            | 9584  |
| INVENTORY VALUE | 1452  |
| PLANT VALUE     | 5696  |
| TOTAL ASSETS    | 16732 |

DISBURSEMENT ALLOCATION(\$VALUE)

|                   |      |
|-------------------|------|
| TRANSPORTATION    | 187  |
| MARKETING         | 450  |
| RESEARCH          | 400  |
| PLANT IMPROVEMENT | 600  |
| PRODUCTION COST   | 5100 |
| TAXES             | 1421 |
| TOTAL             | 8158 |

INVENTORY ALLOCATION(NO. ITEMS)

|               |       |
|---------------|-------|
| BEGINNING     | 71    |
| PRODUCED      | 137   |
| SHIPPED       | 169   |
| BALANCE       | 39    |
| UNIT COST(\$) | 37.23 |

FIRM 3 PERIOD 1

SALES ANALYSIS

| AREA                | 1     | 2     | 3     | 4     | TOTAL |
|---------------------|-------|-------|-------|-------|-------|
| ORDERS              | 30    | 30    | 41    | 73    | 174   |
| SHIPMENTS           | 30    | 30    | 41    | 73    | 174   |
| MARKETING           | 100   | 100   | 150   | 100   | 450   |
| REVENUE             | 1800  | 1800  | 2460  | 4380  | 10440 |
| DLVRD UNIT COST(\$) | 38.25 | 38.25 | 36.25 | 37.25 |       |

PROFIT AND LOSS

|                    |       |
|--------------------|-------|
| CURRENT INCOME     | 10440 |
| COST OF GDS SLD    | 6308  |
| TRANSPORTATION     | 193   |
| MARKETING          | 450   |
| RESEARCH           | 500   |
| DEPRECIATION       | 104   |
| NET PROFIT         | 2885  |
| TAXES              | 1443  |
| PROFIT AFTER TAXES | 1443  |

CASH FLOW FINANCIAL ANALYSIS

|                 |       |
|-----------------|-------|
| RECEIPTS        | 10440 |
| DISBURSEMENTS   | 8086  |
| NET FLOW        | 2354  |
| NEW BALANCE     | 9956  |
| CASH            | 9956  |
| INVENTORY VALUE | 1401  |
| PLANT VALUE     | 5396  |
| TOTAL ASSETS    | 16754 |

DISBURSEMENT ALLOCATION(\$VALUE)

|                   |      |
|-------------------|------|
| TRANSPORTATION    | 193  |
| MARKETING         | 450  |
| RESEARCH          | 500  |
| PLANT IMPROVEMENT | 300  |
| PRODUCTION COST   | 5200 |
| TAXES             | 1443 |
| TOTAL             | 8086 |

INVENTORY ALLOCATION(NO. ITEMS)

|               |       |
|---------------|-------|
| BEGINNING     | 71    |
| PRODUCED      | 141   |
| SHIPPED       | 174   |
| BALANCE       | 38    |
| UNIT COST(\$) | 36.88 |

DONE

CONTRIBUTED PROGRAM **BASIC**ATTEND  
36202**TITLE:**

ABSENTEE LISTINGS

**DESCRIPTION:**

This program provides a listing of absentees in alphabetical order, according to the first three letters of the last name (most efficient method). The list is divided into three groups, according to each student's class (10, 11, or 12). Calculations are also made to determine total absentees and percent attendance. The completed output is then suitable for use as a daily bulletin of high school attendance. Asterisks designate change of alphabetical character in last name.

**INSTRUCTIONS:**

See page 2.

**SPECIAL  
CONSIDERATIONS:**

Care must be exercised to insure sufficient storage for each record, as a file overflow will result in program termination. In all cases, the specific file in which the deficiency has occurred will be indicated by the program. That file should be killed and opened again.

**ACKNOWLEDGEMENTS:**

William R. Hudson  
Butler Senior High School/Butler, Pennsylvania

## INSTRUCTIONS

Files "ATTEN1," "ATTEN2," "ATTEN3," and "ATTEN4," must be opened before each run and killed afterwards. "ATTEN1" - "ATTEN3" accomodates the number of absentees in classes 10, 11 and 12, respectively (5 names per record). For example, if there are 90 absentees in a class, there must be at least 19 records for that corresponding file  $[1+\text{INT}(N/5)]$ .

Since the files will be killed immediately after the run of the program, the number of records opened is of no consequence as far as cost is concerned. Therefore, files should always be opened larger than necessary.

File "ATTEN4" is used as a buffer file. It must be opened (1 record per entry) to the number of students in the largest class.

Absentees should be entered on paper tape (to conserve terminal time) and should be punched as follows:

LAST NAME, FIRST NAME, GRADE [x-off, return, linefeed]

where:

the name of the student is entered as indicated and may occupy 20 positions,  
grade is the class of the student being entered. If omitted, an appropriate error message will be issued.

Name and grade need not be separated; however, any character other than a blank will be accepted as part of the name. If data is not entered on tape, a return is the only needed character to end each line.

### Example:

SMITH, JOHN 12 [return]

After the last absentee has been entered, type "END" at the next input (to signify end of data). Each class will then be alphabetized and recorded. Respond with "YES" or "NO" upon request of "CORRECTIONS?". If "YES" the entry numbers of absentees to be omitted will be requested (entry numbers are assigned sequentially during input). If "NO" is typed, the program will continue.

At the input for "TOTAL ATTENDANCE?", enter the number of students in attendance (the number of students present when there are no absentees). At the next input ("NUMBER OF LINES PER PAGE?"), enter the number of lines to be printed on a single page (57 for a standard sheet).

Execution of the program will not continue until the return key is depressed (allowing time for the placement of a stencil or other duplicating forms, in the teletype).

The return key must again be depressed after the printing of the given number of lines. If the printing form is not changed, printing will be continued at the point at which it was previously halted. For additional executions, RUN-930.

## RUN

RUN  
ATTEND

ENTER ABSENTEES AS FOLLOWS:  
LAST NAME, FIRST - GRADE  
TYPE 'END' AT FINAL DATA REQUEST

ABSENTEES \*\*\*\*\* GR

ENTRY 1? KRIESS, DONNA 10  
ENTRY 2? MIZERAK, PATRICE 12  
ENTRY 3? KELLANDER, LORETTA 11  
ENTRY 4? FREELING, DONNA 11  
ENTRY 5? KALP, DEB 12  
ENTRY 6? JAFFE, JOEL 12  
ENTRY 7? LEYLAND, MIKE 12  
ENTRY 8? KENNEDY, PAULA 12  
ENTRY 9? SCOTT, VALENTINA 12  
ENTRY 10? BOSHO, PAM 12  
ENTRY 11? NANNI, DEB 10  
ENTRY 12? FREDERICK, AMY 12  
ENTRY 13? TOMASOVICH, RICK 11  
ENTRY 14? O'BRIEN, CINDY 11  
ENTRY 15? BARBER, JACK 12  
ENTRY 16? ENGLISH, JOHN 12  
ENTRY 17? GREEN, A-MARTIN 11  
ENTRY 18? MORRISON, ALBY 11  
ENTRY 19? SWIDZINSKI, ROD 11  
ENTRY 20? BOUCH, MARY 11  
ENTRY 21? LANCASTER, JANE 11  
ENTRY 22? SCHEDLER, LINDA 12  
ENTRY 23? STEFFANAUER, KAREN 11  
ENTRY 24? BUREAU, CHUCK 11  
ENTRY 25? BLOOM, LARRY 12  
ENTRY 26? HENDERSHOT, CHUCK 2

INPUT ERROR  
RE-TYPE ENTRY

ENTRY 26? HENDERSHOT, CHUCK 12  
ENTRY 27? GIBBS, CATHY 12  
ENTRY 28? SMALLWOOD, BEV 12  
ENTRY 29? MCKAIN, LARRY 10  
ENTRY 30? ORTH, RON 10

ENTRY 31? COGLEY, BOB 12  
ENTRY 32? GAMBLE, RAY 12  
ENTRY 33? HEITZER, KEN 11  
ENTRY 34? OLESAK, DAVE 11  
ENTRY 35? LEUTHARDT, VICKI 12  
ENTRY 36? ZALIPONI, ROD 12  
ENTRY 37? BIEDENBACH, PAUL 10  
ENTRY 38? TURNER, TOM 10  
ENTRY 39? PATTEN, PAT 10  
ENTRY 40? SCOTT, HAROLD 11  
ENTRY 41? BITTNER, WM. 10  
ENTRY 42? HOCKENBERRY, ROBT 10  
ENTRY 43? ZITZMAN, AL 12  
ENTRY 44? PROTZMAN, S-DWIGHT 10  
ENTRY 45? SWIDZINSKI, DALE 11  
ENTRY 46? ZARNICK, DAVE 12  
ENTRY 47? OTT, LUTHER 11  
ENTRY 48? PALACE, CHUCK 11  
ENTRY 49? SHEPPECK, JERRY 11  
ENTRY 50? GREEN, JULIE 12  
ENTRY 51? LESLIE, SALLY 12  
ENTRY 52? BAUMGART, CAROL 10  
ENTRY 53? DALLAS, KAREN 10  
ENTRY 54? CRILEY, RON 12  
ENTRY 55? GALL, DIANNA 12  
ENTRY 56? DUNKLE, LISS -A 11  
ENTRY 57? WEIGLE, PAT 11  
ENTRY 58? LAMBERT, KAREN 10  
ENTRY 59? URAM, GARY 12  
ENTRY 60? MCCOMMON, DAVE 10  
ENTRY 61? FALLECKER, ROSE 10  
ENTRY 62? GRAHAM, DEB 10  
ENTRY 63? GAUDINO, SABRINA 10  
ENTRY 64? BIEDENBACH, ROGER 11  
ENTRY 65? CINGOLANI, ROBT 12  
ENTRY 66? YURKOVICH, GEO. 11  
ENTRY 67? K-MAUST, KEITH 12  
ENTRY 68? GRAY, PATTY 11  
ENTRY 69? KENNEDY, L-TOM 11

ENTRY 70? MILLER,GEO. 11  
ENTRY 71? CRAIG,RANDY 11  
ENTRY 72? HUTCHISON,KEITH 11  
ENTRY 73? MATSON,JIM 11  
ENTRY 74? HAINER,FRANK 12  
ENTRY 75? BARBE,

INPUT ERROR  
RE-TYPE ENTRY

ENTRY 75? BARBER,JEFF 10  
ENTRY 76? REOTT,ROD 10  
ENTRY 77? SMITH,RANDY 10  
ENTRY 78? WAHLER,RONNIE 10  
ENTRY 79? BAYER,SCOTT 10  
ENTRY 80?END

CLASS 10 RECORDED  
CLASS 11 RECORDED  
CLASS 12 RECORDED  
DATA RECORDED

CORRECTIONS?YES

ENTER NUMBER OF ABSENTEE TO BE OMITTED  
TYPE ZERO AT FINAL DATA REQUEST

ENTRY NUMBER?35  
ENTRY NUMBER?54  
ENTRY NUMBER?ZERO  
??0

TOTAL ATTENDANCE?2400  
NUMBER OF LINES PER PAGE?100

RETURN KEY MUST BE DEPRESSED TO CONTINUE EXECUTION

ATTENDANCE BULLETIN  
7/19/72

GRADE 10:  
 \*BARBER, JEFF  
 BAUMGART, CAROL  
 BAYER, SCOTT  
 BIEDENBACH, PAUL  
 BITTNER, WM.  
 \*DALLAS, KAREN  
 \*FALLECKER, ROSE  
 \*GAUDINO, SABRINA  
 GRAHAM, DEB  
 \*HOCKENBERRY, ROBT  
 \*KRIESS, DONNA  
 \*LAMBERT, KAREN  
 \*MCCOMMON, DAVE  
 MCKAIN, LARRY  
 \*NANNI, DEB  
 \*ORTH, RON  
 \*PATTEN, PAT  
 PROTZMAN, DWIGHT  
 \*REOTT, ROD  
 \*SMITH, RANDY  
 \*TURNER, TOM  
 \*WAHLER, RONNIE

GRADE 11:  
 \*BIEDENBACH, ROGER  
 BOUCH, MARY  
 BUREAU, CHUCK  
 \*CRAIG, RANDY  
 \*DUNKLE, LISSA  
 \*FREELING, DONNA  
 \*GRAY, PATTY  
 GREEN, MARTIN  
 \*HEITZER, KEN  
 HUTCHISON, KEITH  
 \*KELLANDER, LORETTA  
 KENNEDY, TOM  
 \*LANCASTER, JANE  
 \*MATSON, JIM  
 MILLER, GEO.  
 MORRISON, ALBY  
 \*OLEXSAK, DAVE  
 OTT, LUTHER  
 O'BRIEN, CINDY  
 \*PALACE, CHUCK  
 \*SCOTT, HAROLD  
 SHEPPECK, JERRY  
 STEFFANAUER, KAREN  
 SWIDZINSKI, DALE  
 SWIDZINSKI, ROD  
 \*TOMASOVICH, RICK  
 \*WEIGLE, PAT  
 \*YURKOVICH, GEO.

GRADE 12:  
 \*BARBER, JACK  
 BLOOM, LARRY  
 BOSHO, PAM  
 \*CINGOLANI, ROBT  
 COGLEY, BOB  
 \*ENGLISH, JOHN  
 \*FREDERICK, AMY  
 \*GALL, DIANNA  
 GAMBLE, RAY  
 GIBBS, CATHY  
 GREEN, JULIE  
 \*HAINER, FRANK  
 HENDERSHOT, CHUCK  
 \*JAFFE, JOEL  
 \*KALP, DEB  
 KENNEDY, PAULA  
 \*LESLIE, SALLY  
 LEYLAND, MIKE  
 \*MAUST, KEITH  
 MIZERAK, PATRICE  
 \*SCHEDLER, LINDA  
 SCOTT, VALENTINA  
 SMALLWOOD, BEV  
 \*URAM, GARY  
 \*ZALIPONI, ROD  
 ZARNICK, DAVE  
 ZITZMAN, AL

TOTAL ABSENTEES  
 PERCENT ATTENDANCE

77  
 96.79%

DONE



CONTRIBUTED PROGRAM **BASIC**

AVERG1  
36340

**TITLE:**

AVERG1: Averages and Curves Grades

**DESCRIPTION:**

This program will average any number of grades. A passing grade must be inputted by the teacher, and the computer will list the numerical value of the curve and the respected adjusted grades based on the computed averages and the passing grade.

**INSTRUCTIONS:**

Enter grades as DATA in lines 600-700.

**SPECIAL  
CONSIDERATIONS:**

Curving is valid only if the original grade distribution showed a Bell Curve.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

600 DATA 65,78,76,48,65,78,82,69,71,56,90,67,59,60,70,74,62,57,66

601 DATA 64,63,65,59,60,56,48,66

RUN

AVERG1

PASSING GRADE FOR THIS TEST IS ?70

THE AVERAGE OF ALL GRADES ENTERED IS 65.7037 .

THE AVERAGE FALLS BELOW THE PASSING GRADE BY 4 POINTS.  
(ROUNDED TO NEAREST WHOLE NUMBER.)

ADJUSTED GRADE = ORIGINAL GRADE + 4

| STUDENT<br>NUMBER<br>===== | ORIGINAL<br>GRADE<br>===== | ADJUSTED<br>GRADE<br>===== |
|----------------------------|----------------------------|----------------------------|
| 1                          | 65                         | 69                         |
| 2                          | 78                         | 82                         |
| 3                          | 76                         | 80                         |
| 4                          | 48                         | 52                         |
| 5                          | 65                         | 69                         |
| 6                          | 78                         | 82                         |
| 7                          | 82                         | 86                         |
| 8                          | 69                         | 73                         |
| 9                          | 71                         | 75                         |
| 10                         | 56                         | 60                         |
| 11                         | 90                         | 94                         |
| 12                         | 67                         | 71                         |
| 13                         | 59                         | 63                         |
| 14                         | 60                         | 64                         |
| 15                         | 70                         | 74                         |
| 16                         | 74                         | 78                         |
| 17                         | 62                         | 66                         |
| 18                         | 57                         | 61                         |
| 19                         | 66                         | 70                         |
| 20                         | 64                         | 68                         |
| 21                         | 63                         | 67                         |
| 22                         | 65                         | 69                         |
| 23                         | 59                         | 63                         |
| 24                         | 60                         | 64                         |
| 25                         | 56                         | 60                         |
| 26                         | 48                         | 52                         |
| 27                         | 66                         | 70                         |

DONE

**TITLE:** BASKETBALL STATISTICS

**DESCRIPTION:** This program maintains individual and team statistics for varsity and junior varsity basketball teams. Data items input are offensive rebounds, defensive rebounds, losses (losses of the ball by bad passes, fumbles, allowing the ball to be stolen or being tied up and losing the jump), violations (rule violations other than fouls which result in the loss of the ball), gains (individually forcing losses or violations on opponents), assists, fouls, field goals attempted, field goals made, free throws attempted and free throws made. Output consists of a chart divided into Floor Play and Shooting categories which contains individual totals, games played and shooting and scoring averages. Team information consists of totals and averages on all items input.

**INSTRUCTIONS:** Open files VARS and JRVAR with one record each and file NAMES with two records. Enter a zero matrix (21 x 6) in VARS and JRVAR. A program named PROG is provided to enter the zero matrix. Just GET-PROG and RUN to initialize the files. Enter the names of up to 21 varsity players in numerical order in the first record of NAMES and the same information for the junior varsity in the second record. Maximum name length is nine characters.

Two statements must be altered as follows: 80 R = number of varsity players and 110 R = number of junior varsity players.

The argument of the TAB function and the school name in statement 890 should be changed. The formula for the argument is:

If the number of characters in the name string is odd, then the argument is -  $36 \frac{\text{number of characters} + 1}{2}$

If the number of characters in the name string is even, then the argument is -  $36 \frac{\text{number of characters}}{2}$

continued on following page

**SPECIAL  
CONSIDERATIONS:**

In order that all data for one team may be stored in a file of one record, the data which is output from a matrix as large as 21 x 13 is compressed into a 21 x 6 matrix. Of the thirteen items for each player, the rebounding and shooting may each total up to 999 (three digits) and other items up to 99 for a total of 32 digits. These are stored in five six-digit numbers and one two-digit number.

**ACKNOWLEDGEMENTS:** Richard Bach  
North Eugene High School

## INSTRUCTIONS continued

On execution, first input required is the number of players for whom data is to be entered, number of games played to date and team identification (varsity or junior varsity).

Next input is player data consisting of the uniform number followed by the eleven items listed above (in the description of the program) in the order given. Players are entered separately and in order of uniform number.

On the season's first execution, enter data for all players, including those who have not yet played. For them, enter the negative of the uniform number (to avoid counting a game played) and eleven zeroes. The question GAMES? will be typed when a negative uniform number is entered. Enter a zero on first execution.

Errors in data can be corrected after the error appears in a complete printout. To correct for any number or players, execute the program, indicating the number of players for whom corrections are needed. Then enter the negative of the player number followed by zeroes or positive or negative numbers as needed to correct. When GAMES? is typed enter the number required to correct the number of games played.

To get a printout without entering player data, enter zero for the number of players.

## RUN

```
10 FILES NAMES
20 PRINT #1,1;"WOODRUFF","LEWMAN","AINGE DAV","HATFIELD","JACKSON"
30 PRINT #1;"COOLEY","SCHNEIDER","GOHL","MCCONNELL","ROSHAU","HANEKE"
40 PRINT #1;"NEEDS","AINGE DOU","BURGE"
50 END
RUN
MISSING OR PROTECTED FILE
OPE-NAMES,2
RUN
```

## DONE

```
OPE-VARS,1
OPE-JRVAR,1
GET-PROG
```

```
RUN
PROG
```

## DONE

```
GET-BASKET
RUN
BASKET
```

```
ENTER # OF MEN PLAYING, GAME #, TEAM ( VARSITY OR JV )
?14,1,V
ENTER #, OFF RB, DEF RB, LOSS, VIOL, GAIN, ASST, FOULS, FGA, FG, FTA, FT
?12,1,1,0,0,0,2,2,2,1,2,0
?-13,0,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?14,0,1,1,1,1,2,3,6,2,2,2
?20,0,0,0,0,0,0,0,2,2,0,0,0
?22,0,1,1,1,1,3,3,5,3,4,4
?24,1,1,0,0,0,1,1,2,0,0,0
?-26,0,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?-28,0,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?-30,0,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?32,3,4,2,1,1,4,2,12,9,0,0
?3--36,0,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?-40,0,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?50,4,6,1,0,1,2,0,12,8,1,1
?52,3,5,2,1,1,2,2,12,4,5,4
```

NORTH EUGENE HIGH SCHOOL  
 VARSITY BASKETBALL STATISTICS  
 THROUGH 1 GAMES

FLOOR PLAY

| PLAYER NAME   | NO. | OFF REB | DEF REB | LOSS | VIOL | GAIN | ASST | FOULS | GAMES PLAYED |
|---------------|-----|---------|---------|------|------|------|------|-------|--------------|
| WOODRUFF      | 12  | 1       | 1       | 0    | 0    | 0    | 2    | 2     | 1            |
| LEWMAN        | 13  | 0       | 0       | 0    | 0    | 0    | 0    | 0     | 0            |
| AINGE DAV     | 14  | 0       | 1       | 1    | 1    | 1    | 2    | 3     | 1            |
| HATFIELD      | 20  | 0       | 0       | 0    | 0    | 0    | 0    | 2     | 1            |
| JACKSON       | 22  | 0       | 1       | 1    | 1    | 1    | 3    | 3     | 1            |
| COOLEY        | 24  | 1       | 1       | 0    | 0    | 0    | 1    | 1     | 1            |
| SCHNEIDER     | 26  | 0       | 0       | 0    | 0    | 0    | 0    | 0     | 0            |
| GOHL          | 28  | 0       | 0       | 0    | 0    | 0    | 0    | 0     | 0            |
| MCCONNELL     | 30  | 0       | 0       | 0    | 0    | 0    | 0    | 0     | 0            |
| ROSHAU        | 32  | 3       | 4       | 2    | 1    | 1    | 4    | 2     | 1            |
| HANEKE        | 36  | 0       | 0       | 0    | 0    | 0    | 0    | 0     | 0            |
| NEEDS         | 40  | 0       | 0       | 0    | 0    | 0    | 0    | 0     | 0            |
| AINGE DOU     | 50  | 4       | 6       | 1    | 0    | 1    | 2    | 0     | 1            |
| BURGE         | 52  | 3       | 5       | 2    | 1    | 1    | 2    | 2     | 1            |
| TEAM TOTALS   |     | 12      | 19      | 7    | 4    | 5    | 16   | 15    |              |
| TEAM AVERAGES |     | 12.0    | 19.0    | 7.0  | 4.0  | 5.0  | 16.0 | 15.0  |              |

SHOOTING

| PLAYER NAME   | NO. | F G ATT | FLD GLS | FLD GL AVERAGE | F T ATT | FR THR | FR THR AVERAGE | POINT TOTAL | POINT AVERAGE |
|---------------|-----|---------|---------|----------------|---------|--------|----------------|-------------|---------------|
| WOODRUFF      | 12  | 2       | 1       | 0.500          | 2       | 0      | 0.000          | 2           | 2.0           |
| LEWMAN        | 13  | 0       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| AINGE DAV     | 14  | 6       | 2       | 0.333          | 2       | 2      | 1.000          | 6           | 6.0           |
| HATFIELD      | 20  | 2       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| JACKSON       | 22  | 5       | 3       | 0.600          | 4       | 4      | 1.000          | 10          | 10.0          |
| COOLEY        | 24  | 2       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| SCHNEIDER     | 26  | 0       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| GOHL          | 28  | 0       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| MCCONNELL     | 30  | 0       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| ROSHAU        | 32  | 12      | 9       | 0.750          | 0       | 0      | 0.000          | 18          | 18.0          |
| HANEKE        | 36  | 0       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| NEEDS         | 40  | 0       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| AINGE DOU     | 50  | 12      | 8       | 0.667          | 1       | 1      | 1.000          | 17          | 17.0          |
| BURGE         | 52  | 12      | 4       | 0.333          | 5       | 4      | 0.800          | 12          | 12.0          |
| TEAM TOTALS   |     | 53      | 27      |                | 14      | 11     |                | 65          |               |
| TEAM AVERAGES |     | 53.0    | 27.0    | 0.509          | 14.0    | 11.0   | 0.786          |             | 65.0          |

DONE

RUN  
 BASKET

ENTER # OF MEN PLAYING, GAME #, TEAM (VARSITY OR JV)  
 ?8,2,V  
 ENTER #, OFF RB, DEF RB, LOSS, VIOL, GAIN, ASST, FOULS, FGA, FG, FTA, FT  
 ?13,1,1,0,0,0,2,2,2,1,2,0  
 ?14,0,0,1,1,1,2,3,5,2,2,1  
 ?20,0,0,0,0,0,0,2,2,0,0,0,0  
 ?30,1,1,0,0,0,1,1,2,0,0,0,0  
 ?36,3,4,2,1,1,4,2,12,8,0,0,0  
 ?40,4,6,1,0,1,2,0,12,8,1,1  
 ?50,3,5,2,1,1,2,2,12,4,5,4  
 ?52,4,6,1,0,1,2,0,12,8,2,1

NORTH EUGENE HIGH SCHOOL  
 VARSITY BASKETBALL STATISTICS  
 THROUGH 2 GAMES

## FLOOR PLAY

| PLAYER NAME   | NO. | OFF REB | DEF REB | LOSS | VIOL | GAIN | ASST | FOULS | GAMES PLAYED |
|---------------|-----|---------|---------|------|------|------|------|-------|--------------|
| WOODRUFF      | 12  | 1       | 1       | 0    | 0    | 0    | 2    | 2     | 1            |
| LEWMAN        | 13  | 1       | 1       | 0    | 0    | 0    | 2    | 2     | 1            |
| AINGE DAV     | 14  | 0       | 1       | 2    | 2    | 2    | 4    | 6     | 2            |
| HATFIELD      | 20  | 0       | 0       | 0    | 0    | 0    | 2    | 4     | 2            |
| JACKSON       | 22  | 0       | 1       | 1    | 1    | 1    | 3    | 3     | 1            |
| COOLEY        | 24  | 1       | 1       | 0    | 0    | 0    | 1    | 1     | 1            |
| SCHNEIDER     | 26  | 0       | 0       | 0    | 0    | 0    | 0    | 0     | 0            |
| GOHL          | 28  | 0       | 0       | 0    | 0    | 0    | 0    | 0     | 0            |
| MCCONNELL     | 30  | 1       | 1       | 0    | 0    | 0    | 1    | 1     | 1            |
| ROSHAU        | 32  | 3       | 4       | 2    | 1    | 1    | 4    | 2     | 1            |
| HANEKE        | 36  | 3       | 4       | 2    | 1    | 1    | 4    | 2     | 1            |
| NEEDS         | 40  | 4       | 6       | 1    | 0    | 1    | 2    | 0     | 1            |
| AINGE DOU     | 50  | 7       | 11      | 3    | 1    | 2    | 4    | 2     | 2            |
| BURGE         | 52  | 7       | 11      | 3    | 1    | 2    | 4    | 2     | 2            |
| TEAM TOTALS   |     | 28      | 42      | 14   | 7    | 10   | 33   | 27    |              |
| TEAM AVERAGES |     | 14.0    | 21.0    | 7.0  | 3.5  | 5.0  | 16.5 | 13.5  |              |

## SHOOTING

| PLAYER NAME   | NO. | F G ATT | FLD GLS | FLD GL AVERAGE | F T ATT | FR THR | FR THR AVERAGE | POINT TOTAL | POINT AVERAGE |
|---------------|-----|---------|---------|----------------|---------|--------|----------------|-------------|---------------|
| WOODRUFF      | 12  | 2       | 1       | 0.500          | 2       | 0      | 0.000          | 2           | 2.0           |
| LEWMAN        | 13  | 2       | 1       | 0.500          | 2       | 0      | 0.000          | 2           | 2.0           |
| AINGE DAV     | 14  | 11      | 4       | 0.364          | 4       | 3      | 0.750          | 11          | 5.5           |
| HATFIELD      | 20  | 2       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| JACKSON       | 22  | 5       | 3       | 0.600          | 4       | 4      | 1.000          | 10          | 10.0          |
| COOLEY        | 24  | 2       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| SCHNEIDER     | 26  | 0       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| GOHL          | 28  | 0       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| MCCONNELL     | 30  | 2       | 0       | 0.000          | 0       | 0      | 0.000          | 0           | 0.0           |
| ROSHAU        | 32  | 12      | 9       | 0.750          | 0       | 0      | 0.000          | 18          | 18.0          |
| HANEKE        | 36  | 12      | 8       | 0.667          | 0       | 0      | 0.000          | 16          | 16.0          |
| NEEDS         | 40  | 12      | 8       | 0.667          | 1       | 1      | 1.000          | 17          | 17.0          |
| AINGE DOU     | 50  | 24      | 12      | 0.500          | 6       | 5      | 0.833          | 29          | 14.5          |
| BURGE         | 52  | 24      | 12      | 0.500          | 7       | 5      | 0.714          | 29          | 14.5          |
| TEAM TOTALS   |     | 110     | 58      |                | 26      | 18     |                | 134         |               |
| TEAM AVERAGES |     | 55.0    | 29.0    | 0.527          | 13.0    | 9.0    | 0.692          |             | 67.0          |

DONE

**TITLE:** COLLEGE REGISTRATION DEMO COLREG  
36282

**DESCRIPTION:** COLREG is a comprehensive demo package that illustrates the feasibility of an on-line, multi-terminal college registration. The package consists of 10 programs: CLEAR, FILE, PREREG, REPS, AVAIL, REG, SOFAR, GRAD, CLASS, and COPY.

**INSTRUCTIONS:** It is estimated that 1 million characters are needed for each 1,000 students. This estimate is for student and course information only and does not account for program storage.

The operation here assumes that the college registrar will manually plan a list of available courses and associated instructors. This list is entered into the system as well as sent to all students. The students then plan their individual programs at home and then at registration day they enter their programs into the system on one of 32 terminals. This system then checks for validity, class conflict, etc. as students enter their courses. Upon successful completion, the student is given an on-the-spot report of his program. In addition, class reports for the instructors can be obtained at the end of registration.

During the year the individual instructors may enter grades for his students and provide reports for all student grades.

The time per student at registration seems to be about 5 minutes, so a 32 terminal system could handle 384 students/hour.

Continued on following page.

**SPECIAL CONSIDERATIONS:**

1. Maximum number of students - 32
2. Maximum number of courses one student can take - 9
3. Maximum number of credits a student may take - 17
4. Maximum number of courses available - 9
5. Maximum number of sections within a course - 6
6. Maximum number of hours per week a section may have - 5
7. Sections must be scheduled at same start time and length on each available day.
8. Two programs that write on files may not run simultaneously.
9. No deletes are provided for students, courses, or sections.
10. May not change the original quota for any section.

**ACKNOWLEDGEMENTS:** George Tibaldi/Dave Denman  
HP, Eastern Sales Region

INSTRUCTIONS: continued

| <u>NAME OF PROGRAM</u> | <u>FUNCTION</u>                                                           |
|------------------------|---------------------------------------------------------------------------|
| CLEAR                  | Clears student and course files                                           |
| FILE                   | To enter available courses and sections                                   |
| PREREG                 | To enter student names and addresses. Prior to registration (if required) |
| REPS                   | Lists students' name and addresses                                        |
| AVAIL                  | Lists courses and sections available                                      |
| REG                    | To register students (can be used to list any students programs)          |
| SOFAR                  | To list courses, sections and students registered SOFAR                   |
| GRAD                   | To enter midterm or final grades                                          |
| CLASS                  | To provide a class report for each instructor                             |
| COPY                   | Restores (copies) two back-up files to student and course                 |

1. OPEN-STUDNT, 128  
OPEN-COURSE, 128  
OPEN-WORK, 3  
OPEN-WORK1, 10  
OPEN-WORK2, 10
2. RUN "CLEAR" to clean student and course file
3. RUN "FILE" to enter an available curriculum
4. RUN "AVAIL" to get a report of all courses and sections entered with "FILE"
5. May RUN "PREREG" to enter names and addresses of students. This saves time at actual registration ("REG") in that names, etc. are already entered.
6. RUN "REG" to enter courses for students. This student should use this program with a copy of the report from "AVAIL" in his hand.
7. May RUN "SOFAR" at any time to see the number of students enrolled SOFAR
8. May RUN "CLASS" at any time to see the actual students enrolled in each class. This program thus provides class reports for all courses to be given to each instructor
9. At midterm and final time, each instructor would run "GRAD" to enter the grades for his students
10. After all midterm or final grades are entered, run "CLASS" again to see entered grades
11. RUN "REPS" at any time to see students in file

The following list of programs may be run at any time with out altering any files since they read only:

REPS, AVAIL, SOFAR, CLASS or REG (with just typing "END" in response to "COURSE-SEC")

For demo purposes, the following procedures are useful:

- A. RUN "CLEAR"
- B. RUN "FILE" for 7 courses and 3 to 4 sections per course
- C. RUN "PREREG" for about 10 students
- D. Using a file copy program, ("COPY") save both student and course files. In this way this state can easily be recreated from back-up files (CSAVE and SSAVE).

The file copy program, COPY, included in this program package has been set up to perform these steps. user may just RUN COPY to restore the state. The sample RUNs which follow illustrate the building of the files rather than using COPY which has already set up the files.



RUN

GET-CLEAR  
RUN  
CLEAR

CLEARs STUDENT AND COURSE FILE

DONE

GET-REPS  
RUN  
REPS

FILES ARE EMPTY

ALL OR STUDENT # ?  
?ALL

NOT IN FILES

DONE

GET-PREREG  
RUN  
PREREG

RESPOND WITH ANSWER OR END

STUDENT #??229-56-5036  
LAST NAME??BANISCH  
FIRST NAME??JIM  
MIDDLE INITIAL??Z  
PHONE??265-7000  
SEX??M  
CITY??C-KING OF PRUSSIA  
STATE??PENNSYLVANIA  
BAD INPUT, RETYPE FROM ITEM 1  
??PENN.  
STREET ADDRESS??1021 EIGHTH ST.  
STUDENT #??149-24:686  
LAST NAME??FRANK  
FIRST NAME??LEE  
MIDDLE INITIAL??Z  
PHONE??667-4000  
SEX??M  
CITY??CHERRY HILL  
STATE??NEW JERSEY  
BAD INPUT, RETYPE FROM ITEM 1  
??N.J.  
STREET ADDRESS??1060 N. KINGS HIGHWAY  
STUDENT #??136-26-1841  
LAST NAME??BOLCIK  
FIRST NAME??BOB  
MIDDLE INITIAL??Z  
PHONE??948-6370  
SEX??M  
CITY??ROCKVILLE  
STATE??MD.  
STREET ADDRESS??2 CHOKE CHERRY LANE  
STUDENT #??065-32:2709  
LAST NAME??TIBALDI  
FIRST NAME??GEORGE  
MIDDLE INITIAL??A  
PHONE??265-5000  
SEX??M  
CITY??PARAMUS  
STATE??N.J.  
STREET ADDRESS??120 W. CENTURY RD.  
STUDENT #??012-28-2705  
LAST NAME??KELLEY  
FIRST NAME??KEN

PREREGISTER STUDENTS

MIDDLE INITIAL??Z  
PHONE??948-6370  
SEX??M  
CITY??ROCKVILLE  
STATE??MD.  
STREET ADDRESS??2 CHOKE CHERRY LANE  
STUDENT #??END

DONE

GET-REPS  
RUN  
REPS

ALL OR STUDENT # ?  
?ALL  
229-56-5036 BANISCH JIM Z  
1021 EIGHTH ST. KING OF PRUSSIA,PENN.  
265-7000 SEX M

LISTS ALL STUDENTS PREREGISTERED

149-24:686 FRANK LEE Z  
1060 N. KINGS HIGHWAY CHERRY HILL,N.J.  
667-4000 SEX M

136-26-1841 BOLCIK BOB Z  
2 CHOKE CHERRY LANE ROCKVILLE,MD.  
948-6370 SEX M

065-32:2709 TIBALDI GEORGE A  
120 W. CENTURY RD. PARAMUS,N.J.  
265-5000 SEX M

012-28-2705 KELLEY KEN Z  
2 CHOKE CHERRY LANE ROCKVILLE,MD.  
948-6370 SEX M

END OF FILE

DONE

GET-FILE  
RUN  
FILE

TITLE ?ENGI  
CREDITS ?3  
SECTIONS ?3

ENTER COURSES

SECTION # ?2  
START TIME ?10  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?1  
DAY 2 ?3  
DAY 3 ?5  
INSTRUCTOR ?SMITH  
QUOTA ?5

SECTION # ?1  
START TIME ?9  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?1  
DAY 2 ?4  
DAY 3 ?5  
INSTRUCTOR ?DRAPER  
QUOTA ?4

SECTION # ?3  
START TIME ?3  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?1  
DAY 2 ?3  
DAY 3 ?5  
INSTRUCTOR ?BROWN  
QUOTA ?4  
DONE??NO  
TITLE ?HIST1  
CREDITS ?3  
SECTIONS ?4

SECTION # ?1  
START TIME ?9  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?1  
DAY 2 ?3  
DAY 3 ?5  
INSTRUCTOR ?WATTS  
QUOTA ?4

SECTION # ?2  
START TIME ?11  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?1  
DAY 2 ?3  
DAY 3 ?5  
INSTRUCTOR ?WATTS  
QUOTA ?4

SECTION # ?3  
START TIME ?1  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?1  
DAY 2 ?4  
DAY 3 ?5  
INSTRUCTOR ?DRAPER  
QUOTA ?3

SECTION # ?4  
START TIME ?4  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?1  
DAY 2 ?3  
DAY 3 ?5  
INSTRUCTOR ?MARK  
QUOTA ?3  
DONE??NO  
TITLE ?EC01  
CREDITS ?3  
SECTIONS ?4

SECTION # ?1  
START TIME ?10  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?1  
DAY 2 ?3  
DAY 3 ?5  
INSTRUCTOR ?I-HARRIS  
QUOTA ?3

SECTION # ?2  
START TIME ?11  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?1  
DAY 2 ?2  
DAY 3 ?5  
INSTRUCTOR ?MARTIN  
QUOTA ?4

SECTION # ?3  
START TIME ?3  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?1  
DAY 2 ?3  
DAY 3 ?5  
INSTRUCTOR ?HARRIS  
QUOTA ?3

SECTION # ?4  
START TIME ?4  
LENGTH ?1  
TIMES/WEEK ?3  
DAY 1 ?2  
DAY 2 ?3  
DAY 3 ?5  
INSTRUCTOR ?BONNER  
QUOTA ?4  
DONE??NO  
TITLE ?BI01  
CREDITS ?4  
SECTIONS ?4

SECTION # ?1  
START TIME ?9  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?2  
INSTRUCTOR ?MC CLEAN  
QUOTA ?4

SECTION # ?2  
START TIME ?9  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?4  
INSTRUCTOR ?MARIN  
QUOTA ?3

SECTION # ?3  
START TIME ?1  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?4  
INSTRUCTOR ?KNOPP  
QUOTA ?4

SECTION # ?4  
START TIME ?1  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?5  
INSTRUCTOR ?MC CLEAN  
QUOTA ?4  
DONE??NO  
TITLE ?CHEM1  
CREDITS ?4  
SECTIONS ?3

SECTION # ?1  
START TIME ?9  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?2  
INSTRUCTOR ?TOTIE  
QUOTA ?4

SECTION # ?2  
START TIME ?9  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?4  
INSTRUCTOR ?MATHEWS  
QUOTA ?3

SECTION # ?3  
START TIME ?1  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?3  
INSTRUCTOR ?TOTIE  
QUOTA ?4  
DONE??NO  
TITLE ?CHEM1  
DUPLICATE COURSE NAME  
SECTION ADDITION (Y OR N) ?N  
TITLE ?PHY1  
CREDITS ?4  
SECTIONS ?4

SECTION # ?1  
START TIME ?9  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?1  
INSTRUCTOR ?KING  
QUOTA ?4

SECTION # ?2  
START TIME ?9  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?2  
INSTRUCTOR ?FULLER  
QUOTA ?3

SECTION # ?3  
START TIME ?9  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?4  
INSTRUCTOR ?KING  
QUOTA ?4

SECTION # ?4  
START TIME ?1  
LENGTH ?4  
TIMES/WEEK ?1  
DAY 1 ?4  
INSTRUCTOR ?FOSTER  
QUOTA ?4  
DONE??NO  
TITLE ?PHYED1  
CREDITS ?3  
SECTIONS ?4

SECTION # ?1  
START TIME ?9  
LENGTH ?2  
TIMES/WEEK ?2  
DAY 1 ?2  
DAY 2 ?4  
INSTRUCTOR ?PARRISH  
QUOTA ?5

SECTION # ?2  
 START TIME ?9  
 LENGTH ?2  
 TIMES/WEEK ?2  
 DAY 1 ?1  
 DAY 2 ?3  
 INSTRUCTOR ?PEREIRA  
 QUOTA ?5

SECTION # ?3  
 START TIME ?2  
 LENGTH ?2  
 TIMES/WEEK ?2  
 DAY 1 ?4  
 DAY 2 ?5  
 INSTRUCTOR ?MEYER  
 QUOTA ?5

SECTION # ?4  
 START TIME ?1  
 LENGTH ?2  
 TIMES/WEEK ?2  
 DAY 1 ?1  
 DAY 2 ?2  
 INSTRUCTOR ?MACKENZIE  
 QUOTA ?5  
 DONE??YES

DONE

GET-AVAIL  
 RUN  
 AVAIL

PRINTS OUT LIST OF ENTERED COURSES

| COURSE | SEC | CRDS | INSTRUCTOR | TIME        |
|--------|-----|------|------------|-------------|
| ENG1   | 2   | 3    | SMITH      | 10-11MOWDFR |
| ENG1   | 1   | 3    | DRAPER     | 9-10MOTHFR  |
| ENG1   | 3   | 3    | BROWN      | 3-4MOWDFR   |
| HIST1  | 1   | 3    | WATTS      | 9-10MOWDFR  |
| HIST1  | 2   | 3    | WATTS      | 11-12MOWDFR |
| HIST1  | 3   | 3    | DRAPER     | 1-2MOTHFR   |
| HIST1  | 4   | 3    | MARK       | 4-5MOWDFR   |
| EC01   | 1   | 3    | HARRIS     | 10-11MOWDFR |
| EC01   | 2   | 3    | MARTIN     | 11-12MOTUFR |
| EC01   | 3   | 3    | HARRIS     | 3-4MOWDFR   |
| EC01   | 4   | 3    | BONNER     | 4-5TUWDFR   |
| BI01   | 1   | 4    | MC CLEAN   | 9-1TU       |
| BI01   | 2   | 4    | MARIN      | 9-1TH       |
| BI01   | 3   | 4    | KNOPP      | 1-5TH       |
| BI01   | 4   | 4    | MC CLEAN   | 1-5FR       |
| CHEM1  | 1   | 4    | TOTIE      | 9-1TU       |
| CHEM1  | 2   | 4    | MATHEWS    | 9-1TH       |
| CHEM1  | 3   | 4    | TOTIE      | 1-5WD       |
| PHY1   | 1   | 4    | KING       | 9-1MO       |
| PHY1   | 2   | 4    | FULLER     | 9-1TU       |
| PHY1   | 3   | 4    | KING       | 9-1TH       |
| PHY1   | 4   | 4    | FOSTER     | 1-5TH       |

|        |   |   |           |          |
|--------|---|---|-----------|----------|
| PHYED1 | 1 | 3 | PARRISH   | 9-11TUTH |
| PHYED1 | 2 | 3 | PEREIRA   | 9-11MOWD |
| PHYED1 | 3 | 3 | MEYER     | 2-4THFR  |
| PHYED1 | 4 | 3 | MACKENZIE | 1-3MOTU  |

DONE

GET-REG  
RUN  
REG

RESPOND WITH ANSWER OR END

STUDENT # ??229-56-5036

COURSE-SECTION  
?HIST1-3  
CREDITS ENTERED SOFAR= 3

REGISTRATION OF A STUDENT WHO HAD PREREGISTERED

COURSE-SECTION  
?ENG1-1  
CREDITS ENTERED SOFAR= 6

COURSE-SECTION  
?HIST-1  
COURSE OR SECTION NON EXISTENT

STUDENT PICKS COURSES FROM "AVAIL" PRINTOUT

COURSE-SECTION  
?HIST1-1  
ALREADY HAVE HIST1

COURSE-SECTION  
?EC01-1  
COURSE OR SECTION NON EXISTENT

COURSE-SECTION  
?EC01-1  
CREDITS ENTERED SOFAR= 9

COURSE-SECTION  
?CHEM1-3  
CREDITS ENTERED SOFAR= 13

COURSE-SECTION  
?PHYED1-2  
TIME CONFLICT WITH ENG1

COURSE-SECTION  
?PHYED1-1  
TIME CONFLICT WITH ENG1

COURSE-SECTION  
?PHYED1-4  
TIME CONFLICT WITH HIST1

COURSE-SECTION  
?PHYED1-3  
CREDITS ENTERED SOFAR= 16

COURSE-SECTION  
?END



229-56-5036 BANISCH JIM Z

STUDENT'S PROGRAM OF CLASSES

| COURSE | SEC | CRDS | INSTRUCTOR | TIME        |
|--------|-----|------|------------|-------------|
| HIST1  | 3   | 3    | DRAPER     | 1-2MOTHFR   |
| ENG1   | 1   | 3    | DRAPER     | 9-10MOTHFR  |
| EC01   | 1   | 3    | HARRIS     | 10-11MOWDFR |
| CHEM1  | 3   | 4    | TOTIE      | 1-5WD       |
| PHYED1 | 3   | 3    | MEYER      | 2-4THFR     |

TOTAL CREDITS= 16

STUDENT # ??END

DONE



GET-FILE  
 RUN  
 FILE

TITLE ?PHYED1  
 DUPLICATE COURSE NAME  
 SECTION ADDITION (Y OR N) ?Y  
 SECTION # ?8  
 START TIME ?1  
 LENGTH ?2  
 TIMES/WEEK ?2  
 DAY 1 ?3  
 DAY 2 ?4  
 INSTRUCTOR ?PIXLER  
 QUOTA ?2  
 DONE??YES

ADDS A NEW SECTION OF PHYS.ED. BECAUSE OF NEED  
 EVIDENT ON REGISTRATION DAY

DONE

GET-FILE  
 RUN  
 FILE

TITLE ?MATH1  
 CREDITS ?3  
 SECTIONS ?2

ENTERS A NEW COURSE WITH 2 SECTIONS

SECTION # ?1  
 START TIME ?9  
 LENGTH ?1  
 TIMES/WEEK ?3  
 DAY 1 ?1  
 DAY 2 ?3  
 DAY 3 ?4  
 INSTRUCTOR ?GOODMAN  
 QUOTA ?5

SECTION # ?2  
 START TIME ?11  
 LENGTH ?1  
 TIMES/WEEK ?3  
 DAY 1 ?1  
 DAY 2 ?3  
 DAY 3 ?5  
 INSTRUCTOR ?BLAIR  
 QUOTA ?5  
 DONE??YES

DONE

GET-SOFAR

RUN  
SOFAR

DURING REGISTRATION PROCESS WE CAN SEE THE ACTIVITY SO FAR

| COURSE | SEC | CRDS | INSTRUCTOR | QUOTA | SOFAR |
|--------|-----|------|------------|-------|-------|
| ENG1   | 2   | 3    | SMITH      | 5     | 0     |
| ENG1   | 1   | 3    | DRAPER     | 4     | 1     |
| ENG1   | 3   | 3    | BROWN      | 4     | 0     |
| HIST1  | 1   | 3    | WATTS      | 4     | 0     |
| HIST1  | 2   | 3    | WATTS      | 4     | 0     |
| HIST1  | 3   | 3    | DRAPER     | 3     | 1     |
| HIST1  | 4   | 3    | MARK       | 3     | 0     |
| EC01   | 1   | 3    | HARRIS     | 3     | 1     |
| EC01   | 2   | 3    | MARTIN     | 4     | 0     |
| EC01   | 3   | 3    | HARRIS     | 3     | 0     |
| EC01   | 4   | 3    | BONNER     | 4     | 0     |
| BI01   | 1   | 4    | MC CLEAN   | 4     | 0     |
| BI01   | 2   | 4    | MARIN      | 3     | 0     |
| BI01   | 3   | 4    | KNOPP      | 4     | 0     |
| BI01   | 4   | 4    | MC CLEAN   | 4     | 0     |
| CHEM1  | 1   | 4    | TOTIE      | 4     | 0     |
| CHEM1  | 2   | 4    | MATHEWS    | 3     | 0     |
| CHEM1  | 3   | 4    | TOTIE      | 4     | 1     |
| PHY1   | 1   | 4    | KING       | 4     | 0     |
| PHY1   | 2   | 4    | FULLER     | 3     | 0     |
| PHY1   | 3   | 4    | KING       | 4     | 0     |
| PHY1   | 4   | 4    | FOSTER     | 4     | 0     |
| PHYED1 | 1   | 3    | PARRISH    | 5     | 0     |
| PHYED1 | 2   | 3    | PEREIRA    | 5     | 0     |
| PHYED1 | 3   | 3    | MEYER      | 5     | 1     |
| PHYED1 | 4   | 3    | MACKENZIE  | 5     | 0     |
| PHYED1 | 8   | 3    | PIXLER     | 2     | 0     |
| MATH1  | 1   | 3    | GOODMAN    | 5     | 0     |
| MATH1  | 2   | 3    | BLAIR      | 5     | 0     |



TOTAL REGISTERED SOFAR = 5



NOTE NEW COURSES WE ADDED

DONE

NUMBER OF SEATS, NOT STUDENTS

GET-REG  
RUN  
REG

RESPOND WITH ANSWER OR END

STUDENT # ??111-22-3333  
LAST NAME??STAUBER  
FIRST NAME??LEE  
MIDDLE INITIAL??Z  
PHONE??345-6980  
SEX??M  
CITY??CA-  
STATE??CA-  
STREET ADDRESS??123 FORBES ST.

REGISTERS A STUDENT WHOSE NAME WAS NOT PREREGISTERED

COURSE-SECTION  
?MATH1-2  
CREDITS ENTERED SOFAR= 3

COURSE-SECTION  
?PHYED1-8  
CREDITS ENTERED SOFAR= 6

COURSE-SECTION  
 ?HIST1-3  
 TIME CONFLICT WITH PHYED1

COURSE-SECTION  
 ?ENG1-1  
 CREDITS ENTERED SOFAR= 9

COURSE-SECTION  
 ?END

111-22-3333 STAUBER LEE Z

| COURSE | SEC | CRDS | INSTRUCTOR | TIME        |
|--------|-----|------|------------|-------------|
| MATH1  | 2   | 3    | BLAIR      | 11-12MOWDFR |
| PHYED1 | 8   | 3    | PIXLER     | 1-3WDTH     |
| ENG1   | 1   | 3    | DRAPER     | 9-10MOTHFR  |

TOTAL CREDITS= 9

STUDENT # ??END

DONE

GET-CLASS  
 RUN  
 CLASS

AFTER REGISTRATION, 'CLASS' PROVIDES TEACHER WITH  
 ENROLLMENT IN HIS OWN CLASS

ALL, COURSE, OR COURSE-SECTION ?  
 ?ENG1-1

ENG1-1 CR= 3 9-10MOTHFR DRAPER COUNT= 2

| STUDENT #   | NAME          | MT | F |
|-------------|---------------|----|---|
| 229-56-5036 | BANISCH JIM Z |    |   |
| 111-22-3333 | STAUBER LEE Z |    |   |

DONE

GET-GRADE  
 RUN  
 GRADE

ENTER COURSE TITLE?ENG1  
 ENTER SECTION#?1  
 MID-TERM OR FINAL (M OR F)?M  
 ENTER MARK FOR JIM BANISCH?F  
 ENTER MARK FOR LEE STAUBER?A

THE TEACHER MAY ENTER GRADES FOR HIS CLASS

DONE

GET=CA=LASS  
RUN  
CLASS

ALL,COURSE, OR COURSE-SECTION ?  
?ENG1-1

RUN 'CLASS' AGAIN TO SHOW ENROLLMENT AND GRADES

ENG1-1 CR= 3      9-10MOTHFR DRAPER COUNT= 2

| STUDENT #   | NAME        | MT | F |
|-------------|-------------|----|---|
| 229-56-5036 | BANISCH JIM | Z  | F |
| 111-22-3333 | STAUBER LEE | Z  | A |

DONE

CONTRIBUTED PROGRAM **BASIC**

FREQ  
36341

**TITLE:**

FREQ: Bar Graphs of Grades

**DESCRIPTION:**

This program prints a frequency distribution (bar graphs) of grades, for a single test for one or more classes, or for several tests for one student.

**INSTRUCTIONS:**

Place grades in data lines 600-700.

**SPECIAL  
CONSIDERATIONS:**

Accepts up to 150 grades.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

```

600 DATA 25,30,35,40,45,50,55,60,65,70,75,80,85,90,95,100
601 DATA 35,40,45,50,55,60,65,70,75,80,85,90,95
602 DATA 50,55,60,65,70,75,80,85
603 DATA 90,55,70,60,65,70,75,80,85
604 DATA 60,75,65,70,80,85
605 DATA 65,70,75,80
606 DATA 65,70,75,80
607 DATA 70,75

```

RUN  
FREQ

GRADE FREQUENCY DISTRIBUTION (BAR GRAPH)

```

-----
GRADE          1   5   10  15  20  25  30
-----+-----+-----+-----+-----+-----+
0              I
5              I
10             I
15             I
20             I
25             IX
30             IX
35             IXX
40             IXX
45             IXX
50             IXXX
55             IXXXX
60             IXXXXX
65             IXXXXXXXX
70             IXXXXXXXXX
75             IXXXXXXXXX
80             IXXXXXXXXX
85             IXXXXX
90             IXXX
95             IXX
100            IX

```

DONE

CONTRIBUTED PROGRAM **BASIC**

GMARKS

36518

**TITLE:**

GSB GRADING AND EDITING PROGRAM

**DESCRIPTION:**

GMARKS is a grading program which allows the user to enter up to 20 grades per student for a quarter, weight these grades, and compute the final quarter grade. The program conforms to the H+,P+,P,P- and U grading system adopted by the faculty of Stanford University in the Spring of 1971. At the completion of the program a table of the frequencies for each grade is printed and the user is given the option of scaling his grades by one of two methods. The program can be used iteratively until the distribution of grades is satisfactory, and the final grades and distribution can be printed.

Because it is possible that typing errors will occur while grades are entered into the grading program GMARKS, the companion program GMEDIT can be used to edit the file containing all of the grades for a class.

**INSTRUCTIONS:**

In order to use this program, each user must open a file called GRADES. The format should be as follows:

OPEN-GRADES,n      where n is the size of the file.

To determine the file size use the following formula:

$$\text{Integer } \frac{(\text{number of grades} \times \text{number of students}) + 1}{128}$$

The program first requests the user to enter the number of grades per student. This number must be less than or equal to 20. Next, the user is asked to enter the raw weights for each grade. For example, if there are four grades and the user enters weights of 2, 4, 1 and 1, the program will calculate percentage weights of .25, .50, .125 and .125 respectively as the factor to be multiplied by each grade to arrive at a weighted average for each student.

(continued on Page 2)

**ACKNOWLEDGEMENTS:**

Graduate School of Business  
Stanford University

INSTRUCTIONS: (continued)

The user is offered the option to read a set of grades stored on the disk during an earlier session with the program. This allows grades to be saved, modified and recalculated if desired. (Even though the program offers the option to enter either letter or numeric grades, letter grades are converted to their numeric equivalents and only numeric grades are stored on the disk.)

Next the user is asked whether he is entering letter grades or numeric equivalents. If letter grades are entered the various grades correspond to points as follows:

|    |      |
|----|------|
| H  | 1.0  |
| P+ | .5   |
| P  | 0    |
| P- | -.3  |
| U  | -1.0 |

The user is offered the option to see each calculated average as it is computed. This should probably be done for the original entry of the grades. If the user is computing grades which have already been entered on the disk, the program will proceed with execution. If the user is entering the grades for the first time, then he will be requested to enter each student number followed by a carriage return. A student number 999 indicates that all grades have been entered. After the student number has been checked and accepted by the program, the grades are entered on the next line separated by commas. The student numbers must be in sequence beginning with 1. To have a missing grade dropped from the computation and the weights rescaled, a 9 should be entered for numeric grades or a Z for letter grades.

There are several possible errors which may occur during the entry of grades. If an error is noted while the line is being typed, the use of the escape key will enable the user to reenter that line. If errors in grades are noted after all of the grades have been entered, another program, GMEDIT, can be used to update or correct the grades which have been saved on the disk. If the program detects an error in student numbers it will not continue until the correct student number has been entered. It is also possible, particularly with letter grades, that an incorrect grade will be entered. This will most likely result from an error in typing or from the omission of a comma. If such a condition is detected the program will ask for the line to be reentered. The same is true if an insufficient number of grades is entered.

At the completion of computing all of the grades the program will print out a table showing for each grade the absolute number in the class who received it, the percentage who received it, the cumulative percentage receiving that high a grade or higher and the percentage of students receiving each letter grade H, P and U.

At this point the user is given the option to scale the grades using two methods. First, he may add a positive or negative constant to each grade. Second, he may enter new break points from which the averages are calculated. The original break points are shown in the following table.

|       | <u>Average Between</u> | <u>Grade</u> |
|-------|------------------------|--------------|
|       | .75                    | H            |
| .749  | .25                    | P+           |
| .249  | -.15                   | P            |
| -.151 | -.65                   | P-           |
| -.651 | -1.0                   | U            |

The numbers in the second column of the table above are used as the original break points for grades. For example, if a student has an average of .75 or above he receives an H. If he has a .25 or above, but less than .75 he receives a P+ and so on. Thus, by manipulating the break points it is possible to radically change the distribution of grades.

An easy method to experimentally alter the distribution is to enter new break points and run the program again without exercising the option to list each student. This will result in all of the grades being calculated and only a new table of grade distributions being printed. This new table can be examined and the process continued iteratively. When the user is satisfied with the distribution, he should enter a scaling factor of 0 and have each student's grade listed. On this final grading run all students and their grades, the frequency table and the break points are printed.

Finally to terminate the program a scaling factor of 99 is entered.



INSTRUCTIONS: (continued)

If errors in grades have been entered, GMEDIT may be used to update or correct the grades as follows.

The program first asks the user to enter the number of grades for each student. This number should be the same as that originally used to place the grades on the file. Next, the student numbers to be modified should be entered in sequence from low to high. That is, if student numbers 2, 4 and 8 require changes in their grades, they should be entered in that order. To complete this stage of the program a student number of 999 should be entered.

After each student number is entered, his old grades will be printed and the user will be requested to enter a grade number and a change. For example, if a student had grades of -.2, 1.0, .3 and -.5 and it was desired to change the 1 to a .5 the user should type

2,.5

When all of the modifications for this student have been completed, the user should enter a 99,0 to signify the completion of the changes.

It is possible in this process that a student number will be entered in the wrong order. The program will indicate the offending student number and print the present place in the file. If a correction is inadvertently omitted, the editing run should continue and a separate run can be made later to correct the omission.

At the end of correcting existing grades, that is, when a student number of 999 has been entered, new students may be added. At the completion of entering grades for each new student, the user is asked if another student is to be added to the file. If the answer is yes, the program prints the student number which has been assigned to the new student and requests that the grades be entered. All of the grades are entered on one line. If no further students are to be added, then the program is finished.

In order to run the program, type the following:

CRE-SCRTCH,n where n is the same number used in creating the file GRADES  
(or larger to compensate for new students)

At the end of the program

PUR-SCRTCH

**RUN**

RUN  
GMARKS

GSB GRADING PROGRAM. PLEASE ANSWER ALL QUESTIONS Y FOR YES, N FOR NO. ALWAYS USE A CARRIAGE RETURN AFTER ENTERING DATA. USE ESC KEY FOR ERROR. DO YOU WANT INSTRUCTIONS?  
?Y

THE PROGRAM ACCEPTS THE NUMBER OF GRADES FOR THE STUDENTS AND WEIGHTS TO BE MULTIPLIED BY EACH GRADE. THEN EACH STUDENT NUMBER IS ENTERED IN ORDER FOLLOWED BY HIS GRADES ON EACH ASSIGNMENT (EITHER NUMERICAL OR LETTER GRADES). IF LETTER GRADES ARE USED, H IS A +1 AND U A -1. A STUDENT NUMBER OF 999 ENDS THE INPUT. THE GRADES ARE SAVED AND THE PROGRAM CAN READ THEM FROM A PRIOR ENTRY RUN. A DISTRIBUTION IS PRINTED AND GRADES MAY BE SCALED BY ADDING A CONSTANT OR ENTERING NEW BREAKPOINTS.

HOW MANY GRADES ARE THERE (20 MAX).?

?4

WHAT ARE THE RAW WEIGHTS FOR EACH GRADE?

?2,2,4,2

NORMALIZED WEIGHTS ARE:

.2 .2 .4 .2

DO YOU WANT TO READ OLD GRADES FROM DISK?

?N

ARE YOU ENTERING LETTER GRADES?

?N

DO YOU WANT TO SEE EACH GRADE?

?Y

ENTER EACH STUDENT NO. FOLLOWED BY CR. NO=999 FOR LAST STUDENT. ENTER GRADES ON NEXT LINE SEPARATED BY COMMAS, FOLLOWED BY CR FOR MISSING GRADE, ENTER 9, GRADE IGNORED & WEIGHTS RECALCULATED

?1

?0,5,1,2

STN 1 .545 P+

?2

?-1,0,-.2,-.3

STN 2 -.335 P-

?3

?1,1,1,1

STN 3 1.005 H

?4

?-1,-1,-1,-1

STN 4 -.995 U

?5

?0,0,0,0

STN 5 .005 P

?6

?1,1,1,1,1

STN 6 .285 P+

?7

?4,-.5,9,-1

STN 7 -.361667 P-

?8

?0,-.2,-.1,.3

STN 8 -.015 P

?9

?-1,.3,0,9

STN 9 -.17 P-

?10

?2,.2,-.1,-.3

STN 10 -.015 P

?9999

ERROR IN STUDENT NUMBERS: 11 9999

?999

| GRADE | NO | %  | CUM% | %LETTER |
|-------|----|----|------|---------|
| H     | 1  | 10 | 10   | 10      |
| P+    | 2  | 20 | 30   |         |
| P     | 3  | 30 | 60   |         |
| P-    | 3  | 30 | 90   | 80      |
| U     | 1  | 10 | 100  | 10      |

IF YOU WANT TO SCALE GRADES, ENTER SCALING FACTOR. FOR  
NEW BREAKPOINTS ENTER 9, TO STOP ENTER 99. SCALING BEGINS  
AT ORIGINAL GRADES EACH TIME.

?9

ENTER NEW BREAKPOINTS.

H

? .56

P+

? .33

P

? -.1

P-

? -.4

U

? -.2

DO YOU WANT TO SEE EACH GRADE?

?N

| GRADE | NO | %  | CUM% | %LETTER |
|-------|----|----|------|---------|
| H     | 4  | 40 | 40   | 40      |
| P+    | 1  | 10 | 50   |         |
| P     | 4  | 40 | 90   |         |
| P-    | 1  | 10 | 100  | 60      |
| U     | 0  | 0  | 100  | 0       |

IF YOU WANT TO SCALE GRADES, ENTER SCALING FACTOR. FOR  
NEW BREAKPOINTS ENTER 9, TO STOP ENTER 99. SCALING BEGINS  
AT ORIGINAL GRADES EACH TIME.

?0

DO YOU WANT TO SEE EACH GRADE?

?Y

|        |          |    |
|--------|----------|----|
| STN 1  | .545     | P+ |
| STN 2  | -.335    | H  |
| STN 3  | 1.005    | H  |
| STN 4  | -.995    | H  |
| STN 5  | .005     | P  |
| STN 6  | .285     | P  |
| STN 7  | -.361667 | H  |
| STN 8  | -.015    | P  |
| STN 9  | -.17     | P- |
| STN 10 | -.015    | P  |

| GRADE | NO | %  | CUM% | %LETTER |
|-------|----|----|------|---------|
| H     | 4  | 40 | 40   | 40      |
| P+    | 1  | 10 | 50   |         |
| P     | 4  | 40 | 90   |         |
| P-    | 1  | 10 | 100  | 60      |
| U     | 0  | 0  | 100  | 0       |

IF YOU WANT TO SCALE GRADES, ENTER SCALING FACTOR. FOR  
NEW BREAKPOINTS ENTER 9, TO STOP ENTER 99. SCALING BEGINS  
AT ORIGINAL GRADES EACH TIME.

?99

BREAKPOINTS USED FOR GRADING:

H .56

P+ .33

P -.1

P--.4

U -.2

DONE

RUN  
GMEDIT

GSB EDIT PROGRAM FOR GRADING DATA.OPEN FILE SCRTCH AND KILL AT END.  
EACH STUDENT NO. MUST BE ENTERED IN SEQUENCE FROM LOWEST TO HIGHEST.  
SPECIFY EACH STUDENT NO. TO BE CHANGED AS REQUESTED. THEN ENTER  
GRADE NO AND CORRECT GRADE. WHEN DONE FOR THIS STUDENT ENTER  
GRADE NO OF 99 AND GRADE OF 0. ENTER STN NO OF 999 WHEN DONE  
MODIFYING. YOU CAN THEN ADD NEW STUDENTS AT THE END.  
ENTER NUMBER OF GRADES

?4  
ENTER FIRST STUDENT NO TO BE CHANGED. ENTER 999 WHEN NO MORE CHANGES.  
?3

OLD GRADES:  
1 1 1 1  
ENTER EACH GRADE NO. & CHANGE SEPARATED BY , (ONE PAIR/LINE).  
?2,0  
?4,-1  
?99,0  
NEXT STN NO.

?6  
OLD GRADES:  
.1 .1 .1 1  
GRADE,CHANGE  
?2,-.5  
?4,-.3  
?99,0  
NEXT STN NO.

?999  
DO YOU WANT TO ADD ANY STUDENTS?  
?Y

ENTER 4 GRADES FOR STUDENT 11  
?.5,.6,-.1,9  
ANOTHER STUDENT (Y OR N)?  
?Y

ENTER 4 GRADES FOR STUDENT 12  
?-1,.3,.6,0  
ANOTHER STUDENT (Y OR N)?  
?N

GRADES UPDATED. KILL FILE SCRTCH.

DONE

EDUCATIONAL ADMINISTRATION (885)  
CONTRIBUTED PROGRAM **BASIC**

GPAC  
36636

**TITLE:**

GRADE PACKAGE

**DESCRIPTION:**

GPAC is a system of 12 programs written for an HP 2000E system to store and handle accumulative records of points given throughout a normal term's work. In addition, several options are available to combine, manipulate, and display the data in one of several convenient formats. To the user GPAC appears to be one large program with two entry points, one for initialization and the other for subsequent use of the package.

**INSTRUCTIONS:**

The user has the option of selecting the number of bins to be used, their headings, the method by which the raw totals are combined to produce a "score" for the student, and the various weights to be used in combining the raw totals. These parameters may be modified at will by the user.

The possible options that are available to the user, besides the modification options, are those that allow: entering new information into the accumulative arrays, listing by class student number, sorting on any bin or the combined score and listing in descending order, producing a teletype histogram of any bin or the combined score, computing the z-score or t-score of any bin or the score, or producing a short summary for each student so that each can know his precise standing in the class at any time.

**GENERAL CONSIDERATIONS**

GPAC is adaptable for a class with up to 140 students. These may be assigned any arbitrary positive integers as class student numbers. A further constraint is that there is a maximum range of 140 in the student numbers. If a student drops, his student number may be deleted and thereafter that student number is ignored. Thus it is possible to generate a range greater than the maximum even with a class of considerably less. It is suggested that this range be chosen in the interval 1 to 999.

continued on following page.

**SPECIAL  
CONSIDERATIONS:**

The following general constraints hold for GPAC: up to six separate "bins" for storing the accumulative raw totals and a maximum of 140 students in the class. GPAC has been used to help grading procedures for several different classes in at least five different departments at Pacific Union College. Not only is the teacher's time reduced at the end of the term, but the students are able to see their progress on a regular basis throughout the term. While it is possible for a teacher to prepare listings and histograms at regular intervals, the process is time consuming. GPAC was written to make it possible for such displays to be prepared without increasing the teacher's time.

In addition to regular class grades, GPAC has also been used to accumulate the user's time usage of the terminals. This information is accumulated at the end of each month, listed, sorted, and histograms made.

**ACKNOWLEDGEMENTS:**

Lawrence E. Turner, Jr.  
Pacific Union College

## INSTRUCTIONS continued

It should be noted that for listings and sorts, close to the entire line of 72 characters is printed. This takes about seven seconds to print on a teletype terminal, hence a class of 100 would take about twelve minutes to produce a listing on the teletype.

Up to six bins are allowed to accumulated separate totals. These may be entitled by any heading of less than six characters. The user is cautioned that these may be any combination except: HELP, SCORE, RETURN, DUMP. These four are used for special system keys.

Once the user has decided upon what quantities are to be accumulated, the next consideration is how these are to be combined to produce the student's "score". There are two possible methods. In both methods the score is essentially a weighted percentage of the total possible.

The first method (mode = 1) is called constant weights and  $S_n$ , the score for the  $n$ th student, is given by:

$$S_n = \left[ \frac{T_{1n}W_1 + T_{2n}W_2 + \dots}{T_{1N}W_1 + T_{2N}W_2 + \dots} \right] \times 100$$

$$= F \sum_{k=1}^b T_{kn}W_k$$

where  $T_{kn}$  is the accumulated raw score of the  $k$ th bin for student number  $n$ ,  $T_{kN}$  is the total possible for  $k$ th bin,  $W_k$  is a constant weight set by the user,  $b$  is the number of bins, and  $F$  is a normalizing factor which is the same for all students and is such that if a student did perfectly, that is, earned the maximum possible points, his score  $S_n$  would be 100.0.

The second method (mode = 2) is termed constant proportionality factors. Here  $S_n$  is given by:

$$S_n = \left[ \frac{T_{1n}}{T_{1N}} P_1 + \frac{T_{2n}}{T_{2N}} P_2 + \dots \right] \times \frac{100}{P_1 + P_2 + \dots}$$

$$= F \sum_{k=1}^b T_{kn} P_k T_{kN}^{-1}; \quad \text{all } k, T_{kN} \neq 0$$

where  $P_k$  is the constant proportionality factor set by the user. The sum is only over those bins with a non-zero  $T_{kN}$ . Note that  $F$  has same function as used for constant weights but in general will have a different numerical value. In both cases

$$0.0 \leq S_n \leq 100.00$$

The choice of these two modes of operation depends on how the user usually computes grades.

The first method, constant weights, is useful when the user has decided previously on the total possible points available for each item. Consider the example of two exams where the first is to count equally with the second. This can easily be achieved by making the same total possible on each test and the weights equal, or alternately by deciding beforehand what the total possible will be and then adjusting the weights so that the product  $T_{kn}W_k$  is the same for both.

The second method, constant proportionality factors, may be used if the total possible is unknown a priori. Here each bin is weighted relative to the total possible for that bin. Thus, in the example above, merely by selecting the  $P_k$ 's to be equal, each test would count equally regardless of the total possible on the individual tests.

The constant proportionality factors will give the same result at the end of the term as does the constants weights in the case where the user has previously determined the total possible. They may differ at intermediate times since points are not accumulated continuously at the same rate but in rather large discreet amounts.

## INSTRUCTIONS continued

Thus in the case where the user has carefully planned the course and knows the total possible for each category at the beginning, he has the option of either method. At the end of the term the results will be identical. However, for the teacher who does not know just how many points will be possible, it is best to use the second method of constant proportionality factors.

For both these cases the actual values of  $W_k$  or  $P_k$  are unimportant. Only the relative values are involved. It should be possible to find a set of integers that have the proper relative values. Thus, these are to be selected from the set of positive integers.

For simplification the accumulative points are also carried as integers. If the user is accustomed to using fractional points, it is quite easy to multiply each point by a simple factor, and correspondingly reduce the weight or proportionality factor by the same amount.

## INITIALIZATION

The user must have access to a terminal and a user ID and password. He must also have disc storage of 14 sectors. For each different class there must be a different user library, that is, a different ID and password. Alternately the user must declare auxiliary files and transfer information from them before using GPAC and transfer the information back at the end of a session.

GPAC should be made available from the system library. Assuming the user has previously determined what raw points to store, how he wants to combine them assigned student numbers, and has completed other advanced planning, the procedure to initialize GPAC is as follows.

1. Open the disc storage file.

```
OPEN-CLSFIL,14
```

2. GET and RUN GPACI

GPACI, initialization portion of GPAC, will execute and will ask for various items:

CLASS TITLE: This can be any alphanumeric string up to 30 characters long, and will be used as a label for all subsequent output.

NUMBER OF BINS: Up to six bins are allowed.

HEADING: One for each bin, up to 6 characters each. These will be used to identify the bins from this point on. Embedded blanks are significant, trailing blanks are not. The headings must obviously be unique, and they must not be one of the following: HELP, SCORE, RETURN, or DUMP.

MODE: M = 1, constant weights.  
M = 2, constant proportionality factors.

FACTORS: One for each bin, either constant weights or constant proportionality factors depending on mode selected previously. They must be integers.

MINIMUM S.N.: This is an integer greater than zero, and allows numbering the students in a class consecutively from a number other than 1; as an example, numbering a class with integers 101 thru 190.

LARGEST S.N.: Again this is an integer which corresponds to the largest S.N. used. Note that it is possible to add students with higher S.N. than this. This may be done later in the MODIFICATION section. For all student numbers within this range from minimum to largest and all useable bins, a zero will be placed. If there are gaps in the student number range, i.e., students which have dropped, these can be deleted in the MODIFICATION section.

A GPAC STATUS CHECK follows, giving the class parameters. The program automatically chains to the COMMAND section. It is at this point that any further modifications may be made.

## GPAC MAIN PROGRAM

The initialization sequence is to be used only once. Thereafter, the user accesses and RUNS the main program, GPAC, which will retrieve the necessary data from the disc and chain to the COMMAND section.

## COMMAND SECTION

All branches are determined here and eventually return to this section.

Upon printing COMMAND ? the computer requests an alphanumeric response, to determine what action to take. Typing HELP will obtain a listing and a brief explanation of the possible choices available. STOP results in a controlled exit from GPAC. For any COMMAND, typing the first three characters will result in the correct branch.

## INSTRUCTIONS continued

The list of possible commands is:

CHEck  
HELp  
HISto  
LISt  
MODify  
OUT  
SORT  
STAT  
STOp  
UPDate

## STATUS CHECK SECTION

Entry command: CHEck

This section gives a display of the class parameters. It is accessed automatically after INITIALIZATION or upon return from the MODIFICATION section. It may be directly accessed from COMMAND by the above response. After execution it returns automatically to the COMMAND section.

## HISTOGRAM SECTION

Entry command: HISto

This section produces a teletype histogram of any of the used bins or the SCORE. The request KEY ? selects the appropriate bin or the score. The entire heading must be used. The response of HELP will produce a listing of acceptable keys. The response RETURN causes the program to return to the COMMAND section.

The limits of the histogram are entered as three numbers separated by commas for the lower limit, the upper limit, and the interval size respectively.

The histogram produced gives the class title, the date that the disc file was last changed, and the heading of the bin being produced. The TOTAL number is the actual number plotted in the histogram. Hyphens are printed at the top and bottom for those histograms less than one page in length. These are located 11 inches apart for convenient separation into page size.

If a particular datum is equal to the limit of an interval, it is included in the lower interval, that is the interval contains all those points that are described by:

$$L < T_{kn} \leq U$$

where L and U are the lower and upper limits of the interval respectively.

## LIST SECTION

Entry command: LISt

This section produces a teletype listing of the accumulated raw points and the SCORE for each student. The listing is in order of increasing student numbers. Any inactive student numbers, that is, student numbers that have been previously deleted in the MODIFICATION section, are ignored.

The total possible for each bin is given, along with the mean and the standard deviation for each bin and the SCORE.

Hyphens separate the output into page size sheets. The class title and the date the files were last changed are also given.

The program automatically returns to the COMMAND section.

## MODIFICATION SECTION

Entry command: MODify

There are times when one wishes to change certain class parameters or add or delete a student. This is done in the MODIFICATION section.

The process is controlled by the MOD OPTION. A response of HELP produces a listing of the options. The possible options are:

ADD  
DELeTe  
HELp  
PARAm  
RETurn



## INSTRUCTIONS continued

ADD and DELETE add and drop a student respectively. In the case of a drop, that student number is ignored in all subsequent output. Checks are made to insure that only allowed drops and adds are processed.

The PARAM option allows modification of the class parameters originally entered in the INITIALIZATION program. The choice of which class parameter to be modified is selected by the ITEM ? request. The ITEMS that may be modified are:

FACTor  
HELp  
KILL  
MODE  
NAME  
NEW  
RETurn  
SWITch  
TITLe

HELP obtains a listing of items. RETURN, both for the MOD OPTION and the ITEM requests, produces a branch to the COMMAND section.

FACTOR, MODE, NAME, and TITLE provide changing the proportionality or weights (depending on the mode), the mode, the headings of the bins, or the class title respectively.

NEW allows adding a bin, if less than 6 are presently in use. SWITCH allows two bins to be interchanged so that the left to right order as printed in lists or sorts is altered. The contents of the bins are left unchanged.

KILL provides for removal of unwanted bins. If the bin is empty, that is, if the total possible for that bin is zero, the bin is removed without further consideration. If the total possible is non-zero, the disposition of the contents is requested. This may be any other bin. In this case, the contents of the bin to be removed is simply added to the other bin directly, then the first bin is removed. Or if the contents are unwanted a disposition of DUMP results in the bin immediately being deleted. A disposition to the same bin will result in no action and return to the ITEM request.

Note that to obtain histograms, z-scores, etc., for a given set of points in the case that normally they are carried as a total, for example, if all exams are added together in one bin, but it is desired to obtain a histogram separately for the one just entered, a possible procedure is to add a temporary bin, enter the information into it, display it at will, then KILL that bin with a destination of the bin holding the totals.

The disc is automatically updated upon exit from this section.

## OUT SECTION

Entry command: OUT

In order to allow the individual student to know his total points and class standing, a short summary may be provided by the OUT section. These are printed with hyphens between so that they may be separated conveniently and given to the students.

The program requests the minimum and maximum student numbers for which a summary is desired. Inactive student numbers are ignored, and return to COMMAND is automatic.

The user should note that it takes of the order of 45 seconds to produce each student's summary, hence for a class of 100 it would take approximately 1 hour.

In combination with a posted histogram of the SCORE, the student could very nicely determine his class standing. This way a student would only know what his particular totals and SCORE was.

Another method would be to post a listing of the totals and the SCORE. Here, of course, a student could know how another specific student was doing by knowing his student number.

## SORT SECTION

Entry command: SORT

This section produces a listing of the accumulated points and the SCORE for each student. The listing is in order of descending values for any KEY. These are any bin or the SCORE. The response HELP produces a listing of possible keys. The response RETURN causes the program to return to COMMAND.

The bin that is being sorted on is underlined. The total possible, the mean, and the standard deviation for each bin and the score are also printed. Inactivated student numbers are ignored.

Hyphens separate the output into page size sheets.

INSTRUCTIONS continued

### STAT SORT SECTION

Entry command: STAT

This section sorts and produces a sorted listing of any bin or the SCORE. The possible options are:

- HELp
- RETurn
- SCAlE
- STAndard

HELP and RETURN produce a listing of the options, and return to the COMMAND section respectively.

The response of STANDARD prints an ordinary z-score. For t-scores one may use the option: SCALE. The base (i.e., the value which the mean will take) and the scaling factor are requested. The program also requests if letter grades are desired. If so, the t-score criteria for grade assignments are also requested.

Note that the z-scores numerically are t-scores with a base of zero and a scaling factor of one.

The total possible, mean, and standard deviation for the bin are also printed. Inactivated student numbers are ignored.

Hyphens separate the output into page size sheets.

### UPDATE SECTION

Entry command: UPDate

The UPDATE section allows the user to enter new information. Control within this section is determined by OPTIONS. A list is as follows:

- HELp
- INCRe
- RETurn
- SINGle

As previously used, HELP produces a listing of options and RETURN chains back to the COMMAND section. Only the first three characters of the options need to be entered.

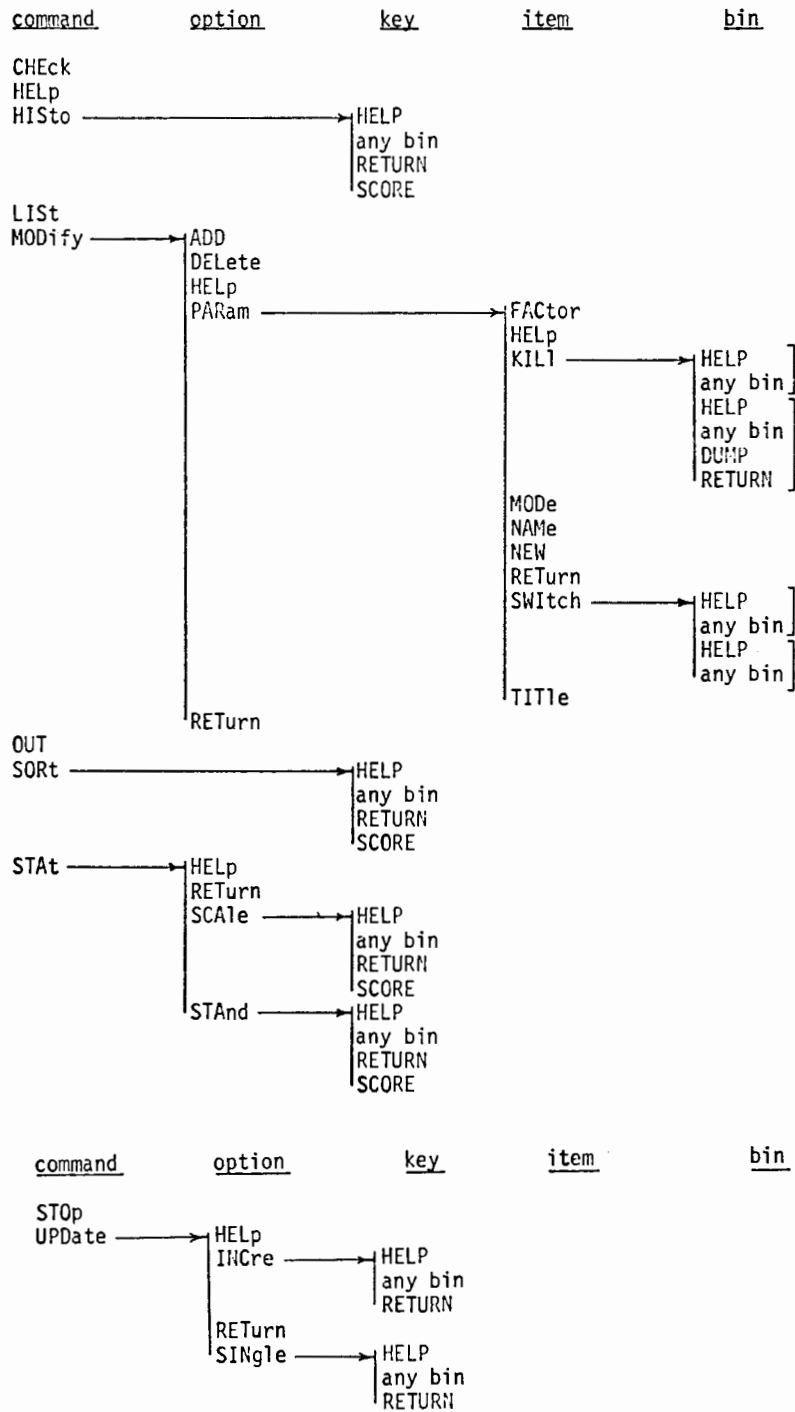
The INCREMENT option allows automatic incrementing through the range of active student numbers, hence the user need only enter the individual item after each request. The TOTAL is the total possible and is entered as the last datum. The bin is selected by the KEY request. Both keys of SCORE and RETURN result in branching to the OPTION request.

The SINGLE option allows entering a certain datum into a given student array. A student number of -1 will return to the OPTION request. The total possible,  $T_{KN}$ , is defined to be student number zero. Note that the entry is added directly to the student's raw total. Hence, if points need to be subtracted, enter a negative number. The bin is selected by the KEY request and the raw totals are printed before and after the datum is entered. Thus the SINGLE option may be used to correct an error made in previous updates.

It is important to note that during execution of the UPDATE section the new information is only entered into the arrays in core. It is not until the return to the COMMAND section that the disc is updated. Hence stopping the program during execution of this section before a RETURN, may result in the loss of the new information. It may be possible to recover just by typing RUN (return) but any other teletype entry may destroy the information in the arrays. If in doubt, restart the package from GPAC MAIN PROGRAM and reenter the new data.

INSTRUCTIONS continued

SUMMARY OF GPAC CONTROL



RUN

RUN  
GPAC I

GPAC-INITIALIZATION

ENTER CLASS TITLE ?ELEMENTARY GPAC

ENTER NUMBER OF BINS DESIRED, (MAX OF 6) ?2

FOR EACH BIN ENTER HEADING, (MAX OF 6 CHAR).

BIN 1           ?HW  
BIN 2           ?TEST1

MODE OPTIONS:   CONSTANT WEIGHTS           (M = 1),  
                  CONSTANT PROP. FACTORS (M = 2).

ENTER MODE:   M = ?2

ENTER PROPORTIONALITY FACTORS

HW            ?20  
TEST1         ?15

ENTER:   MINIMUM STUDENT NUMBER ?101  
ENTER:   LARGEST STUDENT NUMBER ?124

-

GPAC STATUS CHECK

27 MAY 73

TITLE:   ELEMENTARY GPAC

NUMBER OF BINS IN USE:   2

HEADINGS:                HW                TEST1

P FACTORS:               20               15  
POSSIBLE:                0                0

STUDENT NUMBER BASE:   100  
LARGEST STUDENT NUMBER: 124  
NUMBER OF STUDENTS IN CLASS: 24

DATE FILES LAST UPDATED: 27 MAY 73

COMMAND ?HELP

GPAC CONTROL COMMANDS

CHECK:   PRINT OUT CLASS PARAMETERS AND OTHER CLASS INFORMATION.  
HELP:    OBTAIN A LISTING OF ALL COMMANDS.  
HISTO:   MAKE A TTY HISTOGRAM OF ANY USEABLE BIN OR THE SCORE.  
LIST:    LIST THE STUDENT'S RAW TOTAL BY S.N.  
MODIFY:   CHANGE THE USEABLE BINS AND OTHER CLASS PARAMETERS.  
OUT:     OBTAIN A SHORT INDIVIDUAL SUMMARY GIVING THE RAW TOTALS  
          AND THE TOTAL POSSIBLE FOR EACH STUDENT.  
SORT:    SORT AND LIST IN DECREASING ORDER ALL RAW TOTALS AND  
          THE SCORE, THE KEY FOR THE SORT MAY BE ANY USEABLE BIN.  
STAT:    COMPUTES THE Z-SCORE AND SORTS FOR ANY USEABLE BIN OR THE  
          SCORE.  
STOP:    PERFORMS A NORMAL EXIT FROM GPAC.  
UPDATE:  ALLOWS ENTERING OF NEW DATA INTO THE ARRAYS.

COMMAND ?MOD

MODIFICATION SECTION

MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?108  
STUDENT NUMBER 108 IS DELETED

MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?82  
OUT OF RANGE, MIN = 101 MAX = 124 I = 82

MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?109  
STUDENT NUMBER 109 IS DELETED

MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?117  
STUDENT NUMBER 117 IS DELETED

MOD OPTION ?122

INVALID OPTION

ADD:     ACTIVATE A STUDENT  
DELETE:  INACTIVATE A STUDENT  
HELP:    OBTAIN A LISTING OF OPTIONS  
PARAM:   MODIFY THE CLASS PARAMETERS  
RETURN:  RETURN TO COMMAND

MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?122  
STUDENT NUMBER 122 IS DELETED

MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?107  
STUDENT NUMBER 107 IS DELETED

MOD OPTION ?RET

COMMAND ?UPD

UPD OPTION ?INC

KEY ?HW

| S.N.  | HW  |
|-------|-----|
| 101   | ?37 |
| 102   | ?21 |
| 103   | ?28 |
| 104   | ?38 |
| 105   | ?43 |
| 106   | ?49 |
| 110   | ?41 |
| 111   | ?25 |
| 112   | ?33 |
| 113   | ?31 |
| 114   | ?41 |
| 115   | ?0  |
| 116   | ?29 |
| 118   | ?38 |
| 119   | ?46 |
| 120   | ?42 |
| 121   | ?37 |
| 123   | ?45 |
| 124   | ?40 |
| TOTAL | ?50 |



KEY ?TEST1

| S.N.  | TEST1 |
|-------|-------|
| 101   | ?86   |
| 102   | ?96   |
| 103   | ?103  |
| 104   | ?73   |
| 105   | ?87   |
| 106   | ?100  |
| 110   | ?98   |
| 111   | ?85   |
| 112   | ?75   |
| 113   | ?49   |
| 114   | ?85   |
| 115   | ?62   |
| 116   | ?91   |
| 118   | ?101  |
| 119   | ?93   |
| 120   | ?86   |
| 121   | ?79   |
| 123   | ?78   |
| 124   | ?83   |
| TOTAL | ?110  |

KEY ?RET

INVALID KEY, POSSIBLE KEYS ARE:  
 HELP HW TEST1 SCORE RETURN

KEY ?RETURN

UPD OPTION ?RET

COMMAND ?LIS

ELEMENTARY GPAC 27 MAY 73

| S.N.      | HW   | TEST1 | SCORE |
|-----------|------|-------|-------|
| 101       | 37   | 86    | 75.8  |
| 102       | 21   | 96    | 61.4  |
| 103       | 28   | 103   | 72.1  |
| 104       | 38   | 73    | 71.9  |
| 105       | 43   | 87    | 83.0  |
| 106       | 49   | 100   | 95.0  |
| 110       | 41   | 98    | 85.0  |
| 111       | 25   | 85    | 61.7  |
| 112       | 33   | 75    | 66.9  |
| 113       | 31   | 49    | 54.5  |
| 114       | 41   | 85    | 80.0  |
| 115       | 0    | 62    | 24.2  |
| 116       | 29   | 91    | 68.6  |
| 118       | 38   | 101   | 82.8  |
| 119       | 46   | 93    | 88.8  |
| 120       | 42   | 86    | 81.5  |
| 121       | 37   | 79    | 73.1  |
| 123       | 45   | 78    | 81.8  |
| 124       | 40   | 83    | 78.1  |
| POSSIBLE  | 50   | 110   |       |
| AVERAGE   | 34.9 | 84.7  | 73.0  |
| DEVIATION | 11.3 | 13.7  | 15.6  |

COMMAND ?SORT

## SORT SECTION

KEY ?HW

-

## ELEMENTARY GPAC

27 MAY 73

|  | S.N.      | HW<br>---- | TEST1 | SCORE |      |
|--|-----------|------------|-------|-------|------|
|  | 1         | 106        | 49    | 100   | 95.0 |
|  | 2         | 119        | 46    | 93    | 88.8 |
|  | 3         | 123        | 45    | 78    | 81.8 |
|  | 4         | 105        | 43    | 87    | 83.0 |
|  | 5         | 120        | 42    | 86    | 81.5 |
|  | 6         | 110        | 41    | 98    | 85.0 |
|  | 7         | 114        | 41    | 85    | 80.0 |
|  | 8         | 124        | 40    | 83    | 78.1 |
|  | 9         | 104        | 38    | 73    | 71.9 |
|  | 10        | 118        | 38    | 101   | 82.8 |
|  | 11        | 101        | 37    | 86    | 75.8 |
|  | 12        | 121        | 37    | 79    | 73.1 |
|  | 13        | 112        | 33    | 75    | 66.9 |
|  | 14        | 113        | 31    | 49    | 54.5 |
|  | 15        | 116        | 29    | 91    | 68.6 |
|  | 16        | 103        | 28    | 103   | 72.1 |
|  | 17        | 111        | 25    | 85    | 61.7 |
|  | 18        | 102        | 21    | 96    | 61.4 |
|  | 19        | 115        | 0     | 62    | 24.2 |
|  | POSSIBLE  | 50         | 110   |       |      |
|  | AVERAGE   | 34.9       | 84.7  |       | 73.0 |
|  | DEVIATION | 11.3       | 13.7  |       | 15.6 |

-

KEY ?SCORE

-

## ELEMENTARY GPAC

27 MAY 73

|  | S.N.      | HW<br>---- | TEST1 | SCORE<br>---- |      |
|--|-----------|------------|-------|---------------|------|
|  | 1         | 106        | 49    | 100           | 95.0 |
|  | 2         | 119        | 46    | 93            | 88.8 |
|  | 3         | 110        | 41    | 98            | 85.0 |
|  | 4         | 105        | 43    | 87            | 83.0 |
|  | 5         | 118        | 38    | 101           | 82.8 |
|  | 6         | 123        | 45    | 78            | 81.8 |
|  | 7         | 120        | 42    | 86            | 81.5 |
|  | 8         | 114        | 41    | 85            | 80.0 |
|  | 9         | 124        | 40    | 83            | 78.1 |
|  | 10        | 101        | 37    | 86            | 75.8 |
|  | 11        | 121        | 37    | 79            | 73.1 |
|  | 12        | 103        | 28    | 103           | 72.1 |
|  | 13        | 104        | 38    | 73            | 71.9 |
|  | 14        | 116        | 29    | 91            | 68.6 |
|  | 15        | 112        | 33    | 75            | 66.9 |
|  | 16        | 111        | 25    | 85            | 61.7 |
|  | 17        | 102        | 21    | 96            | 61.4 |
|  | 18        | 113        | 31    | 49            | 54.5 |
|  | 19        | 115        | 0     | 62            | 24.2 |
|  | POSSIBLE  | 50         | 110   |               |      |
|  | AVERAGE   | 34.9       | 84.7  |               | 73.0 |
|  | DEVIATION | 11.3       | 13.7  |               | 15.6 |





-

KEY ?RETURN

COMMAND ?OUT

OUT SECTION

ENTER SMALLEST AND LARGEST S.N. DESIRED ?106,111

-

| ELEMENTARY GPAC |    |       | 27 MAY 73 | STUDENT 106 |
|-----------------|----|-------|-----------|-------------|
|                 | HW | TEST1 | SCORE     |             |
| P FACTORS       | 20 | 15    |           |             |
| STUDENT TOTALS  | 49 | 100   | 95.0      |             |
| POSSIBLE        | 50 | 110   |           |             |

-

| ELEMENTARY GPAC |    |       | 27 MAY 73 | STUDENT 110 |
|-----------------|----|-------|-----------|-------------|
|                 | HW | TEST1 | SCORE     |             |
| P FACTORS       | 20 | 15    |           |             |
| STUDENT TOTALS  | 41 | 98    | 85.0      |             |
| POSSIBLE        | 50 | 110   |           |             |

-

| ELEMENTARY GPAC |    |       | 27 MAY 73 | STUDENT 111 |
|-----------------|----|-------|-----------|-------------|
|                 | HW | TEST1 | SCORE     |             |
| P FACTORS       | 20 | 15    |           |             |
| STUDENT TOTALS  | 25 | 85    | 61.7      |             |
| POSSIBLE        | 50 | 110   |           |             |

-

END OUT SECTION

COMMAND ?STAT

STAT SORT SECTION

STAT OPTION ?SCALE

KEY ?SCORE

BASE AND SCALE FACTOR ?0.1  
 DO YOU WISH GRADES ?YES  
 LOWER LIMITS FOR D,C,B,A ?-1.5,-.5,+.5,1.5

-

ELEMENTARY GPAC

27 MAY 73

| S.N. | SCORE | T-SCORE | GRADE | B,S: | 0 | 1 |
|------|-------|---------|-------|------|---|---|
| 1    | 106   | 95.0    | 1.4   | B    |   |   |
| 2    | 119   | 88.8    | 1.0   | B    |   |   |
| 3    | 110   | 85.0    | 0.8   | B    |   |   |
| 4    | 105   | 83.0    | 0.6   | B    |   |   |
| 5    | 118   | 82.8    | 0.6   | B    |   |   |
| 6    | 123   | 81.8    | 0.6   | B    |   |   |
| 7    | 120   | 81.5    | 0.5   | B    |   |   |
| 8    | 114   | 80.0    | 0.5   | C    |   |   |
| 9    | 124   | 78.1    | 0.3   | C    |   |   |
| 10   | 101   | 75.8    | 0.2   | C    |   |   |
| 11   | 121   | 73.1    | 0.0   | C    |   |   |
| 12   | 103   | 72.1    | -0.1  | C    |   |   |
| 13   | 104   | 71.9    | -0.1  | C    |   |   |
| 14   | 116   | 68.6    | -0.3  | C    |   |   |
| 15   | 112   | 66.9    | -0.4  | C    |   |   |
| 16   | 111   | 61.7    | -0.7  | D    |   |   |
| 17   | 102   | 61.4    | -0.7  | D    |   |   |
| 18   | 113   | 54.5    | -1.2  | D    |   |   |
| 19   | 115   | 24.2    | -3.1  | F    |   |   |

POSSIBLE 100.0  
 AVERAGE 73.0  
 DEVIATION 15.6

-

STAT OPTION ?RETURN

COMMAND ?CHE

-

GPAC STATUS CHECK

27 MAY 73

TITLE: ELEMENTARY GPAC

NUMBER OF BINS IN USE: 2

HEADINGS: HW TEST1

P FACTORS: 20 15  
 POSSIBLE: 50 110

STUDENT NUMBER BASE: 100  
 LARGEST STUDENT NUMBER: 124  
 NUMBER OF STUDENTS IN CLASS: 19

INACTIVE S.N.: 107 108 109 117 122

DATE FILES LAST UPDATED: 27 MAY 73

COMMAND ?UPD

UPD OPTION ?SIN

ENTER: S.N. ?115

KEY ?HW

|                 |    |    |
|-----------------|----|----|
| 115             | 0  | 62 |
| ENTER DATUM ?38 |    |    |
| 115             | 38 | 62 |

ENTER: S.N. ?-1

UPD OPTION ?RET

COMMAND ?MOD

MODIFICATION SECTION

MOD OPTION ?HELP

ADD: ACTIVATE A STUDENT  
 DELETE: INACTIVATE A STUDENT  
 HELP: OBTAIN A LISTING OF OPTIONS  
 PARAM: MODIFY THE CLASS PARAMETERS  
 RETURN: RETURN TO COMMAND

MOD OPTION ?PAR

ITEM ?HELP

FACTOR: WEIGHTS OR P. FACTORS  
 HELP: LIST OF ITEMS  
 KILL: REMOVE A BIN  
 MODE: CHANGE MODE  
 NAME: CHANGE BIN NAMES  
 NEW: ADD A NEW BIN  
 RETURN: RETURN TO COMMAND  
 SWITCH: EXCHANGE TWO BINS  
 TITLE: CHANGE TITLE

ITEM ?NEW

BIN TITLE: ?TEST 2  
 P. FACTOR: ?15

ITEM ?RETURN

-

GPAC STATUS CHECK

27 MAY 73

TITLE: ELEMENTARY GPAC

NUMBER OF BINS IN USE: 3

| HEADINGS:  | HW | TEST1 | TEST 2 |
|------------|----|-------|--------|
| P FACTORS: | 20 | 15    | 15     |
| POSSIBLE:  | 50 | 110   | 0      |

STUDENT NUMBER BASE: 100  
 LARGEST STUDENT NUMBER: 124  
 NUMBER OF STUDENTS IN CLASS: 19

INACTIVE S.N.: 107 108 109 117 122

DATE FILES LAST UPDATED: 27 MAY 73

COMMAND ?LIS

-

## ELEMENTARY GPAC 27 MAY 73

| S.N.      | HW   | TEST1 | TEST 2 | SCORE |
|-----------|------|-------|--------|-------|
| 101       | 37   | 86    | 0      | 75.8  |
| 102       | 21   | 96    | 0      | 61.4  |
| 103       | 28   | 103   | 0      | 72.1  |
| 104       | 38   | 73    | 0      | 71.9  |
| 105       | 43   | 87    | 0      | 83.0  |
| 106       | 49   | 100   | 0      | 95.0  |
| 110       | 41   | 98    | 0      | 85.0  |
| 111       | 25   | 85    | 0      | 61.7  |
| 112       | 33   | 75    | 0      | 66.9  |
| 113       | 31   | 49    | 0      | 54.5  |
| 114       | 41   | 85    | 0      | 80.0  |
| 115       | 38   | 62    | 0      | 67.6  |
| 116       | 29   | 91    | 0      | 68.6  |
| 118       | 38   | 101   | 0      | 82.8  |
| 119       | 46   | 93    | 0      | 88.8  |
| 120       | 42   | 86    | 0      | 81.5  |
| 121       | 37   | 79    | 0      | 73.1  |
| 123       | 45   | 78    | 0      | 81.8  |
| 124       | 40   | 83    | 0      | 78.1  |
| POSSIBLE  | 50   | 110   | 0      |       |
| AVERAGE   | 36.9 | 84.7  | 0.0    | 75.2  |
| DEVIATION | 7.4  | 13.7  | 0.0    | 10.3  |

-

COMMAND ?STA

## STAT SORT SECTION

STAT OPTION ?SCA

KEY ?SCORE

BASE AND SCALE FACTOR ?0,1

DO YOU WISH GRADES ?YES

LOWER LIMITS FOR D,C,B,A ?-1.5,-.5,.5,1.5

-

## ELEMENTARY GPAC

27 MAY 73

| S.N. | SCORE | T-SCORE | GRADE | B.S: | 0 | 1 |
|------|-------|---------|-------|------|---|---|
| 1    | 106   | 95.0    | 1.9   | A    |   |   |
| 2    | 119   | 88.8    | 1.3   | B    |   |   |
| 3    | 110   | 85.0    | 1.0   | B    |   |   |
| 4    | 105   | 83.0    | 0.8   | B    |   |   |
| 5    | 118   | 82.8    | 0.7   | B    |   |   |
| 6    | 123   | 81.8    | 0.6   | B    |   |   |
| 7    | 120   | 81.5    | 0.6   | B    |   |   |
| 8    | 114   | 80.0    | 0.5   | C    |   |   |
| 9    | 124   | 78.1    | 0.3   | C    |   |   |
| 10   | 101   | 75.8    | 0.1   | C    |   |   |
| 11   | 121   | 73.1    | -0.2  | C    |   |   |
| 12   | 103   | 72.1    | -0.3  | C    |   |   |
| 13   | 104   | 71.9    | -0.3  | C    |   |   |
| 14   | 116   | 68.6    | -0.6  | D    |   |   |
| 15   | 115   | 67.6    | -0.7  | D    |   |   |
| 16   | 112   | 66.9    | -0.8  | D    |   |   |
| 17   | 111   | 61.7    | -1.3  | D    |   |   |
| 18   | 102   | 61.4    | -1.3  | D    |   |   |
| 19   | 113   | 54.5    | -2.0  | F    |   |   |

|           |       |
|-----------|-------|
| POSSIBLE  | 100.0 |
| AVERAGE   | 75.2  |
| DEVIATION | 10.3  |

-

STAT OPTION ?RETURN

COMMAND ?STOP

GPAC EXIT

DONE



CONTRIBUTED PROGRAM **BASIC**

|                          |                                                                                                                                                                                                                                                                                                                                          |                |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>TITLE:</b>            | GRADE: Test Grade for Number of Questions Missed                                                                                                                                                                                                                                                                                         | GRADE<br>36342 |
| <b>DESCRIPTION:</b>      | This program is useful in determining the grade of an examination consisting of any number of questions. The user inputs the number of questions on the test and the output consists of a general table giving the number of questions missed with the corresponding percentage grade based on 100% and the number of questions correct. |                |
| <b>INSTRUCTIONS:</b>     | User is requested to input the number of questions on the test.                                                                                                                                                                                                                                                                          |                |
| <b>ACKNOWLEDGEMENTS:</b> | Huntington Project<br>Polytechnic Institute of Brooklyn                                                                                                                                                                                                                                                                                  |                |

RUN  
RUN  
GRADE

NUMBER OF QUESTIONS IN THIS TEST IS ?15

| NUMBER<br>WRONG<br>----- | GRADE<br>----- | NUMBER<br>RIGHT<br>----- |
|--------------------------|----------------|--------------------------|
| 0                        | 100            | 15                       |
| 1                        | 93             | 14                       |
| 2                        | 87             | 13                       |
| 3                        | 80             | 12                       |
| 4                        | 73             | 11                       |
| .....                    |                |                          |
| 5                        | 67             | 10                       |
| 6                        | 60             | 9                        |
| 7                        | 53             | 8                        |
| 8                        | 47             | 7                        |
| 9                        | 40             | 6                        |
| .....                    |                |                          |
| 10                       | 33             | 5                        |
| 11                       | 27             | 4                        |
| 12                       | 20             | 3                        |
| 13                       | 13             | 2                        |
| 14                       | 7              | 1                        |
| .....                    |                |                          |
| 15                       | 0              | 0                        |

DONE



EDUCATIONAL ADMINISTRATION (885)  
CONTRIBUTED PROGRAM **BASIC**

**TITLE:**

ITEM1: Number Frequencies

ITEM1  
36343

**DESCRIPTION:**

This program counts and prints the number of times questions are missed on a test.

**INSTRUCTIONS:**

Starting on line 600, enter the test numbers missed in any order. Last data line should be no higher than 700.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN

600 DATA 1,2,3,4,5,2,3,5,6,7,8,9,10,7,8,9,11,13,14,15,10,13,15,10

RUN

ITEM1

ITEM ANALYSIS

-----

NUMBER OF QUESTIONS IN THE TEST IS?15

| QUESTION | NUMBER OF TIMES MISSED |
|----------|------------------------|
| -----    | -----                  |
| 1        | 1                      |
| 2        | 2                      |
| 3        | 2                      |
| 4        | 1                      |
| 5        | 2                      |
| 6        | 1                      |
| 7        | 2                      |
| 8        | 2                      |
| 9        | 2                      |
| 10       | 3                      |
| 11       | 1                      |
| 12       | 0                      |
| 13       | 2                      |
| 14       | 1                      |
| 15       | 2                      |

DONE

CONTRIBUTED PROGRAM **BASIC**SALSIM  
A720-36072A

TITLE: SALARY SCHEDULE COST SIMULATOR

DESCRIPTION: This program computes the total cost, average salary per teacher, cost of training and experience increments, and various other related costs for a proposed salary schedule. Output also includes optional reproduction of personnel matrix with marginal totals and average number of years teaching experience.

INSTRUCTIONS: This program requires two files to be opened (ML0005 and ML0017). In preparing the data tapes type all figures for step 1 in the first data statement, type all figures for step 2 in the next data statement, etc. (Steps and lanes are defined as follows:)

```

                LANE
STEP  7000=  7200  7400 . . .
        7400
        7800
        :

```

The question "what number do you want to multiply your schedule by?" allows two options.

Option 1 To multiply the entire schedule by a percentage increase. (Example: Type in 1.03 to multiply the entire schedule by 3%, 1.05 to multiply by 5%, etc.)

Option 2 To use an index instead of a proposed schedule. If you want to use an index in place of the proposed schedule just follow the same format for preparing the data tape substituting indices for actual salaries.

Because two sets of data are appended to the program it is important that they are numbered correctly.

The "PERMAT" tape (personnel matrix) must be numbered from 4000 to 6900.

The "PROSCH" tape (proposed schedule) must be numbered from 7000 to 9900.

Because these two tapes are appended you must also include an "end"statement (9999 end) either on the end of the "PROSCH" tape or by itself after the two tapes have been appended.

Both the proposed schedule and the personnel matrix may not exceed 15 steps and 14 lanes. Both the proposed schedule and the personnel matrix must have the same Number of steps and lanes.

SPECIAL CONSIDERATIONS: See attached copy for additional information.

ACKNOWLEDGEMENTS: TIES  
St. Paul, Minnesota 55113

SALSIM

(SALary schedule cost SIMulator)

Purpose

To compute the total and related cost for a proposed salary schedule.

Input

1. A copy of the proposed salary schedule.
2. A personnel matrix for your district (number of teachers in each salary category).

Output

1. Optional -- A step-by-lane reproduction of the personnel matrix with marginal totals and the average number of years teaching experience.
2. A cost matrix showing the cost in each category with step and lane marginal totals.
3. The total cost of the proposed schedule.
4. The cost if all teachers were placed on step one.
5. The cost of experience increments.
6. The cost if all teachers were placed in lane one.
7. The cost of training increments.
8. The ratio of cost of experience increments to the cost of training increments. (A number greater than 1 means that more money is being spent on experience than on training. A number equal to 1 means that money being spent on experience is equal to money being spent on training. A number less than 1 means that more money is being spent on training than on experience).
9. The average salary for teachers .

Options

There is now a question within the program that asks WHAT NUMBER DO YOU WANT TO MULTIPLY YOUR SCHEDULE BY? This question gives you two options.

1. To multiply your whole schedule by a percentage increase. (Example: Type in 1.03, when the question is asked, to multiply your whole schedule by 3%, 1.05 to multiply by 5%, etc.)
2. To use an index instead of a proposed schedule. When using an index in place of the proposed schedule follow FORMAT B IN SECTION I UNDER OFF-LINE PROCEDURE. When the above question is asked type in the BA base figure you want to multiply your index by. (Type in 7500 to multiply the entire schedule by \$7500, 8000 to multiply by \$8000, etc.)
3. Type in a 1 if you do not want to multiply your proposed schedule (i.e. if you do not want to take advantage of these options.)

Restrictions

Both the proposed schedule and the personnel matrix may not exceed 15 steps and 14 lanes. Both the proposed schedule and the personnel matrix must have the same number of steps and the same number of lanes.

PRELIMINARY OFF-LINE PROCEDURE FOR RUNNING ALL SALARY PROGRAMS

The following two sections I and II, are instructions for preparing tapes off-line.

To run SALSIM follow sections I and II.

I. Proposed Schedule - PROPS1

You must type a tape of your proposed schedule using the following format.

Type each step of your proposed schedule in one data statement.

NOTE: DATA STATEMENTS FOR THIS FILE MUST BEGIN AT STATEMENT NUMBER 7000 AND CONTINUE AT ANY INTERVAL TO 9000. THE LAST STATEMENT MUST BE A 9999 END.

Format A

7000 DATA 7500, 7700, 7900, 8100, 8400, 8600, 8800  
 7100 DATA 7900, 8100, 8300, 8500, 8900, 9100, 9300  
 7200 DATA 8300, 8500, 8700, 8900, 9400, 9600, 9800  
 :  
 :  
 :  
 8700 DATA 10900, 11300, 11700, 12100, 13500, 14500, 15800  
 9999 END

If you want to use an index in place of the proposed schedule you must follow the format below.

Format B

7000 DATA 1,1.05, 1.1, 1.15, 1.2, 1.25, 1.3  
 7100 DATA 1.06, 1.12, 1.18, 1.24, 1.3, 1.36, 1.42  
 7200 DATA 1.12, 1.19, 1.26, 1.33, 1.4, 1.47, 1.54  
 :  
 :  
 :  
 8700 DATA 1.87, 1.98, 2.09, 2.2, 2.31, 2.42, 2.53  
 9999 END

II. Personnel Matrix - PERMAT

You must type a tape of your personnel matrix using the following format.  
 Type each step of your personnel matrix in one data statement.

NOTE: DATA STATEMENTS FOR THIS FILE MUST BEGIN AT STATEMENT NUMBER 5000  
 AND CONTINUE AT ANY INTERVAL TO 6900.

5000 DATA 10, 4, 2, 0, 3, 0, 0  
 5100 DATA 5, 6, 3, 1, 2, 0, 0  
 5200 DATA 6, 3, 6, 4, 7, 1, 0  
 :  
 :  
 :  
 6700 DATA 4, 7, 12, 16, 8, 5, 3

PRELIMINARY ON-LINE PROCEDURE FOR RUNNING SALARY PROGRAMS

1. Call the H/P Time Sharing System.
2. When you hear a high-pitched tone, place phone in coupler.
3. Type in any number (0-9) and hit carriage return.
4. When computer asks you to log in, type in your appropriate district user ID, hit carriage return, and wait for READY message.
5. The first time you run SALSIM you must type in the following two statement.  
 OPE-ML0005,5  
 OPE-ML0017,7

You need never type in these statements again. (In fact it would be best if you took a pen and crossed out this step after you have done it.)

6. If you have never run SALSIM, proceed to step 7, otherwise type in KIL-PROPS1 and hit carriage return.
7. Type in TAPE, hit carriage return and begin reading in the proposed schedule tape.
8. When the tape has been read in, type in NAM-PROPS1 and hit carriage return.
9. Type in SAV and hit carriage return.
10. Type in SCR and hit carriage return.
11. If you have never run SALSIM, proceed to step 12, otherwise type in KIL-PERMAT and hit carriage return.
12. Type in TAPE, hit carriage return, and begin reading in personnel matrix tape.
13. When tape has been read in, type in NAM-PERMAT and hit carriage return.
14. Type in SAV and hit carriage return.
15. Type in SCR and hit carriage return.

PROCEDURE FOR RUNNING - SALSIM

1. Type in GET-PERMAT and hit carriage return.
2. Type in APP-PROPS1 and hit carriage return.
3. Type in RUN and hit carriage return.

The computer will ask you to PLEASE TYPE IN THE NUMBER OF STEPS THEN THE NUMBER OF LANES SEPARATED BY A COMMA. When you have responded the computer will print DONE.

4. Type in GET-SALSIM and hit carriage return.
5. Type in RUN and hit carriage return.

The computer will now ask the following questions:

PLEASE TYPE IN THE NUMBER OF STEPS THEN THE NUMBER OF LANES SEPARATED BY A COMMA.

WHAT NUMBER DO YOU WANT TO MULTIPLY YOUR SCHEDULE BY? IF YOU DO NOT WANT TO MULTIPLY YOUR SCHEDULE TYPE IN A 1.

PLEASE ENTER YOUR LANE HEADINGS. MAXIMUM HEADING LENGTH IS 7 CHARACTERS. PLEASE TYPE ONLY ONE LANE HEADING AFTER EACH QUESTION MARK THAT FOLLOWS.

EXAMPLE:

- ? BA
- ? BA + 30
- ? MA
- ? MA + 30
- ? PH.D.

DO YOU WISH TO ADVANCE ALL TEACHERS ONE STEP FOR PROJECTED COST COMPUTATIONS? (TYPE 1 FOR NO, 2 FOR YES).

DO YOU WANT A PRINTOUT OF THE PERSONNEL MATRIX? (TYPE 1 FOR YES, 2 FOR NO).

When the program has finished running it will print DONE. If you want to run the program again type in RUN and hit carriage return. If you want to run one of the other programs go to the respective PROCEDURE FOR RUNNING section for that program. If you are done running programs type in BYE and hit carriage return.

## RUN

SAMPLE OUTPUT - SALSIM

DO YOU WISH TO ADVANCE ALL TEACHERS ONE STEP FOR PROJECTED COST COMPUTATIONS?  
(TYPE 1 FOR YES, 2 FOR NO)

1

## \*\*\*\*\*PERSONNEL MATRIX (TRAINING BY EXPERIENCE)\*\*\*\*\*

| LANE 1<br>LANE 6 | LANE 2<br>LANE 7 | LANE 3<br>LANE 8 | LANE 4<br>LANE 9 | LANE 5   |
|------------------|------------------|------------------|------------------|----------|
| 0<br>0           | 60<br>0          | 8<br>0           | 5<br>0           | 0<br>73  |
| 0<br>0           | 57<br>17         | 12<br>0          | 3<br>0           | 1<br>74  |
| 0<br>0           | 29<br>0          | 9<br>0           | 0<br>0           | 0<br>38  |
| 0<br>1           | 17<br>1          | 6<br>0           | 1<br>0           | 1<br>27  |
| 0<br>3           | 12<br>1          | 2<br>0           | 0<br>1           | 0<br>19  |
| 0<br>1           | 15<br>1          | 2<br>1           | 2<br>0           | 1<br>23  |
| 0<br>0           | 6<br>0           | 4<br>0           | 1<br>0           | 0<br>11  |
| 1<br>2           | 0<br>1           | 9<br>0           | 6<br>1           | 1<br>21  |
| 2<br>2           | 0<br>0           | 8<br>0           | 7<br>0           | 0<br>19  |
| 1<br>1           | 3<br>0           | 0<br>1           | 0<br>0           | 1<br>7   |
| 1<br>5           | 11<br>7          | 6<br>7           | 9<br>4           | 0<br>50  |
| 5<br>15          | 210<br>12        | 66<br>9          | 34<br>6          | 5<br>362 |

THE AVERAGE STEP (ROW) ATTAINED BY YOUR CURRENT STAFF IS 4.73

SAMPLE OUTPUT - SALSIM

\*\*\*\*\*

\*\*\*\*\*COST BY CATEGORY FOR THE PROPOSED SALARY SCHEDULE\*\*\*\*\*

| LESS     | BA         | BA+1.5    | BA+30     | BA+45    |
|----------|------------|-----------|-----------|----------|
| \$ 0     | \$ 0       | \$ 0      | \$ 0      | \$ 0     |
| \$ 0     | \$ 498000  | \$ 69600  | \$ 45500  | \$ 0     |
| \$ 0     | \$ 501600  | \$ 110400 | \$ 28800  | \$ 10000 |
| \$ 0     | \$ 269700  | \$ 87300  | \$ 0      | \$ 0     |
| \$ 0     | \$ 166600  | \$ 61200  | \$ 10600  | \$ 11000 |
| \$ 0     | \$ 123600  | \$ 21400  | \$ 0      | \$ 0     |
| \$ 0     | \$ 163500  | \$ 22600  | \$ 23400  | \$ 12100 |
| \$ 0     | \$ 69000   | \$ 47600  | \$ 12300  | \$ 0     |
| \$ 9900  | \$ 0       | \$ 112500 | \$ 77400  | \$ 13300 |
| \$ 21000 | \$ 0       | \$ 105600 | \$ 95200  | \$ 0     |
| \$ 22400 | \$ 189000  | \$ 83400  | \$ 128700 | \$ 14700 |
| \$ 53300 | \$ 1981000 | \$ 721600 | \$ 421900 | \$ 61100 |

\*\*\*\*\*





SAMPLE OUTPUT - SALSIM

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\*\*\*\*\*COST BY CATEGORY FOR THE PROPOSED SALARY SCHEDULE(CONT)\*\*\*\*\*

| MA        | MA+15     | MA+30     | MA+45    | TOTAL      |
|-----------|-----------|-----------|----------|------------|
| \$ 0      | \$ 0      | \$ 0      | \$ 0     | \$ 0       |
| \$ 0      | \$ 0      | \$ 0      | \$ 0     | \$ 613100  |
| \$ 0      | \$ 10800  | \$ 0      | \$ 0     | \$ 661600  |
| \$ 0      | \$ 0      | \$ 0      | \$ 0     | \$ 357000  |
| \$ 11400  | \$ 11800  | \$ 0      | \$ 0     | \$ 272600  |
| \$ 35700  | \$ 12300  | \$ 0      | \$ 13100 | \$206100   |
| \$ 12500  | \$ 12900  | \$ 13300  | \$ 0     | \$ 260300  |
| \$ 0      | \$ 0      | \$ 0      | \$ 0     | \$ 128900  |
| \$ 27600  | \$ 14200  | \$ 0      | \$ 15000 | \$ 269908  |
| \$ 29000  | \$ 0      | \$ 0      | \$ 0     | \$ 250800  |
| \$ 91200  | \$ 109200 | \$ 128000 | \$ 65600 | \$ 832200  |
| \$ 207400 | \$ 171200 | \$ 141300 | \$ 93700 | \$ 3852500 |

\*\*\*\*\*

SAMPLE OUTPUT - SALSIM

THE TOTAL COST FOR THE PROPOSED SALARY SCHEDULE IS # 3852500

THE TOTAL COST FOR THIS SALARY SCHEDULE WOULD BE # 2958600  
IF ALL TEACHERS WERE PLACED ON STEP 1

THE COST OF THE EXPERIENCE INCREMENTS FOR THIS SCHEDULE IS # 893900

THE TOTAL COST FOR THIS SALARY SCHEDULE WOULD BE # 2746000  
IF ALL TEACHERS WERE PLACED IN LANE 1

THE COST OF TRAINING INCREMENTS FOR THIS SCHEDULE IS # 1106500

THE RATIO OF THE COST OF EXPERIENCE INCREMENTS TO THE COST OF  
TRAINING INCREMENTS IS .81

THE AVERAGE SALARY PER TEACHER FOR THE PROPOSED SALARY SCHEDULE IS  
# 10642.3

CONTRIBUTED PROGRAM **BASIC**SGFMS  
36832**TITLE:**

STUDENT GRADE FILE MANAGEMENT SYSTEM

**DESCRIPTION:**

The process of maintaining grade records for large classes can be a complex and time-consuming task for an instructor. If daily grades are given, the amount of record keeping that an instructor must do increases greatly.

The concept of feedback also enters into the process. Once a student is evaluated, the student should be informed of the results as soon as possible. Not only should the numeric results be made available, but the student should be told why he received a particular grade so that the situation becomes a learning experience, thus allowing him to learn from his mistakes, thereby reducing their frequency.

**INSTRUCTIONS:**

This package includes three computer programs:

STUDENT GRADE FILE MANAGEMENT SYSTEM PROGRAM (SGFMS)  
STUDENT STATUS REPORT PROGRAM (SSRP) and  
CRITERIA OCCURRENCE REPORT PROGRAM (CORP)

SETTING UP SGFMS

Two files must be opened: FILEA and FILEB. The size of these files should be calculated as follows:

Size of FILEA - max. # of students to be registered on the system + 1.

Size of FILEB + max. # of criteria to be stored onto the system. (99 Max.)

The files are created using the create command, e.g.,

CRE-FILEA, 100 (Creates FILEA to 100 blocks) (99 Students)  
CRE-FILEB, 20 (Creates FILEB to 20 blocks)

Procedure

1. Create two files: FILEA and FILEB of the proper size.
2. Get and run SGFMS.
3. Invoke the SYS command. Use the reset option.
4. Invoke the CLE command.
5. Invoke the REG command and register students on the system.
6. Invoke the STA command and get a list of the student names and passwords placed on the system using the NAM print.
7. Use the ALT command to correct any misspelled student names.
8. Invoke the STA command again and get a new list of names in a triple spaced format which may be cut up and distributed to the students.

Continued On Next Page.

**ACKNOWLEDGEMENTS:**

The Ohio State University  
College of Pharmacy

INSTRUCTIONS: Continued.

9. Invoke the CRI command and enter the criteria onto the system.

The system is now ready for use.

The objectives of the SGFMS are:

1. Allow an instructor to store and retrieve a student's name and grades on a teletypewriter or CRT.
2. Three grade types are to be accepted:  
Exam, Quiz and Criteria-based grades (daily grades).
3. The daily grades must be criteria-based. The criteria on which the daily grades are based should be placed within the record.
4. The mode of grade input must be efficient, and contain appropriate checks to insure that input errors are not made.
5. The instructor should have the ability to extract reports of:
  - a. An individual student's record.
  - b. The records of the entire class.
  - c. A report which summarizes a student's work.
  - d. Any particular test or quiz for the entire class.
  - e. A list of names of students currently registered on the system.
6. The system must store a list of criteria on a direct access device on which a student's daily grades must be based.
7. The criteria files should be completely flexible in terms of status reports and input of criteria into the files, and addition of the criteria into a student's record.
8. System security provisions must be established.
9. The system must be easy to set up and maintain.

The SGFMS is designed to allow flexibility in maintaining student records and criteria records. Once the user has accessed and started the SGFMS running, he is prompted for a command. The instructor types a command which directs the system to perform certain operations. The commands presently on the system are:

|     |                                                               |
|-----|---------------------------------------------------------------|
| ALT | (ALTer) Changes a student name or password.                   |
| CLE | (CLEAr) Clears the student record file.                       |
| CRI | (CRITerion) Initiates the criteria file maintenance commands. |
| DRO | (DROp) Drops a student record from the system.                |
| END | (END) Terminates a system or subsystem.                       |
| HEL | (HELp) Prints a list of system commands and their actions.    |
| INP | (INPut) Allows user to input grade into student's records.    |
| REG | (REGistration) Registers students on the system.              |
| STA | (STATus) Prints reports on file contents.                     |
| SYS | (SYStem) Sets system's parameter previous to registration.    |
| UPD | (UPDate) Corrects an erroneous student record.                |

NOTICE that the commands use the first three letters of a base word.

Description of SGFMS Commands

ALT

The purpose of the ALTER command is to change the student name or password.

INSTRUCTIONS: Continued.

### CRI

The purpose of the CRI command is to initiate the CRITERIA MAINTENANCE control section.

(The following commands are not to be confused with the main control section commands.)

There are four CRITERIA MAINTENANCE COMMANDS:

```
CLE (CLEAr)
END (END)
INP (INPut)
PRI (PRInt)
```

CLE - The purpose of the CLE command is to clear the contents of the criterion files.

END - The END command terminates the CRITERION MAINTENANCE MODE.

INP - The purpose of the INP command is to place or update criteria in the criterion files.

PRI - The purpose of PRI is to print selected criteria stored on the system.

### CLE

The purpose of the CLE command is to clear the student record file. The user responds to the TYPE COMMAND prompt with the command "CLE".

The CLE command is protected by a password. The password of the sample RUN program is R<sub>c</sub>U<sub>c</sub>N<sub>c</sub>. The system will then type: TYPE C TO CLEAR OR X TO ABORT.

The user may type the letter "C" to clear the student files, or he may type the letter X to prevent a clear from being performed. Once the file is cleared, the system will type: CLEAR COMPLETED  
TYPE COMMAND?

### DROP

Sometimes it is desirable to eliminate a student record from the system; this task is accomplished through use of the DROP command. Once a student record has been dropped, no more grades may be placed in the record.

### END

This command terminates the SGFMS program.

### HELP

A list of system commands and their actions may be obtained by responding to the TYPE COMMAND? prompt with HELP.

HELP may be used in response to the SELECT REPORT TYPE? of the STATUS command. If HELP is typed, the system will respond with a list of status reports and their contents.

### INP

The purpose of this command is to input student grades. The input routine has three modes: CBG (Criteria Based Grade), Q, E.

The CBG mods allows the instructor to enter criteria-based grades (CBG) on student records, e.g.,

Once the INP command is invoked the user must specify the number of the exercise for which he wishes to place CBG's. Once he specifies the exercise number all of the following inputs will be entered for that particular exercise. Until the user respecifies a new exercise number, the dialogue is as follows:

```
TYPE COMMAND? INP
SELECT INPUT MODS: CBG, Q, OR E? CBG
EXERCISE # 5
ALL INPUTS WILL BE PLACED IN EXERCISE #5
STUDENT NUMBER? 010
JOHN SMITH
GRD,GR1? 9,4
GR2? 0
STUDENT NUMBER?

} See Explanation Below
```

INSTRUCTIONS: Continued.

The first system prompt "STUDENT NUMBER?" calls for the student number.

If a valid student number is entered, the system will immediately respond with the student's name and then prompt for the grade and first criterion #, e.g.,

```
STUDENT NUMBER? 10
JOHN SMITH
GRD,CR1? 9,4
```

In the previous example, the user typed in "Student Number 10". The system replied with the name "JOHN SMITH". Then the system prompted for the grade and a first criteria number, separated by a comma. The "9" in the previous example is the grade and "4" is the number of a criterion which will be inserted into JOHN SMITH's record.

The system will then prompt for two more criteria numbers, e.g.,

```
CR2? 5
CR3? 10
```

The system will accept a maximum of three criteria numbers and a minimum of one. If the instructor does not wish to add the 2nd and 3rd criteria to the student record, e.g.,

```
STUDENT NUMBER? 10
JOHN SMITH
GRAD, CR1? 8,4
CR2? 0 - a zero prevents any additional criteria being placed into the record.
```

In the previous example, only one criterion, #4, was added to JOHN SMITH's record.

If the instructor should wish to specify a new exercise number, he should enter a STUDENT NUMBER of zero. This will cause the EXERCISE #? prompt to be printed. (See example below.)

To terminate the INP of CBG's a zero must be entered to the STUDENT NUMBER? and the EXERCISE #? prompt. (See below.)

```
TYPE COMMAND? INP
SELECT INPUT MODE: CBG, Q, OR E? CBG
EXERCISE #? 5
ALL INPUTS WILL BE PLACED IN EXERCISE 5.
```

```
STUDENT NUMBER? 11
JACK HAMILTON
GRD, CR1? 8,2
CR2? 3
CR3? 0
```

```
STUDENT NUMBER? 0
```

```
EXERCISE #? 6
ALL INPUTS WILL BE PLACED IN EXERCISE 6
```

```
STUDENT NUMBER? 27
TONI JAMES
GRD, CR1? 10,1
CR2? 0
```

```
STUDENT NUMBER? 0
EXERCISE #? 0
TYPE COMMAND?
```

The Q or E inputs allow the instructor to enter quiz or exam grades. Both the input modes are identical. The quizzes and exam grades should be entered into the system in the same order that the quizzes or exams are taken. That is, the grades of the third quiz should not be entered into the system before the grades of the fourth quiz.

To terminate the input of quiz or exam grade, a zero should be entered to the STUDENT NUMBER? prompt.

```
STUDENT NUMBER? 10
JOHN SMITH
QUIZ? 90
STUDENT NUMBER? 0
TYPE COMMAND?
```

In the previous example, a quiz grade of 90 was added to JOHN SMITH's record.

INSTRUCTIONS: Continued.

### UPD

The UPD command allows the instructor to correct an erroneous student record, e.g.,

```
STUDENT NUMBER? 10
JOHN SMITH
DISPLAY CBG, Q, E, OR Y? E
EXAM GRADES
G1 - 10 G2 - 0 G3 - 0 G4 - 0
UPDATE: CBG, Q, E, OR X? E
EXAM #,GRD?
? 1, 95
TYPE COMMAND?
```

The previous sequence changed JOHN SMITH's first exam grade from a 10 to a 95. If an "X" is typed for the prompt:

```
DISPLAY; CBG, Q, E, OR X?
```

The "X" will prevent the student's record from being displayed.

```
UPDATE; CBG, Q, E, OR X?
```

The reply of an "X" to this prompt will result in no update being made.

### REG

The REG command places the student's name into the student record file; routine also generates the student password which is used in SSRP, e.g.,

```
TYPE COMMAND? REG
REGISTRATION
TYPE END TO TERMINATE REGISTRATION
TYPE NAME 1
? JOHN SMITH
TYPE NAME 2
? BETTY WILLIS
TYPE NAME 3
? END
TYPE COMMAND?
```

The previous example set up records on the system for John Smith and Betty Willis.

### STA

The STA command permits reports to be obtained from the system. There are five types of records which may be obtained.

GRD - This report summarizes student grades. The following information is printed for each student registered:

```
Student name and # of CBG's stored.
CBG average.
# of quiz grades stored.
Quiz grade average.
# of exam grades stored.
Exam grade average.
```

DMP - This report dumps any quiz or exam onto the printer. The report includes the student name and number.

NAM - NAM reports the student #, student name and password. All students registered on the system are printed. This report may be single or triple-spaced. The triple spaced form may be cut apart and distributed to the respective students at the beginning of the quarter.

RAN - The RAN report dumps the entire contents of the student's records. All the records may be printed over a range of student numbers.

STU - The STU report displays a particular student's record.

INSTRUCTIONS: Continued.

### SYS

The SYS command is used to set up the SGFMS system. It is used to inform the SGFMS system of the size of the student record and criteria files.

### SGFMS FOR THE PROGRAMMER

#### Expanding SGFMS Files

##### A. Student Grade File (FILEA)

The student grade file cannot be enlarged unless the SGFMS program is programmed to do so. One way of avoiding this difficulty is to allow enough blocks of disc storage space to allow for additional records. (Each student record requires one block of space.)

##### B. Criteria File (FILEB)

The criteria may be expanded if it is found after the initial system setup that additional criteria are needed. Use the following procedure to expand the criteria file:

1. Open a temporary file equal to the size of the old file.
2. GET and RUN the HP utility program \$COPYFL; copy FILEB into the temporary file.
3. KIL-FILEB, reopen it to the appropriate size.
4. Run \$COPYFL copy the temporary file into the new FILEB.
5. GET and RUN the SGFMS.
6. Invoke the SYS command and RESET the space parameters.
7. Invoke the CRI command and INPUT the additional criteria.

#### System Grade Capacity

VERSION B of SGFMS can store for each student a maximum of:

- 40 criteria-based grades
- 120 criteria numbers, (3 per criteria based grade)
- 10 quiz grades
- 10 exam grades

#### System Record Capacity

STUDENT RECORD FILE -- within disc space limitations.  
CRITERIA FILE -- 1 to 99 records.

#### Criteria Number Storage

The INP command allows that user to store up to three criteria numbers to describe each daily grade. These criteria are stored in array C (see SGFMS file structure). To conserve space all three criteria numbers are placed in one numeric word of storage. For example, if the criteria describing a particular grade were 5, 7, and 16 these criteria would be stored as: 160705.

A special program must be written to decode this number so the criteria number can be extracted. (The criteria number is a disc address used to retrieve the criteria from the criteria file.)

SGFMS program statements 7840-8060 will decode the criteria code; read and print the appropriate criteria from the criteria file.

#### SGFMS File Structure

It is often desirable to read the SGFMS files for the purpose of extracting information not contained in the SGFMS or CORP reports. For example, an instructor may find it desirable to run a statistical analysis on data stored in SGFMS files.



INSTRUCTIONS: Continued.

SGFMS File Structure

BLOCK 1

|    |    |    |         |  |
|----|----|----|---------|--|
| N4 | L8 | C9 | Y\$(25) |  |
|----|----|----|---------|--|

WHERE:

- N4 = number of registered students
- L8 = size of student grade file (FILEA) in blocks
- C9 = size of criteria file (FILEB) in blocks
- Y\$ = course name

BLOCK 2 AND ALL SUBSEQUENT BLOCKS

|         |        |       |       |       |       |  |
|---------|--------|-------|-------|-------|-------|--|
| D\$(25) | Z\$(4) | B(40) | C(40) | Q(10) | P(10) |  |
|---------|--------|-------|-------|-------|-------|--|

WHERE:

- D\$ = student name
- Z\$ = password
- B = CBG
- C = criteria numbers
- Q = quiz grades
- P = exam grades

INSTRUCTIONS: Continued.

STUDENT STATUS REPORT PROGRAM (SSRP)

The purpose of SSRP is to provide the student with the ability to recall his own grade record, that has been set up the STUDENT GRADE FILE MANAGEMENT SYSTEM (SGFMS).

When the students are registered using SGFMS, a student number and four-letter password is inserted into the student's record. This number and four-letter password is required for a student to print his grade record using SSRP. (To obtain a list of registered students and passwords, use the NAM print of the STA command.)

Use of SSRP

The user types the underlined commands:

```
GET-SSRP
RUN
SSRP
STUDENT STATUS REPORT PROGRAM
TYPE YOUR NUMBER?1
PASSWORD? ZAKL
ANN ALBERS
SELECT PRINT: RX,PE,TS, ALL OR STOP?
```

COMMAND            RESULTING ACTION

|             |                                                         |
|-------------|---------------------------------------------------------|
| <u>RX</u>   | Prescription grades are printed (Criteria based grade). |
| <u>PE</u>   | Practical exam grades are printed (Quiz grades).        |
| <u>TS</u>   | Test grades are printed (exam grades).                  |
| <u>ALL</u>  | All of the above.                                       |
| <u>STOP</u> | Terminates the SSRP                                     |

Once the print command is typed, the system will respond with the appropriate information.

In addition, the SSRP computes the criteria based grade and quiz average for the entire class and for the individual student.

Each individual exam is averaged for the individual student as well as for the class. This capability gives the student a means of judging his standing in relation to the rest of the class.

If the student selects the RX, PE, or TS print, the SSRP program must be terminated manually. This is done by typing the word "STOP"

CRITERIA OCCURRENCE REPORT PROGRAM (CORP)

The purpose of CORP is to provide an analysis of criteria occurrence. CORP analyzes the daily grade criteria that are stored by the STUDENT GRADE FILE MANAGEMENT SYSTEM (SGFMS).

CORP enables the instructor to obtain three types of reports:

1. A report which counts the criteria of each student for a specified exercise.  
(E.g., criteria counts for exercise #5.)
2. A report which summarizes the criteria occurrence within a particular student's record.  
(E.g., criteria counts for John Doe.)
3. A report which counts the criteria in all student's records.  
(E.g., total criteria count for all exercises.)

The benefits of such an analysis are of extreme importance to the instructor. By counting the criteria which have occurred for a particular exercise (Report 1), the instructor can immediately determine which criteria are being missed most frequently. This should allow adjustments to be made in the instructional emphasis of the course.

By counting criteria occurrence within a particular student's record (Report 2), the instructor can determine if a student is not grasping concepts which have resulted in excessive occurrence of a particular criteria within the student's record.

INSTRUCTIONS: Continued.

Use of Corp

The user types the underlined commands:

GET-CORP  
RUN  
 PASSWORD? Gc Oc  
 CRITERIA OCCURRENCE REPORT PROGRAM  
 PRINT REPORT BY PUPIL, BY EXERCISE, OR SUMMARY?

If the criteria count is obtained according to EXERCISE, there are 2 options available:

1. The print may be obtained for one individual exercise.
2. The print may be started on a particular exercise and stopped at a particular exercise; that is, a range of individual exercises may be printed.

**RUN**

CRE-FILEA,100  
 CRE-FILEB,20

**GET-SGFMS**  
**RUN**  
**SGFMS**

**STUDENT GRADE FILE MANAGEMENT SYSTEM**  
**PASSWORD? G<sup>c</sup>O<sup>c</sup>**  
**HELP AVAILABLE**

USE OF THE SYS, CLE AND REG COMMANDS

**TYPE COMMAND?SYS**  
**SYSTEMS CONFIGURATION**  
**DISPLAY OR RESET PARAMETERS?**  
**?RESET**  
**COURSE NAME?PHARMACEUTICS 887**  
**NUMBER OF BLOCKS ALLOCATED FOR FILEA (GRADE FILE)?83**  
**NUMBER OF BLOCKS ALLOCATED FOR FILEB (CRITERIA FILE)?15**

TYPE COMMAND?CLE  
STUDENT RECORD FILE CLEAR  
AUTHORIZATION?  
TYPE C TO CLEAR OR A TO ABORT  
?C  
CLEAR COMPLETED

TYPE COMMAND?REG  
REGISTRATION  
IF YOU MAKE AN ERROR IN TYPING A STUDENT NAME,  
YOU MAY CORRECT IT BY USE OF THE ALT (ALTER) COMMAND.

TYPE END TO TERMINATE REGISTRATION  
RECORD LENGTH -- 101 WORDS  
TYPE NAME 1  
?SUSAN ALDERN-MAN  
TYPE NAME 2  
?ARKWRIGHT G. AMBERG  
TYPE NAME 3  
?ROBERT BARBER  
TYPE NAME 4  
?LISA BLOCHER  
TYPE NAME 5  
?GEORGE CLARK  
TYPE NAME 6  
?ALBERT CROFT  
TYPE NAME 7  
?JOHN EPPICH  
TYPE NAME 8  
?JON FAUST  
TYPE NAME 9  
?PATRICIA HOBBS  
TYPE NAME 10  
?END

TYPE COMMAND?STA STATUS COMMAND (NAME PRINT)  
STATUS REPORTS  
HELP AVAILABLE  
SELECT REPORT: DMP, GRD, NAM, RAN, STU?NAM  
SINGLE OR TRIPLE SPACE REPORT?SINGLE

REGISTERED STUDENTS PHARMACEUTICS 887

|   |                     |      |
|---|---------------------|------|
| 1 | SUSAN ALDERMAN      | BIAI |
| 2 | ARKWRIGHT G. AMBERG | DOPR |
| 3 | ROBERT BARBER       | ICYW |
| 4 | LISA BLOCHER        | TDYY |
| 5 | GEORGE CLARK        | GDTB |
| 6 | ALBERT CROFT        | UREF |
| 7 | JOHN EPPICH         | NDJT |
| 8 | JON FAUST           | TOEX |
| 9 | PATRICIA HOBBS      | RSFH |

TYPE COMMAND?ALT  
STUDENT NUMBER?4 USE OF THE ALTER AND DROP COMMANDS  
LISA BLOCHER TDYY  
ALTER NAME OR PASSWORD?PASSWORD  
PASSWORD?TDSY

TYPE COMMAND?DRO  
STUDENT NUMBER?8  
DROP JON FAUST?YES  
STUDENT DROPPED

TYPE COMMAND?CRI  
 CRITERIA MAINTANCE  
 SELECT: CLE, END, INP, PRI  
 TYPE CRITERIA COMMAND?CLE  
 CLEAR CRITERIA FILES  
 TYPE C TO CLEAR FILES OR X TO ABORT  
 ?C  
 CLEAR COMPLETED  
 TYPE CRITERIA COMMAND?INP  
 INPUT (SET C#=0 TO TERMINATE ROUTINE)  
 SYSTEM WILL ACCEPT 15 CRITERIA

C#?1

CRITERION:  
 ?CONGRATULATIONS!! YOU MADE NO ERRORS

C#?2

CRITERION:  
 ?PACKAGING OR LABELING ERROR

C#?3

CRITERION:  
 ?TYPING OR SPELLING L-ERROR ON LABEL

C#?0

TYPE CRITERIA COMMAND?PRI  
 SELECT PRINT: RANGE OR SELECT  
 ?RANGE  
 LOWER LIMIT?1  
 UPPER LIMIT (MAX IS 15 73

- 1 CONGRATULATIONS!! YOU MADE NO ERRORS
- 2 PACKAGING OR LABELING ERROR
- 3 TYPING OR SPELLING ERROR ON LABEL

HELP COMMAND

TYPE CRITERIA COMMAND?END

TYPE COMMAND?HELP

ALT --- ALTER: ALTERS STUDENT NAME OR PASSWORD  
 CLE --- CLEAR: ERASES STUDENT NAMES AND THEIR GRADE RECORDS  
 CRI --- CRITERIA: INVOLKES THE CRITERIA FILE  
 MAINTAINANCE SUBSYSTEM  
 DRO --- DROP: DROPS A REGISTERED STUDENT  
 END --- TERMINATES A SYSTEM OR SUBSYSTEM  
 INP --- INPUT: USED TO INPUT STUDENT'S GRADES  
 REG --- REGISTRATION: PLACES THE STUDENT NAMES AND  
 PASSWORDS ON THE SYSTEM  
 STA --- STATUS: PRINTS STATUS REPORTS  
 SYS --- SYSTEM: USED IN INITIALIZING THE SYSTEM  
 UPD --- UPDATE: PERMITS THE CORRECTION OF A STUDENT RECORD

TYPE COMMAND?INP

SELECT INPUT MODE: CBG, Q, OR E?CBG  
 EXERCISE #?5  
 ALL INPUTS WILL BE PLACED IN EXERCISE # 5

STUDENT NUMBER?090---9  
 PATRICIA HOBBS  
 GRD,CRI?  
 ?9.4  
 CR2?0

STUDENT NUMBER?3

ROBERT BARBER  
GRD,CR1?  
?8,2  
CR2?3  
CR3?0

STUDENT NUMBER?0

EXERCISE #?6  
ALL INPUTS WILL BE PLACED IN EXERCISE # 6

STUDENT NUMBER?5

GEORGE CLARK  
GRD,CR1?  
?10,1  
CR2?0

STUDENT NUMBER?0

EXERCISE #?0

TYPE COMMAND?UPD

RECORD UPDATE  
AUTHORIZATION?  
SET STUDENT NUMBER = 0 TO TERMINATE UPD  
TYPE X TO BYPASS  
STUDENT NUMBER?1  
SUSAN ALDERMAN  
DISPLAY: CBG, Q, E, OR X?CBG  
NO CBG'S STORED  
UPDATE: CBG, Q, E, OR X?CBG  
EX#,CBG,CR1?5,8,3  
CR2?4  
CR3?0

UPDATE COMMAND

STUDENT NUMBER?9

PATRICIA HOBBS  
DISPLAY: CBG, Q, E, OR X?CBG  
CBG'S  
EX # 5 -- 9  
UPDATE: CBG, Q, E, OR X?E  
EXAM#,GRD?  
?2,88

STUDENT NUMBER?0

TYPE COMMAND?END

DONE

**TITLE:**

STAT: Statistical Analysis of Lab Data

**DESCRIPTION:**

This program treats class sets of laboratory data statistically. Aside from a table of experimental values with errors and percent errors, the teacher has a choice of experimental value distribution with bar graph, ranking by percent error, ranking by experimental value, mean deviation, and standard deviation.

OBJECTIVES:

- A. To make percent error in experiments more meaningful.
- B. To increase competitive spirit in the laboratory due to ranking portion of statistical analysis.
- C. To provide a basis for further discussion of laboratory data and techniques.

**INSTRUCTIONS:**PRELIMINARY PREPARATION:

This program is not generally for student use.

DISCUSSION:

Often a teacher is forced to work with some arbitrary percent error scale for marking purposes. With a statistical analysis of the laboratory results, a realistic scale can easily be developed.

Also, it is often desirable to discuss the class results but without a statistical analysis this usually turns out to be rather shallow. The analysis can now be obtained in the few minutes it takes the students to clean their equipment and put it away.

It may be helpful to discuss a few of the ways in which the teacher can input data. First, the teacher may simply call up the program and then either he or his students can input the data as the experiments are finished. Next, with the teletype unit on local, a tape can be made and the analysis can be made at any convenient time. With tapes a teacher can do a statistical analysis of his classes separately or as a group as long as each student gets a different student number. The program conversationally requests input.

**ACKNOWLEDGEMENTS:**

Huntington Project  
Polytechnic Institute of Brooklyn

RUN  
 RUN  
 STAT

THIS PROGRAM WILL DO THE FOLLOWING:

1. PRINT OUT A TABLE OF EXPERIMENTAL VALUES, ERRORS, AND PERCENT ERRORS INCLUDING AVERAGES FOR ALL.
2. GIVE YOU A CHOICE OF ALL OF THE FOLLOWING:
  - CHOICE 1 - EXPERIMENTAL VALUE DISTRIBUTION INCLUDING A BAR GRAPH
  - CHOICE 2 - RANKING BY PERCENT ERROR
  - CHOICE 3 - RANKING BY EXPERIMENTAL VALUE
  - CHOICE 4 - OTHER INFORMATION
  - CHOICE 5 - ALL OF THE ABOVE CHOICES
  - CHOICE 6 - ENDS PROGRAM

INSTRUCTIONS

1. LINES 100 TO 159 HAVE BEEN RESERVED FOR DATA.
2. NOTE: THE FIRST DATA LINE MUST ALWAYS BE NO. 100 AND LINE 101 MUST ALWAYS BE USED.
3. THERE IS ROOM FOR DATA FOR A MAXIMUM OF 50 STUDENTS.
4. INPUT SHOULD BE IN THE FORM:  
 100 DATA STUDENT NO., VALUE, STUDENT NO., VALUE, ETC.,
5. STUDENT NUMBERS MUST RANGE FROM 1-50.
6. OLD DATA IS ERASED BY INPUTTING NEW DATA WITH THE SAME LINE NUMBERS DURING SUBSEQUENT RUNS.
7. IF THE FIRST RUN REQUIRES DATA LINES 100-110 AND THE SECOND RUN REQUIRES LINES 100-109, LINE 110 IS TYPED IN TO ERASE OLD DATA IN THAT LINE.
8. NEVER TYPE SAVE DURING THE RUN OF ANY PART OF THIS PROGRAM.

DONE

100 DATA 1,37,-.8,2,38.6,3,39.7,4,37.9,5,38.6,40.6,7,41,-.8,8,37.6,9  
 101 DATA 39.5,10,40.1,11,39.8,12,39.4,13,35.4,14,33.9,15,42,16,39.6  
 102 DATA 17,38.7,18,37,-.6,19,38.5,20,40.1

RUN  
 STAT

WHAT IS THE TOTAL NO. OF STUDENTS AND THE CALC. VALUE?20,39

DATA LISTED BY STUDENT NUMBER

-----

| STUDENT NO. | VALUE | ERROR    | PERCENT ERROR |
|-------------|-------|----------|---------------|
| 1           | 37.8  | -1.2     | 3.07692       |
| 2           | 38.6  | -.400002 | 1.02564       |
| 3           | 39.7  | .699997  | 1.79486       |
| 4           | 37.9  | -1.1     | 2.82051       |
| 5           | 38    | -1       | 2.5641        |
| 6           | 40.6  | 1.6      | 4.10256       |
| 7           | 41.8  | 2.8      | 7.1795        |
| 8           | 37.6  | -1.4     | 3.58975       |
| 9           | 39.5  | .5       | 1.28205       |
| 10          | 40.1  | 1.1      | 2.82051       |
| 11          | 39.8  | .800003  | 2.05129       |
| 12          | 39.4  | .400002  | 1.02564       |
| 13          | 35.4  | -3.6     | 9.23077       |
| 14          | 33.9  | -5.1     | 13.0769       |
| 15          | 42    | 3        | 7.69231       |
| 16          | 39.6  | .599998  | 1.53846       |
| 17          | 38.7  | -.300003 | .769239       |
| 18          | 37.6  | -1.4     | 3.58975       |
| 19          | 38.5  | -.5      | 1.28205       |
| 20          | 40.1  | 1.1      | 2.82051       |

THE ARITHMETIC MEAN (AVERAGE) IS 38.83  
 THE AVERAGE ERROR (ABSOLUTE) IS 1.43  
 THE AVERAGE PERCENT ERROR IS 3.66667

DO YOU DESIRE ADDITIONAL INFORMATION ? IF SO, TYPE  
 IN THE NUMBER OF YOUR CHOICE.?5

FOR THE DISTRIBUTION, WHAT LOWER LIMIT, UPPER LIMIT,  
 AND STEP DO YOU DESIRE ?35,42.5,.5



## EXPERIMENTAL VALUE DISTRIBUTION

| FROM | TO LESS THAN | NO. | BAR GRAPH |
|------|--------------|-----|-----------|
| 0    | 35           | 1   | *         |
| 35   | 35.5         | 1   | *         |
| 35.5 | 36           | 0   |           |
| 36   | 36.5         | 0   |           |
| 36.5 | 37           | 0   |           |
| 37   | 37.5         | 0   |           |
| 37.5 | 38           | 4   | ****      |
| 38   | 38.5         | 1   | *         |
| 38.5 | 39           | 3   | ***       |
| 39   | 39.5         | 1   | *         |
| 39.5 | 40           | 4   | ****      |
| 40   | 40.5         | 2   | **        |
| 40.5 | 41           | 1   | *         |
| 41   | 41.5         | 0   |           |
| 41.5 | 42           | 1   | *         |
| 42   | 42.5         | 1   | *         |
| 42.5 | INFINITY     | 0   |           |

## RANKING BY PERCENT ERROR

| RANK | STUDENT NO. | PERCENT ERROR |
|------|-------------|---------------|
| 1    | 17          | .769239       |
| 2    | 2           | 1.02564       |
| 3    | 12          | 1.02564       |
| 4    | 9           | 1.28205       |
| 5    | 19          | 1.28205       |
| 6    | 16          | 1.53846       |
| 7    | 3           | 1.79486       |
| 8    | 11          | 2.05129       |
| 9    | 5           | 2.5641        |
| 10   | 4           | 2.82051       |
| 11   | 10          | 2.82051       |
| 12   | 20          | 2.82051       |
| 13   | 1           | 3.07692       |
| 14   | 8           | 3.58975       |
| 15   | 18          | 3.58975       |
| 16   | 6           | 4.10256       |
| 17   | 7           | 7.1795        |
| 18   | 15          | 7.69231       |
| 19   | 13          | 9.23077       |
| 20   | 14          | 13.0769       |

## RANKING BY EXPERIMENTAL VALUE

| RANK | STUDENT NO. | EXPER. VALUE |
|------|-------------|--------------|
| 1    | 14          | 33.9         |
| 2    | 13          | 35.4         |
| 3    | 8           | 37.6         |
| 4    | 18          | 37.6         |
| 5    | 1           | 37.8         |
| 6    | 4           | 37.9         |
| 7    | 5           | 38           |
| 8    | 19          | 38.5         |
| 9    | 2           | 38.6         |
| 10   | 17          | 38.7         |
| 11   | 12          | 39.4         |
| 12   | 9           | 39.5         |
| 13   | 16          | 39.6         |
| 14   | 3           | 39.7         |
| 15   | 11          | 39.8         |
| 16   | 10          | 40.1         |
| 17   | 20          | 40.1         |
| 18   | 6           | 40.6         |
| 19   | 7           | 41.8         |
| 20   | 15          | 42           |

OTHER INFORMATION

-----

THE MEDIAN VALUE IS 38.7  
THE LOWEST VALUE IS 33.9  
THE HIGHEST VALUE IS 42  
THE MEAN DEVIATION (AVERAGE DEVIATION) IS .130003  
THE STANDARD DEVIATION IS 1.87776  
THIS CONCLUDES THE RUN.

DONE

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Cable: COOPERATOR Karachi

Mushko & Company, Ltd.  
38B, Satellite Town  
Rawalpindi  
Tel: 41924  
Cable: FEMUS Rawalpindi

**PHILIPPINES**  
Electromex, Inc.  
6th Floor, Amalgamated  
Development Corp. Bldg.  
Ayala Avenue, Makati, Rizal  
C.C.P.O. Box 1028  
Makati, Rizal  
Tel: 86-18-87, 87-76-77,  
87-86-88, 87-18-45, 88-91-71,  
89-81-12, 83-82-12  
Cable: ELEMEX Manila

**SINGAPORE**  
Mechanical & Combustion  
Engineering Company Pte.,  
Ltd.  
10/12, Jalan Kilang  
Red Hill Industrial Estate  
Singapore, 3  
Tel: 647151 (7 lines)  
Cable: MECOMB Singapore

Hewlett-Packard Far East  
Area Office  
P.O. Box 87  
Alexandra Post Office  
Singapore 3  
Tel: 633022  
Cable: HEWPAK SINGAPORE

**SOUTH AFRICA**  
Hewlett-Packard South Africa  
(Pty.), Ltd.  
Hewlett-Packard House  
Daphne Street, Wendywood,  
Sandton, Transvaal 2001  
Tel: 407641 (five lines)

Hewlett-Packard South Africa  
(Pty.), Ltd.  
Breeccastle House  
Bree Street  
Cape Town  
Tel: 2-6941/2/3  
Cable: HEWPAK Cape Town  
Telex: 0006 CT

Hewlett-Packard South Africa  
(Pty.), Ltd.  
641 Ridge Road, Durban  
P.O. Box 99  
Overport, Natal  
Tel: 88-6102  
Telex: 567954  
Cable: HEWPAK

**TAIWAN**  
Hewlett-Packard Taiwan  
39 Chung Shiao West Road  
Sec. 1  
Overseas Insurance  
Corp. Bldg. 7th Floor  
Taipei  
Tel: 389160, 1, 2, 375121,  
Ext. 240-249  
Cable: TP824 HEWPAK Taipei

**THAILAND**  
UNIMESA Co., Ltd.  
56 Chongkonee Building  
56 Suriwongse Road  
Bangkok  
Tel: 37956, 31300, 31307,  
37540  
Cable: UNIMESA Bangkok

**UGANDA**  
Uganda Tele-Electric Co., Ltd.  
P.O. Box 4449  
Kampala  
Tel: 57279  
Cable: COMCO Kampala

**VIETNAM**  
Peninsular Trading Inc.  
P.O. Box H-3  
216 Hien-Vuong  
Saigon  
Tel: 20-805, 93398  
Cable: PENTRA, SAIGON 242

**ZAMBIA**  
R. J. Tilbury (Zambia) Ltd.  
P.O. Box 2792  
Lusaka  
Zambia, Central Africa  
Tel: 73793  
Cable: ARJATYEE, Lusaka

**MEDITERRANEAN AND  
MIDDLE EAST COUNTRIES  
NOT SHOWN PLEASE  
CONTACT:**  
Hewlett-Packard  
Co-ordination Office for  
Mediterranean and Middle  
East Operations  
Piazza Marconi 25  
I-00144 Rome-Eni, Italy  
Tel: (6) 59 40 29  
Cable: HEWPAKCT Rome  
Telex: 61514

**OTHER AREAS NOT  
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Export Trade Company  
3200 Hillview Ave.  
Palo Alto, California 94304  
Tel: (415) 493-1501  
TWX: 910-373-1287  
Cable: HEWPAK Palo Alto  
Telex: 034-8300, 034-8493