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# basic EXCHANGE

Series 80 Comes On Strong

"Series 80" refers to the entire HP personal computer product line including mainframes, peripherals, and software. The term is based on the mainframe product numbers—the HP-85 and now the HP-83. The new HP-83 is completely compatible with the HP-85; interfaces, ROM's, and all else are interchangeable between these two

products. In fact, they are identical except that the HP-83 does not come with an integrated tape cartridge drive and an integrated thermal printer. It is designed for business and technical professionals who require disc storage and a high-speed, full-width printer and have no need of the tape drive and thermal printer built into the HP-85. The HP-83 saves about a thousand dollars in the cost of their systems. The two functional additions to the HP-83 are autostart from disc and peripheral paper advance control from the keyboard.

The HP-83 and three new application pacs are our latest efforts in broadening the solutions we provide to professionals. The **Information Management Pac** and the **Graphics Presentations Pac** are additional business software we've developed to more completely meet the needs of business professionals. The third pac, **Surveying**, comprises generally useful routines for surveyors. Our plans are to develop more general software while independent software developers concentrate on highly specialized applications.

INFORMATION MANAGEMENT from Hewlett-Packard
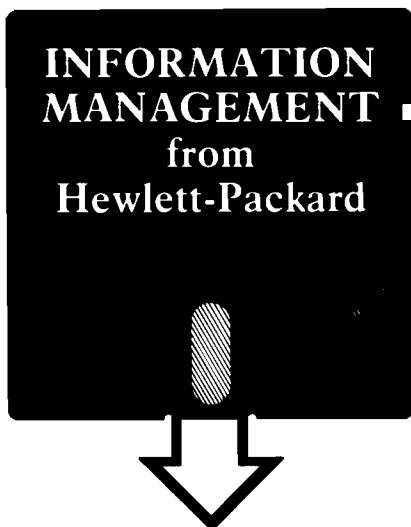
The Computer The Software The Mass Memory Device

If your work routinely involves decision-making, you can make a big impact on your daily performance by adding **IMPac** and an HP 82901M Flexible Disc Memory to your Series 80 system. **IMPac** is an all-purpose information management software tool to help you rapidly store, organize, access, and report large amounts of information. The

HP 82901M Flexible Disc Memory allows you to immediately jump to the file of your choice. This speed, combined with large storage capacity, gives you the freedom to explore many more combinations of data to reach better decisions.

The dual-drive configuration also gives you the flexibility to keep programs on one disc and data on the other so that different programs and data can be used interchangeably.

The major features and functions of the **Information Management Pac** are:

- Each record can be from 20 to 1,024 bytes long.
- Up to 10,000 records can be handled.
- Each record can contain up to 99 elements, or fields.
- Fields can be defined as *Dollars, Alphanumeric,* and *Numeric-only.*
- Using the *CREATE* program, new fields can also be added to an existing master file, and existing fields can be renamed.
- The *UPDATE* program allows you to add new records, modify the values of fields in existing records, or delete entire records.
- The *SEARCH* program allows you to set as many as 15 conditions to use in locating records.
- File and record sizes can be changed after creation with the *EXTEND* program.

In addition, a querying system and a report writer are included, as well as sorting capabilities and data base statistics (like totaling). The pac also includes a program specifically for mailing lists.

But it is the graphics capabilities that take this pac beyond most personal computer data management systems. With **IMPac**, you can create line, curve, bar, and pie charts for use in reports and presentations. Thus, you can extend the

Rental Property Income Analysis
Example Situation
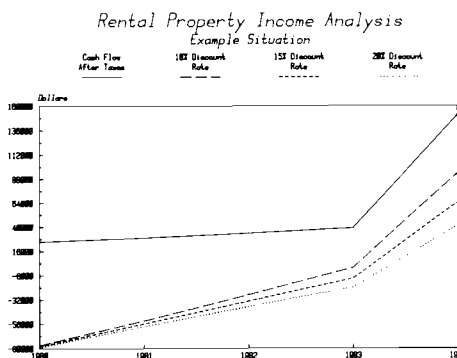
report writing capability of **IMPac** into graphs, charts, and tables with color and impact.

Finally, **IMPac** provides support as you use it with the *HELPER* program. *HELPER* acts as a mini-user's manual available whenever you use **IMPac**.

IMPac is a general-purpose data manager with many possible uses—client lists; product lists; the structural and processing characteristics of different plastics could be stored and accessed by engineers. In short, any activity that can categorize clients, accounts, products, items, or components by multiple fields can benefit from **IMPac**. Creating, updating, and printing customer mailing lists, inventory records, catalogs, and other data bases are quick and easy with these programs. ■

Graphics For Decision Making

by Bryan Butler, Product Manager
Hewlett-Packard, San Diego Division

There is a revolution going on in how business and technical professionals analyze data and make decisions. More and more people are using computer-generated graphics to turn complicated tables of numbers into easy-to-understand charts and graphs. Their goal is efficiency. For example, an article in *Business Week* magazine reported how the use of computer graphics has shortened meetings from 2-hours to only 20 minutes! But efficiency is not the only benefit. When presented graphically, trends or danger signs may be quickly spotted. The same article describes how General Mills credits their graphics exhibits with warning them of a dangerous disparity between sales and production growth. Quick reaction prevented a product shortage.

The common forms used for graphically displaying data should be familiar to readers of most news and business magazines. They are:

- Pie charts—for showing how components add up to a whole. Often two pies are shown side by side to highlight changes between two points in time.

- Bar charts—for comparing distinct values. Bars can be single, stacked, or clustered, depending on the data being presented.

- Line graphs—for plotting one variable against another. Often one of the variables is time, for spotlighting trends.

Whether drawn on paper for individual use or on overhead transparency film for group viewing, these graphic forms will improve the speed and quality of data analysis.

Once these high-quality graphics could only be produced by skilled artists, a costly and time consuming process. However, now with personal computer graphics, they can be produced in minutes, by you, without even having to write a single line of a program! And you already have at least one component of a computer graphics system—your Series 80 Personal Computer. The other necessary elements are: an HP 7225 Graphics Plotter with an HP 17601A personality module (interface); a 16K Memory Module; a Plotter/Printer ROM; an HP-IB interface; and **VisiCalc™ PLUS,** the **Graphics Presentations Pac,** or **IMPac.** ∎

VisiCalc™ is a trademark of Personal Software, Inc., and designates a software product produced under license from Personal Software, Inc. and Software Arts, Inc.

Graphics Presentations Pac

The **Graphics Presentations Pac** is a versatile set of programs that lets the user make four-color overhead projection transparencies or report copies of text, bar charts, pie charts, and line charts. Management reports, customer presentations, sales seminars and other meetings and reports can all benefit from the graphics this pac generates.

Property Operating Expenses

1980 Expense Summary
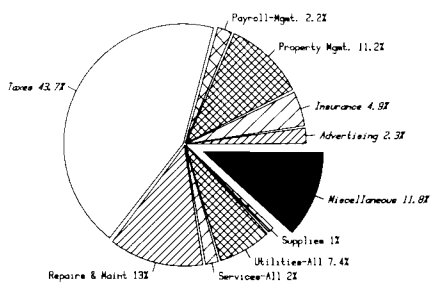
Even those who have never used a computer before discover it's easy to generate quality slides and charts with a Series 80 Personal Computer, a plotter, and the **Graphics Presentations Pac.** And right away! After creating a few slides and charts with the manual as a reference, you can proceed by following the instructions and messages contained in the program. For easy reference, brief descriptions of the various screen formats, called Help Numbers, are located in a section in the back of the manual.

The slide creation section of the manual shows many detailed examples of slides from start to finish. In addition to the creation of slides, the examples also cover some of the editing features and the storage capability built into the pac. The examples include a text slide, a pie chart, a line graph, and a bar chart. Situations unique to a particular type of slide or chart are demonstrated in these examples.

The **Graphics Presentations Pac** has the following features and capabilities:

TEXT MODE—nine letter sizes; three type styles that can be either upright or slanted; four pen colors; three alternative highlighting capabilities (centered, underlined, both) in addition to no highlight; and several special characters including many Greek letters and European characters.

PIE CHARTS—1 or 2 pies; 2 to 25 slices per pie (each slice can be exploded independently); 6 hatching (shading) types; 4 pen colors; 15-character labels; optional percentage labeling; and 32-character titles and subtitles.

BAR CHARTS—normal, clustered, or stacked bars; 1 to 25 bars (clusters); 6 hatching (shading) types; 4 pen colors; axes labels; and 32-character titles and subtitles.

LINE CHARTS—2 to 25 points; 6 line types; 4 pen colors; axes labels; and 32-character titles and subtitles. ∎

Surveying Pac

The **Surveying Pac** contains a set of programs chosen to aid surveyors in many of their most-often-encountered computations. This pac allows for fast and easy calculations, improves computational accuracy, and maintains coordinate point storage for easy recall of data. And by using an executive program, you have easy access between programs without losing stored data. The **Surveying Pac** also enables you to

manipulate up to 150 traverse points in a Series 80 Personal Computer. With the addition of the 16K Memory Module you can work with up to 550 points. These points can be entered, edited, or recalled for future use. And most of the programs contain graphics routines that let you plot data and layouts either right on the CRT or on a peripheral plotter.
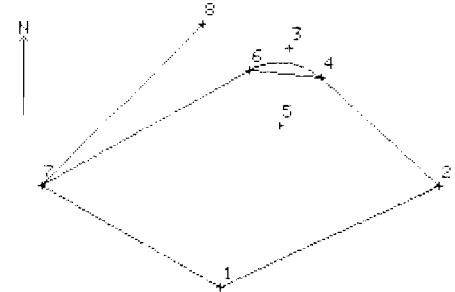
Programs included in the **Surveying Pac** allow you to:

- Reduce field data for traverses, inverses, and sideshots. Slope distances and curved sides may be included.
- Make traverse adjustments by compass, transit, or Crandall's Rule.
- Use closure routines to determine areas and distances traversed.
- Calculate coordinate transformations.
- Compute intersections and offsets from a point to a line.
- Solve universal triangles.
- Calculate horizontal curve layout, vertical curves, grades, and the parameters of circular curves.
- Compute earthwork volume using the method of Average End Area.
- Compute the volume of a Borrow Pit.
- Compute resection points and land parcels with predetermined areas. ∎

Toll-Free Number

We have a toll-free number for:

1. Locating the HP dealer nearest you.
2. Product or literature inquiries.
3. Service information.
4. Information on new product availability.

You may call 800-547-3400 excluding Alaska and Hawaii (in Oregon call 758-1010) between the hours of 6:00 a.m. to 6:00 p.m., Pacific Time, Monday through Friday. ∎

Application Pac	Required System Elements Using HP-83 As Mainframe	Required System Elements Using HP-85 As Mainframe
BASIC Training	A	
VisiCalc PLUS	A, C, F	C
graphics portion	A, B, C, F	B, C, D
Graphics Presentations	A, B, C	B, C, D
Information Management	A, C, F	A, C
graphics portion	A, B, C, F	A, B, C
Financial Decisions	A	
Linear Programming	A	
Text Editing	A, F	
Math	A	
Data Communications	A, E, C	E, C
General Statistics	A	
Basic Statistics and Data Manipulation	A	
Regression Analysis	A *	*
AC Circuit Analysis	A	
Waveform Analysis	A	
Surveying	A	
Games	A	

16K Memory Module Price Reduction

You can double system memory in Series 80 mainframes with an HP 82903A 16K Memory Module. It plugs into any one of the four ports in the back of the computer, adding 16K bytes instantly. Large data files and long programs can automatically take advantage of the new capacity. Several application pacs also require the memory module—refer to the Software/Hardware Matrix above. Oh yes, the new price is only $295.† ■

† All prices in this newsletter are U.S. prices excluding state and local taxes. For information outside the U.S. please contact the sales office or dealer nearest you.

Key:

A: HP 82937A HP-IB, HP 82900-Series Flexible Disc Memory or HP 9895A Flexible Disc Memory, HP 82936A ROM Drawer, HP Mass Storage ROM (00085-15001).
B: HP 7225 Plotter, HP 17601A Personality Module, HP Plotter/Printer ROM (00085-15002).
C: HP 82903A 16K Memory Module.
D: HP 82937A HP-IB, HP 82936A ROM Drawer, HP Plotter/Printer ROM (00085-15002).
E: HP 82939A Serial Interface, HP 82936A ROM Drawer, HP I/O ROM (00085-15003), Modem (any manufacturer's).
F: Printer recommended, HP Plotter/Printer ROM (00085-15002). (See your HP dealer for interfacing options.)
* Basic Statistics and Data Manipulation Pac.

The Ultimate Graphics Tool

by Rosemary Kramer, Sr. Advertising and
Sales Promotion Specialist
Hewlett-Packard, Greeley Division

The HP 9111A Graphics Tablet actually lets you draw on the graphics screen. As you move a pen-like stylus around the tablet, the tablet translates your movements into digital code and transmits the code to the computer. Points are entered whenever the stylus is pressed down or continuously while you draw. The HP 9111A acts as a cursor mover, bypassing the keyboard.

The HP 9111A Graphics Tablet comes with a software pac that includes a drawing utility, a graphics entry utility, and a planimeter utility program. The programs can be used as-is or incorporated into your own applications programs.

The drawing utilities help you create graphics with ease, executing all the graphic routines necessary right from the tablet. For example, you can create a drawing, store and retrieve it, and plot the drawing on the plotter using commands on the tablet. (There are those famous HP softkeys again.)

The capabilities provided by the software include:

- Drawing—a point entered can be interpreted by the program as the end of a line, center of a polygon, or corner of a rectangle.

- Freehand sketching—you can do freehand sketching or trace existing documents—drawings, diagrams, charts, or photographs. The graphics tablet continuously sends points to the program, which traces the movements onto the graphics screen.

- Erasing—once a drawing is in the computer, it can be easily modified. You need only to enter the changes, not redraw it.

  Scaling—take the entire drawing and scale it ... enlarge a portion or reduce it.

- Panning—pan across the entire drawing for a complete look at the picture. Shift up and down, right or left.

- Windowing—frame an area of the drawing by simply indicating two points, then the program will enlarge that framed area to fit the CRT.

Convert Graphics Into Data Files

If your application calls for quick data manipulation and graphical interpretation, and not the precise accuracy and high-resolution provided by larger digitizers, then the graphics tablet can provide the immediate answers you're after.

Through the HP 9111A's Graphic Data Entry Program, you can take existing graphical source documents—strip charts, maps, photos—and digitize them right at your desk into x-y-coordinates. Then you can analyze the data using other Series 80 software.

Accurate Measurement

Through the HP 9111A's Area/Distance Measurement Program, you can measure areas and the lengths of lines and curves with the mere press of the stylus. Just lay the document on the tablet. The program will calculate the scaled distance you move the stylus, or the area inside a figure you've traced.

Menuing

In addition to these applications, you can use the graphics tablet to pick from a menu. A menu is a customized keyboard which you design yourself. Simply draw it on paper, and place it on the tablet. Then, write a program to interpret the menu for the computer. For example, you can define one area of the tablet to display a phrase. When using the menu, all you'll have to do is press the stylus once in that area to enter the entire phrase. The HP 9111A has 16 softkeys across the top of the platen that can be used to represent the list of elements on your menu. If more elements are needed, the entire active platen area can be converted into menu areas.

Comfortable, Durable Design

The design is human-engineered for maximum comfort and reliability. The glass ceramic selected for the work surface is incredibly durable and will not scratch or pit. The axes lines and 16 softkeys are permanently fired into the platen surface. Our research proved that users prefer the comfort of a sloping surface to that of a flat pad. The resulting shape is convenient, comfortable, and completely self-contained.

On-Going Testing

The HP 9111A has the capability to perform extensive verification of proper operation. An electronic self-test is initiated by the computer every time the HP 9111A is powered on. Also, a series of tests take place on the internal hardware at power-up to help isolate any problems should they arise.

The graphics tablet and software require a 16K Memory Module, an HP-IB interface, and the Plotter/Printer ROM. To see just how the HP 9111A Graphics Tablet can add to your Series 80 graphics system, visit your local dealer for a dynamic demonstration. ■

Users' Library

Software Supplier Program

The Series 80 Software Supplier Program is now well under way. There are over a dozen suppliers currently in the program and, of these, three have products listed in the Catalog.

A fine example of what you can expect this program to produce is the structural

HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

engineering software available from **ECOM Associates, Inc.**, of Milwaukee, Wisconsin. ECOM has six structural design pacs in the Catalog for steel and concrete column and beam design as well as flat slab and plane frame analysis. Structural engineers should peruse the description in the *Series 80 Software Catalog*.

Binary Utilities

Binary programs can reside unobtrusively in memory with BASIC programs, adding powerful BASIC commands, statements, and functions to the repertoire built into the machine. With the equivalent of the Assembler ROM, our engineers have developed 23 binary programs that are now available to you through the Users' Library. These programs define about 100 BASIC key words that add some great new capabilities to your machine.

Suppose, for example, that you have to enter names into a data file—Jones, Harvey P. That comma makes life difficult because the INPUT statement thinks you have entered two names when it has only asked for one. If instead of INPUT, you use LINPUT, you can input any character including commas, quotation marks, and leading blanks—Green, "Mean" Joe. But before the program can execute the LINPUT statement, the binary program "LINKEY" must be in place. LOADBIN "LINKEY" is programmable, so this may be accomplished automatically in the BASIC program, unbeknown to the user.

"LINKEY" adds four other BASIC key words in addition to LINPUT. The KEY ON statement can be used to define any key on the keyboard as an immediate-execute key that will behave just like the soft keys, K1 through K8, built into the system. All or a subset of the keys so defined can be turned off using the KEY OFF statement. "LINKEY" also provides cursor control. MOVE CURSOR lets you move the cursor to any location on the display.

Remember, there can be at most one binary and one BASIC program in memory at one time. But the SCRATCHBIN command provided by "LINKEY" lets you erase the binary program without scratching the BASIC program. Since SCRATCHBIN is programmable, a BASIC program can erase one and load another binary program when necessary. Pretty tricky. And "LINKEY" only uses 889 bytes of memory!

Want to create your own typing aids? "SOFKEY" is a binary program that returns up to 96 characters with the touch of one

key. A special feature of the SOFT KEY statement is that you can optionally cause the string to be executed as a command immediately upon display, like AUTO, which is built into the system.

"PCOL" is a binary program that assigns the capabilities of the HP-85 graphics screen to the print-head of the built-in printer. "BPLOTB" provides two more extremely helpful graphics functions: a BREAD that reads groups of dots from the graphics screen and generates a corresponding character string; and a BPLOT that performs an OR (rather than an EXOR) with existing dots on the screen.

"GCURS" allows you to place the cursor on the graphics screen at specified coordinates, maneuver it around using the edit keys, and read the x-y-coordinates of the cursor location.

Normally, a Series 80 machine stores programs in its own unique internal language. DSAVE, provided by "DGTSAV", saves a program as string data, one program line per string. One use for "DGTSAV" that comes quickly to mind is transferring programs over the telephone. DGET loads a program previously saved with the DSAVE command or any string data file consisting of valid BASIC statements preceded by line numbers, stored one line per string. The program lines that are read into program memory are merged with any program lines already in memory. A line with the same number would replace the original line.

Here, then, is a way of having a program modify other programs or even itself. Note that DGET is not programmable, so that while a program can rewrite itself, it can't execute the new program. Still, you can do some interesting things, like packing programs using @'s to combine program lines, in order to pinch memory. DGET is also a convenient way to merge two programs.

"IPBIN" provides a high degree of control over the keyboard and the CRT. A few of the capabilities it provides are illustrated in the Dvorak and Dynatyper articles elsewhere in this issue. "IPBIN" would be an excellent choice for your premium selection. (See page 11.)

"STRNGB" enhances the string manipulation capabilities of your machine. With it, you can underline strings, reverse the order of string elements, rotate the elements, and delete leading and trailing blanks. You can even find the number of times a particular string occurs. And SAR$ (string expression, match string, replacement string) allows you to perform a search and replace operation, where the

match string will be replaced by the replacement string every time it occurs in the string expression.

In addition to these, there are statistical functions, math functions, and commands to re-dimension arrays and verify tapes. If you have access to a Hewlett-Packard desktop computer like an HP 9845A, there are binary programs that will help you transfer data and programs back and forth between systems. You can read all about the binary utility programs in the *Series 80 Software Catalog* (Catalog Nos. 900-0003 through 900-0024). They may be ordered from the Users' Library for $12† each plus media cost ($26 for tape and $18 for disc including the first program). Or, you can get all 23 recorded on either medium for only $150.

Moon and Stick People

An amazing program by **R. B. Goyer** of North Hollywood, California provides a half-hour of sheer enjoyment as your CRT becomes a window on a moonlit country scene. It's kind of a Currier and Ives cartoon—a snow-covered hillside with lots of people milling about, a barking dog, and smoke curling up the chimney. Imagine, animation on the graphics screen. You'll be continually surprised and delighted by Mr. Goyer's imagination.

The program requires the 16K Memory Module and uses every bit of it. In fact, you may have to remove your ROM drawer; even the small amount of RAM that some ROM's would allocate for their own use is used. You can get a copy from the Users' Library. Order program #900-0026, and I recommend you have it recorded on disc or tape; I can't imagine typing it in. Neither can I imagine what Mr. Goyer would do armed with the new graphics binary utilities and an HP 9111A Graphics Tablet. ∎

Revised O. S.

The HP-85 has been providing solutions for thousands of professionals with business and technical problems since its introduction in January of 1980. During that time the quality and reliability of the product have impressed even veteran HP customers—no small feat with a group that is not accustomed to settling for less than the best. Still, products of that complexity are never totally free of problems and the HP-85 is not without a few minor ones. The more serious operating limitations we've found are discussed below. Though few of you are likely to ever encounter them, you should be aware of their existence: 1)When a non-integer number is assigned to an integer variable, or is used as a parameter of a function requiring integer parameters, or is used as an array index, the number is first rounded by the HP-85. This rounding is done incorrectly in the range $-1 < X < +1$. In this range the number will always round to zero. 2) Short precision variables may round incorrectly. Real numbers in the range $.999995 \leqslant X \leqslant .999999999999$ round to .01 in short precision and real numbers in the range $-.999999999999 \leqslant X \leqslant -.999995$ round to $-.01$ in short precision. 3) When making string comparisons the HP-85 will always find a longer string to be greater than a shorter string, regardless of the characters in the strings, e.g., "Z" < "AA". 4) Comments following statements that include logical operators (AND, OR, NOT, etc.) can cause the HP-85 to stop accepting keyboard inputs. To regain control of the computer you may have to turn it off.

These anomolies in the HP-85's operating system have been eliminated and future HP-85's will be shipped with the revised operating system. All HP-83's also contain the new operating system.

You can determine which operating system you have by pressing the HP-85 TEST key and checking the characters printed at the end of the test. If the last two characters are RL, you have the revised operating system; earlier models will print OL.

If these anomolies are of concern to you in your applications there are ways to program around most of them. For information, give us a call at Corvallis Customer Service (503) 757-2000. If your applications depend heavily on these features you should consider having a revised operating system installed in your HP-85. This can be done by returning your computer to any Hewlett-Packard Field Repair Center. Before returning your HP-85 you should check with the repair center to make sure they have the parts on hand so there will be no delay. There will be no charge for installing the revised operating system. ∎

Dynatyper™

I recently had a chance to use Rochester Data's Dynatyper. Perhaps you've seen it advertised. Essentially, it is a mechanical interface to a typewriter, where solenoids actually press the typewriter keys. The idea has a lot of merit. Since the Dynatyper merely rests on top of the typewriter keyboard, you don't have to tamper with the typewriter and void the manufacturer's warranty. And you can get the ultimate in letter-quality, hard-copy output. It probably also represents the lowest cost alternative hard-copy device if you already have a typewriter.

The Dynatyper clearly shows how easy it is to interface Series 80 systems; some of you will find a look at how they did it informative and interesting. Note that this product is not available from, nor is it supported or endorsed by Hewlett-Packard. You may get more information directly from Rochester Data, Inc./3000 Winton Road South/Rochester, New York 14623/U.S.A.

The software driver is a BASIC program, as opposed to a binary program. This is only possible beacause of the powerful capabilities provided by the GPIO Interface and the I/O ROM. For example, the Dynatyper's logic requires about a 2-millisecond strobe pulse to latch the data, with positive-true logic for the data and negative-true logic for the strobe. All this is accommodated using three CONTROL statements.

In order to be typed, a character's ASCII code has to be converted into the 6-bit address of the appropriate solenoid. This is accomplished in one statement—
CONVERT OUT 4 PAIRS; X$.

Now you might think that a driver written in BASIC vs. machine language would be too slow, but the system types about 115 WPM (9.6 CPS), which is right up against the mechanical limitations of most typewriters. In fact, the driver uses another powerful feature of Series 80 BASIC, the WAIT statement, to slow down the operation.

The driver supports all the keys on the typewriter, including backspace and tab. It also provides for putting a pause symbol right in the text to permit changing line spacing or changing the typing element.

The driver is the smaller part of the software that comes from Rochester Data. The bulk of it makes the computer act like a smart typewriter when you're entering text.

When the computer is powered up, it displays the soft key assignments and asks what the margin width is to be. Then, when you type to within five spaces of the right margin, a "bell" rings; every subsequent keystroke causes a beep until END LINE is pressed. This feature makes margins independent of the size of the CRT and gets around wrap-around.

The program also includes some simple text editing features. You can use the edit keys to move the cursor around the screen, delete characters, and insert up to five characters per line. To accomplish this, the program uses the binary program "IPBIN." Becuase of this and because of the way their program is written, it's easy to incorporate the Dvorak keyboard conversion (below) into their program. Essentially, you would just replace line 150 of their program with lines 50-70 of the Dvorak listing. ∎

Dynatyper™ is a trademark of Rochester Data, Inc.

Dvorak Keyboard

The QWERTY keyboard found today on virtually every computer was developed in the 1870's for a klunky mechanical typewriter. The keys were actually arranged so as to slow down the typist to prevent the crude mahcine from jamming. Well, obviously, computers don't suffer any such mechanical constraints, but all attempts to supplant the *de facto* standard have failed.

What makes this all the more incredible is that a keyboard some 20 times more efficient was developed in the 1930's. The simplified keyboard was the fruit of 10 years of research and development by **Professor August Dvorak** at the University of Washington.

What you notice most when you type on a Dvorak keyboard is how infrequently you have to move your fingers off the home-row. All the vowels are positioned under the fingers on the left hand with the major consonants under the fingers on the right hand. In fact, Dvorak's statistics show that the total distance the fingers travel is reduced 95%. They also show that awkward keystrokes are reduced by 90%. Just think what that means to your error rate! The Dvorak keyboard attempts to use the fingers according to their strengths. It assigns the
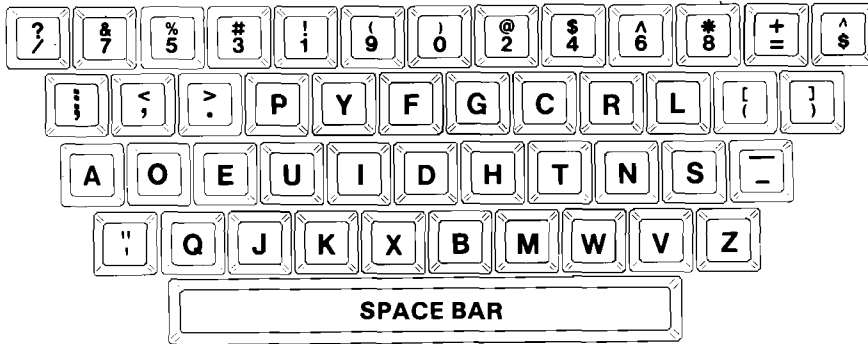
SERIES 80 DVORAK KEYBOARD

left hand only 44% of the work as opposed to the 57% the QWERTY keyboard does.

While looking over the binary programs in the Users' Library, it occured to me that "IPBIN" provides the statements and functions necessary to convert the standard HP-85 keyboard to a Dvorak keyboard. The BASIC subroutine listed below (which requires the binary "IPBIN") puts the keyboard in Dvorak mode whenever it is called. The routine can be modified and incorporated in other programs—text editors, for example.

You have probably noticed that the numbers on the Dvorak keyboard are also in different locations than they are on the standard keyboard. I recommend that you leave them in their QWERTY positions.(Just delete Z8$ from line 70). Remember that the modification uses a BASIC program that must be running for the Dvorak keyboard to be active, and this isn't always possible (e.g., when you're writing another program). Because the machine can't always be in Dvorak mode, it's nice to have the location of the symbols associated with the number keys (like #, $, &) in the same positions regardless of which keyboard is operational. Then, if you can touch-type on a QWERTY keyboard, you can just label the letter keys for Dvorak mode and move between keyboards with ease. You would expect numbers to occur randomly anyway, so it shouldn't matter much from an efficiency point of view where the number keys are positioned.

To use this subroutine, use a `GOSUB 7777` before every `INPUT` statement. For aesthetic reasons, you may also wish to use prompts in the form `DISP "____?"` instead of `DISP "____";`. `END LINE` must also be pressed twice rather than once, although you may do it rapidly. And just like on a teletype, a back space is effected by pressing `CTRL` `H` (`CTRL` `D` on the Dvorak keyboard).

```
10 DIM Z9$[192],Z8$[96],Z7$[96]
20 ON ERROR GOTO 40
30 LOADBIN "IPBIN"
40 OFF ERROR
50 Z8$="1/273543516970829406-8!
   ?@&#%$#%!^(&)*@_*\$!^"
60 Z7$="q:w<e>rptyyfugicorplsod
   eQ;W,E.RPTYYFUGICORPLSODEFUG
   IHDJHKTLN;S'-Z'XQCJVKBXNB,W.
   V/Z"
70 Z9$=Z8$&Z7$&CHR$(34)&"_z"&CH
   R$(34)&"fugihdjhktln:sxqcjvk
   bxnb<w>v?z"
100 DISP "DVORAK MODE"
110 DISP "NAME?"
120 GOSUB 7777
130 INPUT N$
140 DISP "THE NAME IS ";N$
150 GOTO 110
7777 ! SUBROUTINE DVORAK
7778 Z5=CCPOS
7779 ON KBD GOTO 7780 @ GOTO 777
     9
7780 CONVERT KBD PAIRS ;  Z9$ @
     Z6$=KBD$ @ IF Z6$=CHR$(154)
     THEN CCURSOR Z5-2 @ RETURN
7781 CDISP Z6$ @ GOTO 7779  ∎
```

Sorting

Sorting algorithms are all difficult to follow with their multiple indices and looping within loops. The bubble sort is the exception, which is probably why everybody knows about it. Conceptually, it's delightful—the smallest element "floats" to the top. The program only requires two indices, but the processing workload is horrendous and so is the execution time. In this article, we'll look at some other sorting techniques and discuss a way of deciding which one to use. There is no one "best" algorithm; the best one to use depends on the length of the list and the distribution and order of the list elements. But you don't have to immerse yourself in binary trees and other esoteric concepts to be able to choose a good sorting algorithm. You can use a more pragmatical approach.

A while back, I received a letter from **Eugene Hungate** of Elkhart, Indiana, that pointed out this approach. "On page 177 of the HP-85 Owner's Manual, a program is shown that sorts numbers using a method referred to as a 'bubble sort.' As a novice programmer, I used this technique for sorting. Recently, I have been introduced to a faster sort called the 'Shell-Metzner sort.' To find the speed advantage, I modified the program on page 177 to include some timing statements. I then changed the program to use the 'Shell-Metzner' technique. Sorting the integers 100 to 1 required 2.66 minutes for the 'bubble sort' and only .4 minutes for the 'Shell-Metzner sort.' " Programs for assessing the two algorithms using the internal timer are listed below.

```
10 OPTION BASE 1
20 DIM A(100)
30 DISP "HOW MANY NUMBERS";
40 INPUT N
60 FOR I=1 TO N
70 A(I)=N+1-I
80 NEXT I
90 Z1=TIME
100 FOR K=1 TO N-1
110 FOR M=K+1 TO N
150 IF A(K)<=A(M) THEN GOTO 190
160 R=A(K) @ A(K)=A(M) @ A(M)=R
190 NEXT M
200 NEXT K
220 Z2=TIME @ Z3=(Z2-Z1)/60
230 PRINT "HERE IS THE LIST IN I
    NCREASING ORDER"
240 FOR I=1 TO N
250 PRINT A(I);
260 NEXT I
270 PRINT
280 PRINT "SORTING TIME WAS";Z3;
    "MINUTES FOR BUBBLE SORT"
290 END
```

```
10 OPTION BASE 1
20 DIM A(100)
30 DISP "HOW MANY NUMBERS";
40 INPUT N
50 FOR I=1 TO N
60 A(I)=N+1-I
70 NEXT I
80 Z1=TIME
90 M=N
100 M=INT(M/2)
110 IF M=0 THEN GOTO 210
120 FOR S=1 TO M
130 I=S @ J=S+M @ Z=0
140 IF A(I)<=A(J) THEN GOTO 160
150 Z=1 @ R=A(I) @ A(I)=A(J) @ A
    (J)=R
160 I=J @ J=J+M
170 IF J<N+1 THEN GOTO 140
180 IF Z=1 THEN GOTO 130
190 NEXT S
200 GOTO 100
210 Z2=TIME @ Z3=(Z2-Z1)/60
220 PRINT "HERE IS THE LIST IN I
    NCREASING ORDER"
230 FOR I=1 TO N
240 PRINT A(I);
250 NEXT I
260 PRINT
270 PRINT "SORTING TIME WAS";Z3;
    "MINUTES FOR SHELL-METZNER S
    ORT"
280 END
```

The Shell-Metzner sort is a frequently used, very fast algorithm. Were the number of elements (N) increased, the difference would have been even more dramatic. While the number of comparisons made in the bubble sort goes up exponentially with the number of elements to be sorted, actually $(N**2-N)/2$ comparisons, the number of comparisons made in the Shell-Metzner sort is a linear function, about $10*N$. The number of reversals required in the Shell-Metzner algorithm is also linear, about $5*N$ for a normal distribution of elements, or about half the time.

Note that the number of reversals actually made in the test programs above would have been quite different were the list originally reversed (change line 60 to `A(I)=N+1-I`). Execution time would be different still if the array A were comprised of random integers with a normal distribution.

This leads us to the next algorithm. What if the list is already pretty much in order, like a mailing list with a few new additions? A routine published in the September 1980 issue of *BYTE* runs about 7 times faster than the Shell-Metzner sort when the list is ordered to begin with. And the algorithm is just a bubble sort, with a window! "The idea is so simple it cannot be new" says the author, **Paul Brady**. If you have programs that require ordered data in files, you can afford to call this routine even if nothing was done to disturb the order.

```
10  OPTION BASE 1
20  DIM A(100)
30  DISP "HOW MANY NUMBERS";
40  INPUT N
60  FOR I=1 TO N
70  A(I)=I
80  NEXT I
90  Z1=TIME
100 W=2 @ X=N
110 FOR I=1 TO N
120 T1=X @ X=0
130 IF W<2 THEN W=2
140 T2=W-1 @ W=0
150 FOR J=T2 TO T1-1
160 IF A(J)<=A(J+1) THEN GOTO 20
    0
170 T=A(J) @ A(J)=A(J+1) @ A(J+1
    )=T
180 X=J
190 IF W=0 THEN W=J
200 NEXT J @ IF X<=1 THEN GOTO 2
    30
220 NEXT I
230 Z2=TIME @ Z3=(Z2-Z1)/60
240 PRINT "HERE IS THE LIST IN I
    NCREASING ORDER"
250 FOR I=1 TO N
260 PRINT A(I);
270 NEXT I
280 PRINT
290 PRINT "SORTING TIME WAS";Z3;
    "MINUTES FOR WINDOW SORT"
300 END
```

There are also algorithms that are optimal when the list to be sorted is considerably disordered. For example, the September issue of *CREATIVE COMPUTING* contains a BASIC listing and a discussion of "Heapsort" that meets this contingency. However, with this particular test (i.e., just 100 numbers), the execution times were 2.70 and 4.16 minutes for A(1)=100 and A(1)=1, respectively. The important thing is that you fit the sorting algorithm to your data, and doing this simply involves timing the candidates. ■

Assembler ROM

This Assembler ROM makes it possible to write Assembly-language binary programs for HP-83/85 personal computers. These may be loaded into system RAM along with BASIC programs and will allow you to do such things as mentioned on page 6, where the binary utility routines available through the Users' Library are discussed. A binary program can be used to enrich the built-in BASIC language by providing new statements and system functions. You can tailor statements to your own purposes, using a binary program to take over and redefine built-in BASIC statements and functions. Using binary programs, you can expand I/O control and speed up I/O processes. You can even redefine the system, taking over system "hooks" to gain access to the operating system. This means you can implement languages other than BASIC. It also means that you can defeat the computer's internal safeguards and damage the machine, so you better know what you're doing. The Assembler ROM is primarily intended to help software developers create programs for Series 80 machines. The manual is not tutorial, but assumes a knowledge of programming in assembly language. The manual may be ordered separately (part number 00085-90444; $20.†) Assembler ROM part number 00085-15007; $295.†

The Assembler ROM permits entering and editing source code for binary programs right on the CRT. Automatic line numbering and cursor movement are active, and the source code can be stored on a tape cartridge or disc, listed, and edited in much the same way a BASIC program is stored, listed, and edited. As source statements are entered, they are automatically checked for syntax errors and duplicate labels.

At assembly time, the resulting object code (machine language) is stored on a tape or disc. This object code can also be loaded automatically or on command into the HP-83/85, ready to run.

Included with the Assembler ROM (on both tape and disc) is a global file of HP-83/85 system labels and their memory addresses, providing entry points into many powerful routines that are resident in the operating system. The tape and disc also contain useful sample programs to help illustrate how binary programs are created.

The Assembler ROM also contains all driver routines necessary for using the System Monitor, an optional plug-in module. The System Monitor is NOT required, but it makes debugging binary programs much easier. With it, you can set two breakpoints that interrupt program execution. Once execution has been halted, you can examine and change the contents of memory. You can also execute one instruction at a time, single-stepping through a program; you can even trace program execution, printing the status of the CPU after each instruction. ■

Disc Handling

by **Rick Spangler, Manufacturing Engineering Manager Hewlett-Packard, Greeley Division**

The media we supply for use in our flexible disc drives are produced for us by media manufacturers. We have tested more than a dozen different brands over a 3-year period and learned that there is a wide range of performance between brands and that characteristics may vary from one shipment to the next.

The vendor qualification testing for the 5¼-inch disc has been in progress for over a year. We have tested six different brands so far and have only found one that will meet our specifications. The graph shows the results of the wear tests. The curve for each vendor shows the percentage of discs of that type that are likely to fail before a given number of revolutions in the drive. For

WEAR LIFE

Legend:
- VENDOR A
- VENDOR B
- VENDOR C
- VENDOR D
- VENDOR E
- VENDOR F
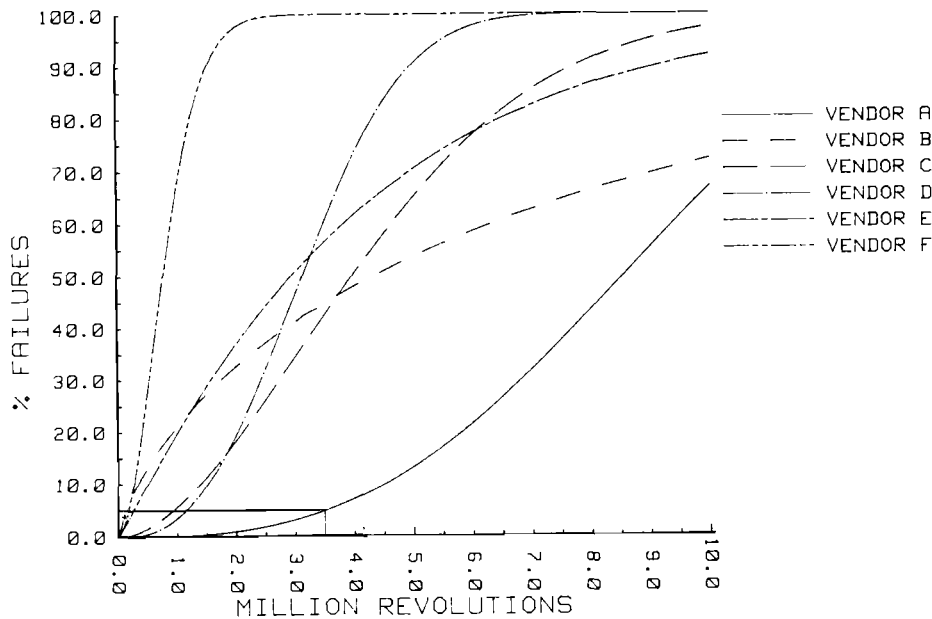
acceptance, we require that no more than 5% are likely to fail before 3.5 million revolutions (about 200 hours).

Media wear is critical to the reliability of flexible disc drives. The single most important way to optimize your success with floppies is to treat the disc carefully. The magnetic coating on the surface of the disc is only 100 microinches (.025mm) thick, so the smallest scratch can kill it. And the thickness of a fingerprint or a smoke particle is enough to lift the head off the disc and cause errors. The double-sided drives are much more susceptible to this type of failure than single-sided drives. Here are some specific DO's and DON'T's to protect your disc.

Do

Return the Disc to the Storage Envelope When Not In Use.

The disc is not a frisbee; don't throw it around. If it's laid on a desk unprotected, it will collect dust, which can accumulate under the head and plow away the disc's magnetic coating. This is the most common cause of media failure. .

Remove the Disc From the Drive When Not In Use.

This is very important on 8-inch drives because whenever the disc is in the drive, it will rotate even if it is not being accessed. In all drives, this rotation causes wear between the disc and particles trapped in the jacket. In the case of the double-sided drive, the lower head is lightly in contact with the disc, causing "unloaded" wear.

Operate Your System in a Clean Environment

A dirty environment is deadly to a floppy disc, causing both data errors and premature wearout. The most common contaminates are dust, smoke, ashes, erasure crumbs, bread crumbs, and chemical vapors (and occasionally volcanic ash).

Maintain Proper Temperature and Humidity

The proper operating range is 10° to 40° C and 20% to 80% relative humidity. Temperature and humidity variations cause the disc to expand, which moves the head off of the track. High humidity reduces the disc's wear characteristics, and low humidity allows static buildup, which attracts dust. We always see more media failure during the winter in cold climates — the result of low indoor humidity.

Don't

Don't Touch the Magnetic Surface.

Fingerprints are killers, particularly on double-sided discs.

Don't Damage the Disc (obviously).

Label the disc with a soft felt-tip pen. Don't bend, fold, mutilate, etc. (I saw one disc with a label stapled to it!)
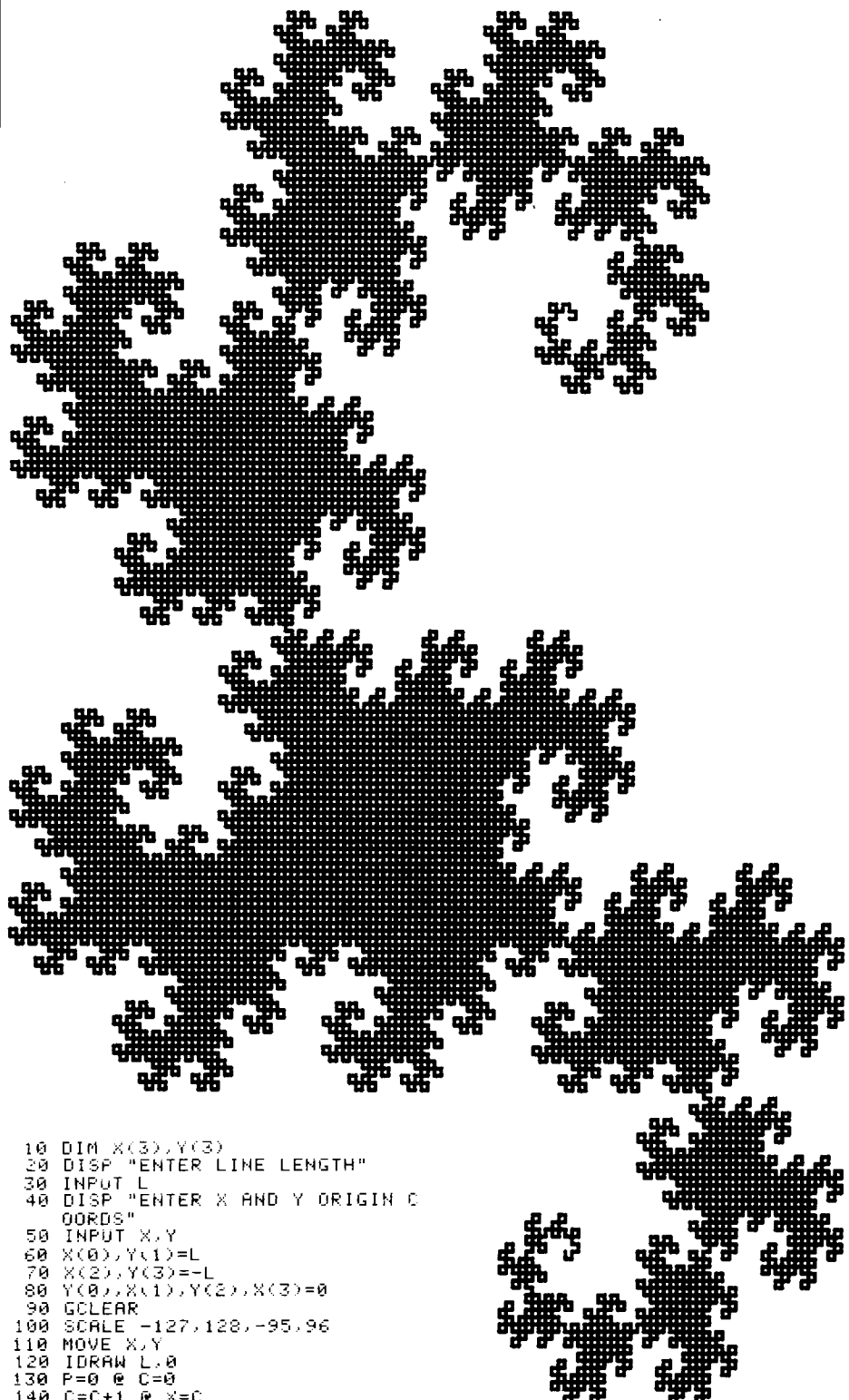
Don't Try to Clean a Disc.

The inside surface of the disc jacket is covered with a special material that cleans the disc as it rotates. Any other cleaning method may cause solvent damage or scratches.

Eventually the disc will wear out. It's bad enough that you lose your disc and its data when it dies, but if left in the drive, an abrasive layer of disc material can build up on the head. This can cause damage to other discs.

Two more procedures are therefore necessary for successful operation. First, always backup critical data. Second, replace discs before they approach wearout. The frequency with which discs should be replaced is difficult to pin down because it is dependent on how much the disc is used. The discs are designed to give several million revolutions of life under normal conditions, but they add up fast. ∎

Dragon Curve

Some time ago, **William J. Butler Jr.** of Warwick, Rhode Island, shared a philosophy with me that I tend to agree with. He said he found the first issue interesting, as linear programming is one of his pet topics, but "... an in-place matrix inversion may mean something to a limited number of mathematicians, but virtually everyone seems to be dazzled by the BLINK, FLASH, and TWINKLE of computer graphics. The enclosed program displays a Dragon Curve — the result of repeatedly folding a piece of paper and then partially unfolding it so that the creases form 90° angles. A line length of 1 and an origin of −30,50 is virtually guaranteed to distract the user for quite some time."

Questionnaire

On the back page, you'll find some questions that will help us to know who you are and what you want. My first priority is to make *BASIC EXCHANGE* interesting, but what's interesting to you? Bit mechanics? Payroll accounting?

It is important for you to understand that the best newsletter is a two-way medium. The users' newsletter is also your communication channel to us! If we hear from you, not only will the newsletter contain what you want to read about, but our new products will be a reflection of what you want, too.

Now I'm sure you all realize that without hard data *BASIC EXCHANGE* can't be steered by users, but we're all only human, and questionnaires usually don't get returned. So to help ease the pain, we've spiced the deal with a premium—your choice of any program in the Users' Library (listing only). Indicate your choice right on the questionnaire, and return it by May 1st. If you want it recorded on disc or tape (as a binary program must be), you must order another program at the regular Users' Library price to cover the cost of the medium. The program you choose for your premium will be recorded with it free.

If you don't want to tear off the back page, just return a photocopy of the questionnaire. Send it to Curtis Adams, Editor/Hewlett-Packard Co./1000 N.E. Circle Blvd./Corvallis, OR 97330. ∎

```
10 DIM X(3),Y(3)
20 DISP "ENTER LINE LENGTH"
30 INPUT L
40 DISP "ENTER X AND Y ORIGIN C
   OORDS"
50 INPUT X,Y
60 X(0),Y(1)=L
70 X(2),Y(3)=-L
80 Y(0),X(1),Y(2),X(3)=0
90 GCLEAR
100 SCALE -127,128,-95,96
110 MOVE X,Y
120 IDRAW L,0
130 P=0 @ C=0
140 C=C+1 @ X=C
150 IF X MOD 2=0 THEN X=X*.5 @ G
    OTO 150
160 IF .5*(X-1) MOD 2=0 THEN P=(
    P+1) MOD 4 ELSE P=(P-1) MOD
    4
170 IDRAW X(P),Y(P) @ GOTO 140
180 END
```
∎

1. Occupation:

2. Professional Affiliations:

3. Age (optional):

4. Level of Computer Expertise:

   1 2 3 4 5 6 7 8 9 10
   beginner   expert

5. How many application pacs do you own?

6. Do you modify them? Program at all?

7. What applications would you like to see developed?

8. Do you have
   a plotter?
   a disc?
   any ROM's?
   16K Memory Module?
   other peripherals?

9. Did you purchase your computer or did your company?

10. Do you use it at home or at work? Or both?

11. How many people use your machine?

12. Do you own other computers or programmable calculators?

13. Rank the functions the newsletter serves for you.
    (1 = most important)
    _____ Entertainment
    _____ Increase Efficiency
    _____ Education/Personal Growth
    _____ Exposure to Other Fields
    _____ A Source of Practical Programs
    _____ Improving Programming Techniques
    _____ Information on new products

14. What would be the subject of a special (dedicated) issue you would like to see published?

15. Have you tried using any of the programs published so far?

16. Why do you use an HP-85 computer in particular?

17. What are your primary applications?

18. What would you consider the most desirable improvements to the HP-85?

19. What is your orientation? (check one or more)
    _____ computers
    _____ science
    _____ _____ engineering
    _____ academic
    _____ business
    _____ other

20. What do you read?
    _____ technical journals
    _____ trade journals
    _____ business magazines
    _____ popular sci/tech mags.
    _____ science fiction
    _____ other _____

21. Do you share *BASIC EXCHANGE* with your colleagues?

22. Would you like to see more price information included?

23. Would you like to see articles about unique users' applications?

24. Rate the articles that have appeared in the first three issues (1 = liked best; 3 least)

V1N1	V1N2	
_____	_____	*Software Highlight*
_____	_____	*Hardware Highlight*
_____	_____	*Communique*
_____	_____	*Hardware Domain*
_____	_____	*Software Domain*
_____	_____	*Further Reading*
_____	_____	*Users' Library*
_____	_____	*Quick Routines*

V2N1

_____ Assembler ROM
_____ Moon and Stick
_____ Surveying Pac
_____ IMPac
_____ Graphics Pres. Pac
_____ Sorting
_____ Disc Handling
_____ Binary Utilities
_____ Dynatyper
_____ Dvorak Keyboard
_____ Graphics Tablet
_____ Dragon Curve

25. Please send me the following Users' Library program for my free premium for completing the questionnaire:

HEWLETT PACKARD

Address Correction Requested
Return Postage Guaranteed

Printed in U.S.A.