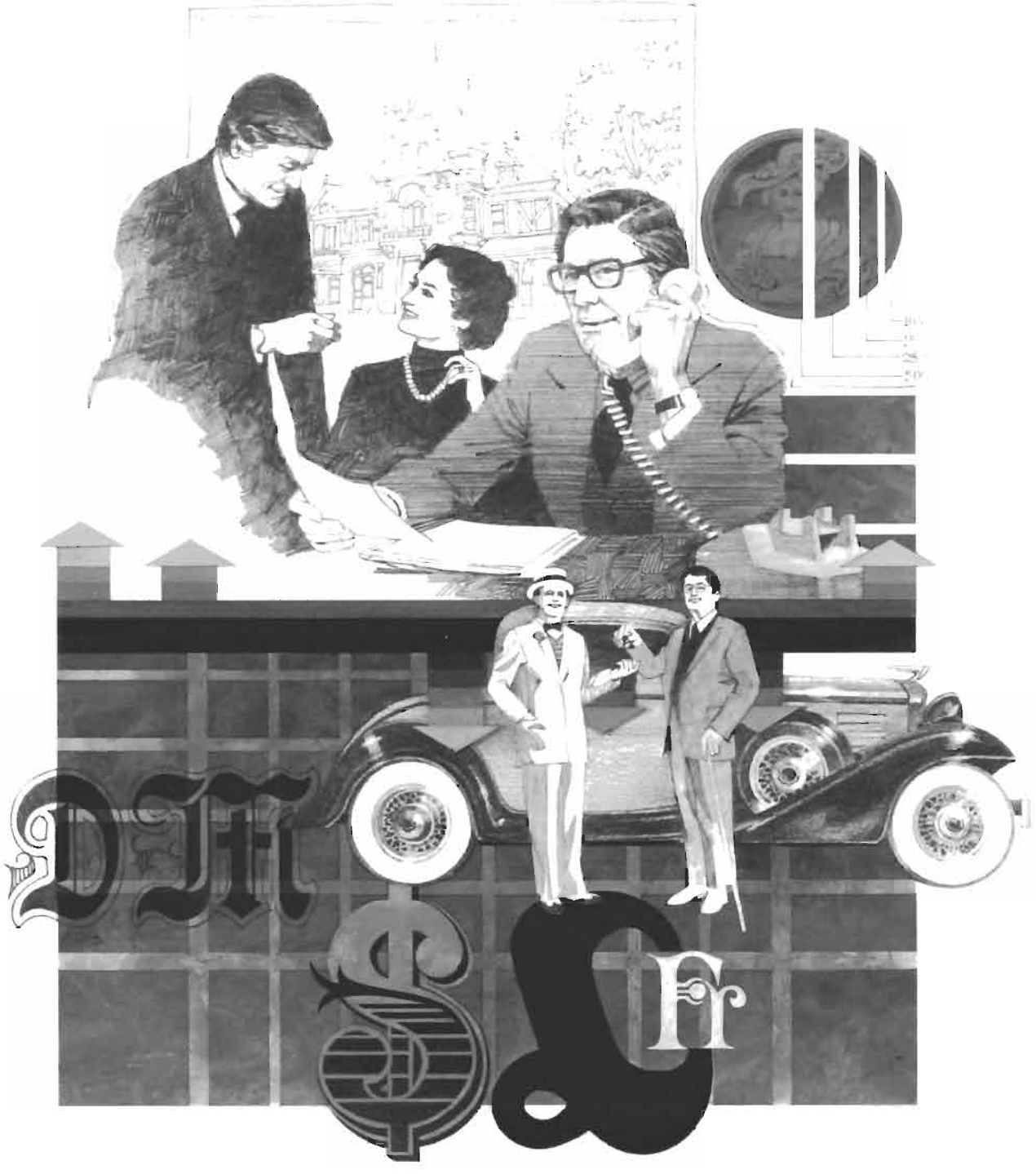
HEWLETT-PACKARD

HP-85

FINANCIAL DECISIONS PAC



Hewlett-Packard Intercontinental
3495 Deer Creek Road
Palo Alto, CA 94304
(415) 856-1501

HPSA
7, rue du Bois-du-Lan
P.O. Box
CH-1217 Meyrin 2
Geneva, Switzerland
(022) 82 70 00

Hewlett-Packard
1000 N.E. Circle Blvd.
Corvallis, OR 97330
(503) 757-2000

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Financial Decisions Pac

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Introduction

The Financial Decisions Pac has been designed to provide you with immediate solutions to a wide variety of financial decision-making problems.

The pac contains eight programs and offers problem-solving capability in the following areas: compound interest and loan amortization, discounted cash flow analysis (IRR, NPV, FMRR), depreciation, simple interest and interest conversions, price and yield for bonds and notes, break-even analysis, and odd days interest.

For each program in the pac the manual contains a program description, a set of User Instructions and a number of example problems. Each program also contains a set of guidelines which summarizes information in the manual and explains special features of the program.

The pac includes three programs for solving compound interest problems. These are: Compound Interest and Loan Amortization, Discounted Cash Flow Analysis, and Odd Days Interest. Before using these programs we suggest that you read the section titled *Compound Interest Solutions: The Cash Flow Diagram and Sign Convention*. By using the concepts presented in this section, you can easily reduce your most complex investment problems to a time series of positive and negative cash flows.

You do not need a knowledge of programming to use the Financial Decisions Pac, however, you should be familiar with sections 1 through 5 of the Owner's Manual. If you are a programmer, you may want to make use of the pac's Remarks program, which contains program listing comments and variable definitions to aid you in following program flow. Appendix A contains the principal financial formulas used in the pac and Appendix C contains User Instructions for the Remarks program.

We hope that the programs in the Financial Decisions Pac prove helpful in solving your financial decision-making problems.

Contents

Format of User Instructions

The User Instructions are your guide to operating the programs in this pac.

Certain key words have been used to indicate specific types of operations. You should become familiar with the meanings of these words so that the intent of the User Instructions can then easily be followed.

Key Word	Meaning/Use
INSERT	Put the tape cartridge into the tape transport
PRESS	Push an immediate execute key, e.g., [END LINE] or [RUN]
TYPE	Push a series of keys which form a command, e.g., Type: [REW LOAD] "MONEY"
ENTER	Push a series of keys as a response to a machine prompt, e.g., Enter: The number of compounding periods [END LINE].
GO TO Step n	Change the flow in the User Instructions
REPEAT	Designates a repeatable group of instructions
NOTE:	Extra comments concerning instructions for this step
TOGGLE	Push a special function key to alternate between two program operation modes.

The User Instructions are written in outline form so that you can easily follow the instructions and the flow of operation.

Whenever a special function key is labeled HELP, the program includes a "HELP" section which displays a short description of the function of each special function key. Whenever a key is labeled GUIDE, or DISPLAY GUIDELINES? is displayed, summary information from the program description and User Instructions is presented to aid you in solving your problems. After solving a few problems using the written User Instructions, you should be able to solve problems rapidly, referring only to the program "HELP" and "GUIDELINES" to refresh your memory.

The program flow will often ask for a "YES" or "NO" answer to a question. A "YES" answer requires that you enter Y or YES before pressing [END LINE]. However, you may answer "NO" simply by pressing [END LINE]. Entering N or NO beforehand is optional.

Program Operation Hints

These programs have been designed to execute with a minimum amount of difficulty, but problems may occur which you can easily solve during program operation. There are four different types of errors or warnings that can occur while executing a program: input errors, math errors, tape errors and image format string errors.

The input errors include errors 43, 44, and 45. All of these errors will cause a message to be output followed by a new question mark as a prompt for the input. You should verify your mistake and then enter the corrected input.

The programs will not proceed until the input is acceptable. There is a more complete discussion of INPUT in your Owner's Manual.

The second type of error that might occur is a math error (errors 1 thru 13). With DEFAULT ON, the first eight errors listed in Appendix E of your Owner's Manual cause a warning message to be output, but program execution will not be halted. The cause of these errors can usually be attributed to specific characteristics of your data and the type of calculations being performed. In most cases, there is no cause for alarm, but you should direct your attention to a possible problem. An example of such a case is found in the Standard Pac when the curve fitting program computes a curve fit to your data which has a value of 1 for the coefficient of determination, r^2. The computation of the F ratio results in a divide by zero, Warning 8.

The third type of error, tape errors (60 thru 75), may be due to several different problems. Some of the most likely causes are the tape being write-protected, the wrong cartridge (or no cartridge) being inserted, a bad tape cartridge, or wrong data file name specification during program execution. Appendix E of your Owner's Manual should be consulted for a complete listing. After correcting the error, press (CONT) to resume program execution.

The fourth type of error is due to generalizing the output to anticipated data ranges. In many cases, the output has assumed ranges which may or may not be appropriate with your data. Adjusting the image format string for your data will solve this type of problem. You may also want to change the image string if you require more digits to the right of the decimal point.

Whenever a running program is interrupted from the keyboard by inadvertantly pressing a key, the system beeps. To continue program execution, press (CONT).

The Financial Decisions Pac programs define the output peripherals in the standard manner: i.e., CRT is 1 and printer is 2 and uses PRINT and DISP statements accordingly. If you want to ensure that the peripherals are defined as the programs assume, press (RESET) before running a program. The currently defined key labels are obtainable at any time while a program is running by pressing (KEY LABEL). Remember to press (CLEAR LINE) before pressing (END LINE) if the key labels are in the input line. All files on the Financial Decisions Pac cartridge have been secured using a code of HP and a security type of 2. To store a changed version of a program, you must first unsecure the file using HP as the security code and 2 as the security type.

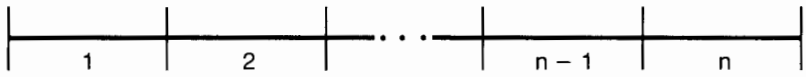
These are the more common problems which may occur during program operation. Your Owner's Manual should be consulted if you need more assistance.

Compound Interest Solutions:
The Cash Flow Diagram and Sign Convention

The most universal financial calculations involving time, money and interest rates are the compound interest functions. Although the functions have been known for hundred of years, their use has been restricted by the need for complicated tables until the advent of high-speed digital computers.

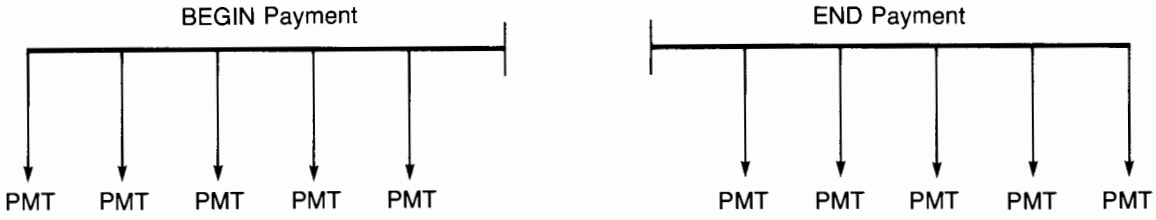
The five variables which have become standard for formatting and describing most compound interest problems can best be explained by referring to a pictorial representation called the cash flow diagram.

The diagram begins with a horizontal line called the time line. It represents the duration of a financial problem and is divided into *n* compounding periods of equal duration (length).



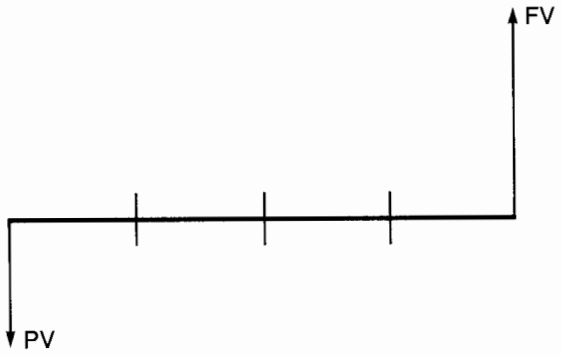
Exchange of cash is represented with vertical arrows. Cash received is represented by an arrow pointing up (positive) from the time line where the transaction occurred and cash paid out is represented by an arrow pointing down (negative).

Payments (*PMT*) represent a series of cash exchanges of the same direction and amount. In the standard cash flow diagram the payments occur coincidental with the compounding periods and are equal to the number of periods. The payments can either occur at the beginning of the period (BEGIN) or at the end of the period (END).



It is always necessary when working compound interest problems involving payments (*PMT*) to specify which of the two possible payment streams is applicable, BEGIN or END. In the parlance of various industries BEGIN payments are often referred to as annuity due, or first payment in advance. END payments are referred to as ordinary annuity or payment in arrears.

A single cash flow at the start of the time line is called the present value (*PV*). A similar single cash flow at the end of the time line is called the future value (*FV*).



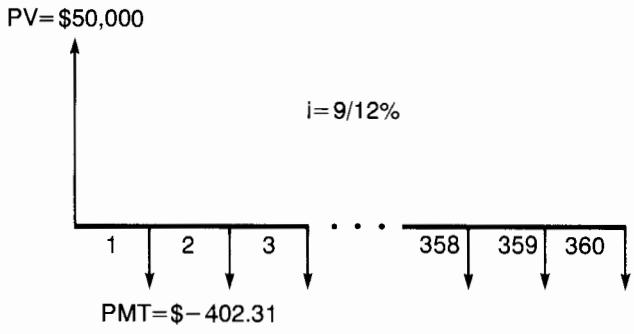
The fifth variable is i, the compound interest rate per period.

The following examples demonstrate the five variables n, i, *PMT*, *PV* and *FV* and their use in the framework of the cash flow diagram to depict common compound interest problems.

Example:

Draw a cash flow diagram to depict the following transaction.

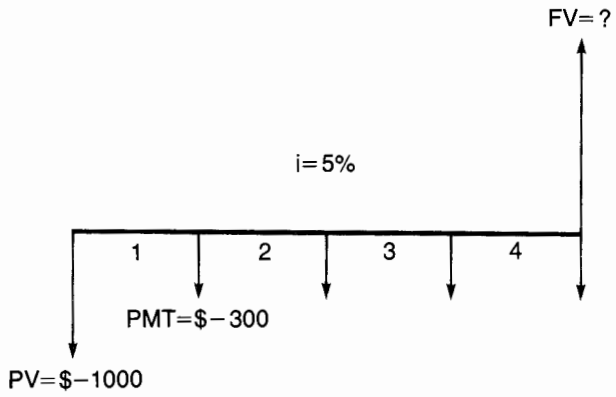
A payment amount of $402.31 is necessary to amortize a mortgage loan of $50,000 over 30 years. Payments are made monthly; interest is compounded monthly at .75% (9% annually) and the first payment is made 1 month after the exchange of the initial loan amount (END).



Note: *PV* is positive (arrow pointing up) because it represents cash received. *PMT* is negative (arrow pointing down) because it represents cash paid out. The use of positive and negative signs to represent the direction in which cash is exchanged is called the *cash flow sign convention*. It is important in eliminating ambiguity in analyzing various transactions.

Example:

What will be the balance in a savings account (*FV*) at the end of 4 years if an initial deposit of $1000 is made followed by 4 annual deposits of $300 (END)? Interest is compounded yearly at 5% (*i*).

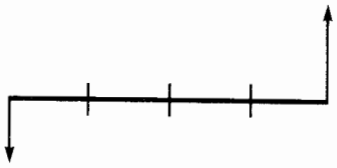


When using the cash flow diagram and the cash flow sign convention to format compound interest problems the following rules always apply.

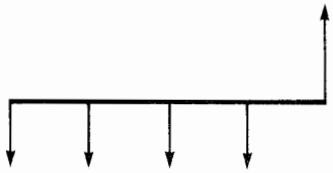
1. Both *n* and *i* must be present in a problem. Either both values are known, or one is known and the other is to be computed.
2. *n* and *i* must correspond to the same period of time.
3. Cash received (arrow pointing up) is represented by a positive value (+). Cash paid out (arrow pointing down) is represented by a negative value (−). A valid financial transaction must always include at least one positive cash flow and one negative cash flow.
4. When periodic payments (*PMT*) are involved, the type of payment stream (BEGIN or END) must be specified.

The cash flow diagram can be used to describe many variations of compound interest problems. Although the terminology used to describe a particular cash transaction may vary from industry to industry the cash flow diagram remains consistent. In providing a means of describing financial problems without using terminology specific to a particular segment, the cash flow diagram becomes, in a sense, a universal language.

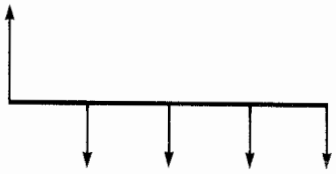
Six variations of the basic diagram are presented below. Under each diagram are listed a number of the more common industry terms used to describe the represented cash exchange.



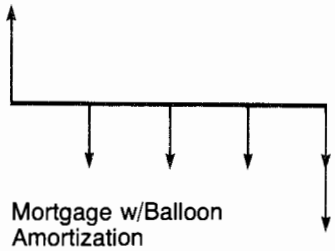
Compound Growth
Savings Account
Appreciation



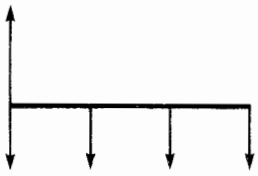
Savings Plan
Pension Fund
Annuity Due



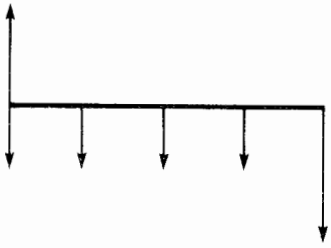
Mortgage
Direct Reduction (Installment) Loan
Amortization
Ordinary Annuity



Mortgage w/Balloon
Amortization
Ordinary Annuity



Lease
Amortization
Annuity Due



Lease w/Buyback (Residual)
Amortization
Annuity Due

Compound Interest and Loan Amortization

This program will allow you to solve a variety of problems involving time, money and interest rates. The following five financial variables may be inputs or outputs:

n, the number of compounding periods. (For a 30 year loan with monthly payments, $n = 12 \times 30 = 360$.)

i, the periodic interest rate expressed as a percent. (For other than annual compounding, divide the annual percentage rate, or APR, by the number of compounding periods per year, i.e., 9% APR compounded monthly equals 9/12 or 0.750%.)

PMT, the periodic payment amount.

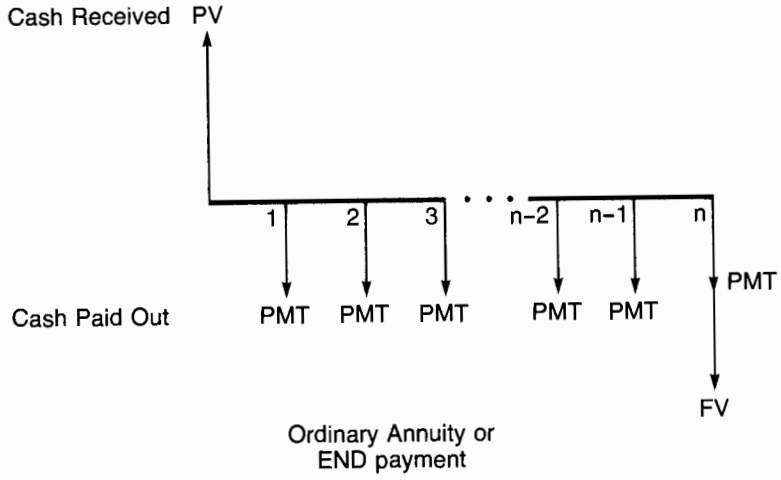
PV, the present value; the initial cash flow or the discounted value of a series of future cash flows.

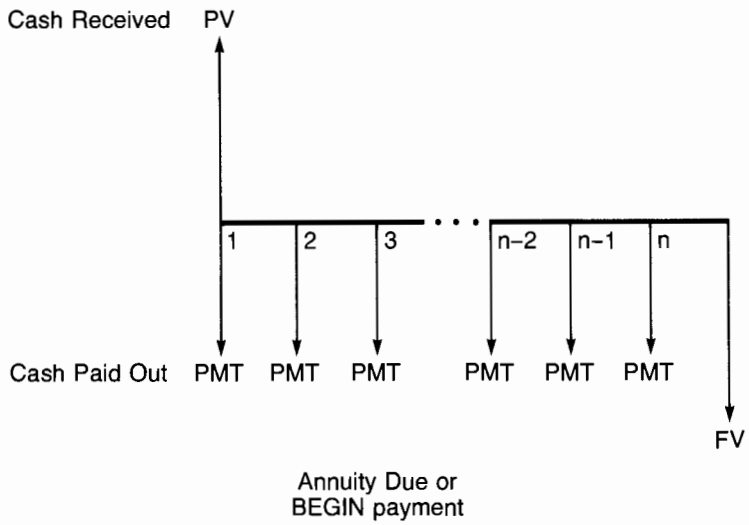
FV, the future value; the final cash flow or the compounded value of a series of cash flows.

The program accommodates payments which are made at the end of each compounding period (END payment) or at the beginning (BEGIN payment). Payments made at the end of each compounding period (ordinary annuity) are common in direct reduction loans and mortgages while payments at the beginning of each compounding period (annuity due) are common in leasing.

Compound Interest

A cash flow diagram enables you to describe a compound interest problem in terms that the program can understand. Once you have drawn and labeled your cash flow diagram, simply enter the known values when prompted and solve for the unknown variable.





(For more information on cash flow diagrams, see *Compound Interest Solutions: The Cash Flow Diagram and Sign Convention*).

Solving for any of the five financial variables (*n, i, PMT, PV,* or *FV*) is easily accomplished. There are four rules to remember—rules that are the same for all compound interest calculations.

1. Given three or four of the financial variables (*n, i, PMT, PV,* or *FV*), you can solve for the fourth and/or fifth variables, as long as *n* and/or *i* are known. Both *n* and *i* must be present in a problem. Either both values are known or one is known and the other is to be computed.* Known values may be entered in any sequence.

2. *n* and *i* must correspond to the same period of time. For example, if *n* is measured in months, then *i* must be a monthly periodic interest rate.

3. The cash flow sign convention is used in all compound interest calculations (including amortization). Cash received (arrow pointing up) is represented by a positive value (+). Cash paid out (arrow pointing down) is represented by a negative value (−). A valid financial transaction must always include at least one positive cash flow and one negative cash flow.

4. Whenever payments (*PMT*) are involved, it is always necessary to specify whether the payments are made at the beginning of the compounding period (BEGIN) or at the end of the compounding period (END). Toggle KEY #6 to select the payment mode. The key label for the current mode is underlined.

Known values are entered by pressing the appropriate special function key and entering the value when prompted. To solve for the unknown variable, simply press the appropriate special function key and then press (END LINE).

Calculated values for *PMT, PV* and *FV* are rounded to the nearest cent before being displayed.

---

* The program uses all four variables to solve for the fifth. Zero is assigned to variables that have not been computed or entered since the variable values were last cleared.

Loan Amortization

Most mortgages and installment loans are called direct reduction loans. The debt is discharged by equal periodic payments paid at equal intervals. As each payment is received by the note holder, interest is calculated on the outstanding balance since the last payment, subtracted from the payment amount and the remainder applied to the balance. As the balance drops with each payment so does the interest. With a smaller portion of each payment being deducted for interest, the amount remaining to pay off the balance increases. The breakdown of each payment into the principal reduction portion and interest portion over the life of a loan is called an amortization schedule.

This program calculates the principal and interest portion of each periodic payment and the remaining balance after the payment has been made, for any series of equal periodic amortization payments from any first period to any last period.

Periodic payments may be made at the end of the compounding period (END payment) or at the beginning (BEGIN payment). Most loans are END payment and most leases are BEGIN payment. Toggle KEY #6 to select the payment mode. The key label for the current mode is underlined.

The periodic installment schedule generated is valid for loans that have a single large last payment (balloon) as well as for loans which are arranged to be fully amortized. For a loan with a balloon payment, the remaining balance of the last payment period is the balloon payment due. For BEGIN payment problems (annuity due), any remaining balance or balloon must be compounded for one period since it is due at the *end* of the last payment period.

For tax purposes and certain financial analyses, payments to principal and interest are desirable on an annual basis rather than on an individual payment basis. The amortization routine computes accumulated principal and accumulated interest from the first period to the last period and allows you to output these summary totals with or without the full amortization schedule.

Four variables (*n, i, PMT, PV*) are required to calculate a loan amortization schedule. After entering or solving for the necessary values, press KEY #7 (AMORT) to generate an amortization schedule for a specified number of periods.

User Instructions

1. To load the program:
   a. Insert the Financial Decisions Pac cartridge into the tape transport.
   b. Type: (REW LOAD) "MONEY" (END LINE)
2. When the program has been loaded:
   a. Press: (RUN)
3. When DISPLAY GUIDELINES (Y/N)? is displayed:
   a. Enter: Y (END LINE) to display the guidelines.
   b. Press: (CONT) when prompted, to continue.

   OR:
   a. Enter: N (END LINE) if guidelines are not needed.
4. When PRINT OR DISPLAY OUTPUT(P/D)? is displayed:
   a. Enter: P (END LINE) to print the output.

   OR:
   a. Enter: D (END LINE) to display the output.

Note: Contents of the display screen may be output to the printer at any time by pressing (SHIFT) (COPY).

5. When the keys are labeled:

```
--------------------------------
HELP    BEGIN/END   AMORT      FV
  n         i          PMT     PV
```

a. Press: KEY #5 (HELP) to display the key functions.

6. Toggle: KEY #6 (BEGIN/END) or (BEGIN/END) to select payment at the beginning of the period (BEGIN payment) or at the end of the period (END payment). The current mode is underlined.

7. To enter the known values, or solve for the unknown variable:

n:

a. Press: KEY #1 (n) to enter or solve for the number of compounding periods.
When NUMBER OF COMPOUNDING PERIODS? (PRESS END LINE TO SOLVE FOR n) is displayed:

1) Enter: The number of compounding periods (END LINE).

Note: Use algebraic operators to enter the value. Example: If the period length is one month, the number of compounding periods for a 25 year loan may be entered as 25*12 or 300.

OR:

1) Press: (END LINE) to solve for the number of compounding periods.
2) After the answer is displayed or printed, go to step 8.

i:

a. Press: KEY #2 (i) to enter or solve for the periodic interest rate.
When PERIODIC INTEREST RATE, PERCENT? (PRESS END LINE TO SOLVE FOR i) is displayed:

1) Enter: The periodic interest rate (END LINE) in percent.

Note: Use algebraic operators to enter fractional values. Example: If the period length is one month, and the annual interest rate is $9\frac{3}{8}\%$, the periodic interest rate is entered as: (9+3/8)/12

OR:

1) Press: (END LINE) to solve for the periodic interest rate.
When # OF COMPOUNDING PERIODS/YEAR? is displayed:
a) Enter: The number of compounding periods per year (END LINE).
2) After the answer is displayed or printed, go to step 8.

PMT:

a. Press: KEY #3 (PMT) to enter or solve for the periodic payment amount.
When PERIODIC PAYMENT AMOUNT? (PRESS END LINE TO SOLVE FOR THE PMT) is displayed:

1) Enter: The periodic payment amount (END LINE).

OR:

1) Press: (END LINE) to solve for the periodic payment amount.
2) After the answer is displayed or printed, go to step 8.

PV:

a. Press: KEY #4 (PV) to enter or solve for the present value.
When PRESENT VALUE AMOUNT? (PRESS END LINE TO SOLVE FOR PV) is displayed:

1) Enter: The present value amount (END LINE).

OR:

1) Press: (END LINE) to solve for the present value.
2) After the answer is displayed or printed, go to step 8.

FV:

a. Press: KEY #8 (FV) to enter or solve for the future value.
When FUTURE VALUE AMOUNT? (PRESS END LINE TO SOLVE FOR FV) is displayed:
1) Enter: The future value amount (END LINE).

OR:

1) Press: (END LINE) to solve for the future value.
2) After the answer is displayed or printed, go to step 8.

8. When CLEAR PROBLEM VALUES (Y/N)? is displayed:
   a. Enter: Y (END LINE) to reset the five financial variables to zero, and the payment mode to END payment (BEGIN/END).
   b. Go to step 5.

   OR:

   a. Enter: N (END LINE) to retain current variable values and payment mode.
   b. After the payment mode and variable values are displayed, go to step 5.

9. To compute an amortization schedule:
   a. Press: KEY #7 (AMORT).
   b. When PRINT OR DISPLAY OUTPUT (P/D)? is displayed:
      1) Enter: P (END LINE) to print the output.

      OR:

      1) Enter: D (END LINE) to display the output.

10. When FIRST PERIOD OF SCHEDULE? (INTEGER FROM 1 TO *n*) is displayed:
    a. Enter: The first period number (END LINE).
11. When LAST PERIOD OF SCHEDULE? (INTEGER FROM (first period) TO *n*) is displayed:
    a. Enter: The last period number (END LINE).
12. When SCHEDULE OR TOTALS ONLY (S/T)? is displayed:
    a. Enter: S (END LINE) to display or print the variable values and the amortization schedule for each period.
    b. The variable values, amortization schedule and summary totals are now displayed or printed.

    OR:

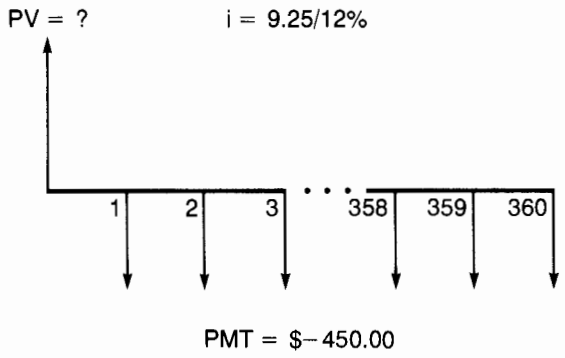
    a. Enter: T (END LINE) to display or print only the summary totals, over the selected time period, for principal, interest and remaining balance.
    b. The summary totals are now displayed or printed.
13. When CHANGE FIRST & LAST PERIODS (Y/N)? is displayed:
    a. Enter: Y (END LINE) to enter new first and last amortization periods.
    b. Go to step 10.

    OR:

    a. Enter: N (END LINE) if no more schedules or totals are desired.
    b. Go to step 8.

Example 1:

A borrower can afford a $450.00 monthly principal and interest payment on a 30 year, 9¼% mortgage. What is the largest such mortgage he can obtain? (Enter the number of compounding periods as `30 * 12`, and the periodic interest rate as `9.25/12`).



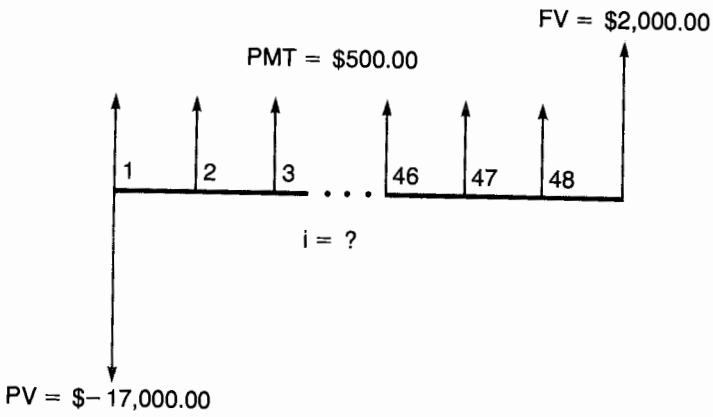

```
BEGIN/END
            n=          360.00
            i=            0.771 %
          PMT=$        -450.00
           FV=$           0.00

           PV=$       54699.58
```

If the mortgage required is only $53,500, what is the monthly payment? (Change the *PV* and solve for *PMT*).

```
BEGIN\END
            n=          360.00
            i=            0.771 %
           PV=$       53500.00
           FV=$           0.00

          PMT=$         -440.13
```

Example 2:

A construction firm owns some equipment worth $17,000. They intend to lease this equipment to another firm for 4 years with monthly payments, in advance, of $500.00. The equipment is assumed to have a salvage value of $2,000 at the end of the lease. What periodic interest rate and annual percentage rate (APR) does this represent? (Note that payments are made at the beginning of each period.)




```
BEGIN/END
          n=          48.00
        PMT=$       500.00
         PV=$    -17000.00
         FV=$      2000.00

          i=           1.833 %
        APR=          21.990 %
```

Example 3:

How much money must be set aside in a savings account each month in order to accumulate $4000 in three years if the account compounds monthly at 6% per year? The deposits begin immediately (BEGIN payment).

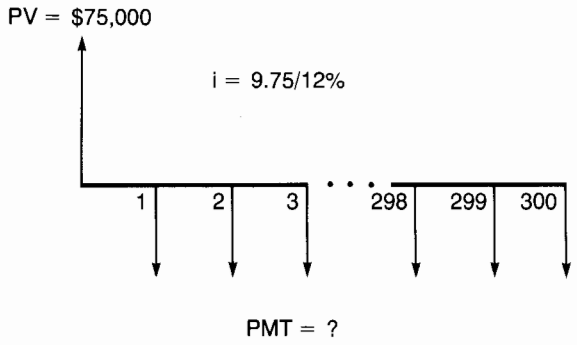
```
BEGIN/END
          n=          36.00
          i=           0.500 %
         PV=$          0.00
         FV=$       4000.00

        PMT=$       -101.18
```

What periodic interest rate and APR did the bank pay if the actual amount at the end of the three years was $4,025.50? (Change *FV* and solve for *i*. There are 12 compounding periods per year.)

```
BEGIN/END
          n=          36.00
        PMT=$       -101.18
         PV=$          0.00
         FV=$       4025.50

          i=           0.534 %
        APR=           6.403 %
```

Example 4:

What is the monthly payment required to fully amortize a 25 year, $75,000 mortgage, at an annual percentage rate of 9.75%? (Enter the periodic interest rate as: 9.75/12.)




```
BEGIN/END
            n=          300.00
            i=            0.813 %
          PV=$        75000.00
          FV=$            0.00

         PMT=$         -668.35
```

Generate an amortization schedule for the first 12 periods.

```
          AMORTIZATION SCHEDULE
BEGIN/END
            n=          300.00
            i=            0.813 %
         PMT=$         -668.35
          PV=$        75000.00
          FV=$            0.00

 P   PRINCIPAL  INTEREST    BALANCE

 1       58.97    609.38   74941.03
 2       59.45    608.90   74881.58
 3       59.94    608.41   74821.64
 4       60.42    607.93   74761.22
 5       60.92    607.43   74700.30
 6       61.41    606.94   74638.89
 7       61.91    606.44   74576.98
 8       62.41    605.94   74514.57
 9       62.92    605.43   74451.65
10       63.43    604.92   74388.22
11       63.95    604.40   74324.27
12       64.47    603.88   74259.80

TOTALS FOR PERIODS 1 TO 12 :
 PRINCIPAL    INTEREST     BALANCE

    740.20     7280.00    74259.80
```

What is the total applied to principal and interest, and what is the remaining balance, for each of the next four years?

```
TOTALS FOR PERIODS 13 TO 24 :
 PRINCIPAL    INTEREST     BALANCE

    815.70     7204.50    73444.10


TOTALS FOR PERIODS 25 TO 36 :
 PRINCIPAL    INTEREST     BALANCE

    898.87     7121.33    72545.23


TOTALS FOR PERIODS 37 TO 48 :
 PRINCIPAL    INTEREST     BALANCE

    990.54     7029.66    71554.69


TOTALS FOR PERIODS 49 TO 60 :
 PRINCIPAL    INTEREST     BALANCE

   1091.54     6928.66    70463.15
```

The remaining balance at the end of period 60 is $70,463.15.

This value may also be calculated by solving for the future value at period 60: (Change n to 60 and solve for FV).

```
BEGIN/END
            n=          60.00
            i=           0.813 %
        PMT=$         -668.35
         PV=$        75000.00

         FV=$       -70463.20
```

The remaining balance is $70,463.15, while the FV is $-70,463.20. (Cash flow sign convention is ignored in amortization schedule output.) The $.05 difference is due to the method of calculation. The FV calculation is direct, using the other four variables. By comparison, the amortization routine calculates the accumulated interest for each period, and rounds to the nearest penny before calculating the amount applied to principal, and then the remaining balance. It is this rounding in successive periods which produces the different value. In calculating the remaining balance on a loan, this method is considered more correct than the direct calculation of remaining balance by solving for future value.

Notes

Discounted Cash Flow Analysis

Discounted cash flow analysis is a method of evaluating investments which have uneven cash flows. This program will enable you to perform three types of discounted cash flow analysis: Internal Rate of Return (IRR), Net Present Value (NPV), and Financial Management Rate of Return (FMRR).

Entering Cash Flows

Cash flows may be entered individually, and the program will accept up to 100 equal or unequal cash flows, including the initial cash flow, or initial investment. Figure 1 is representative of problems with individual cash flows.

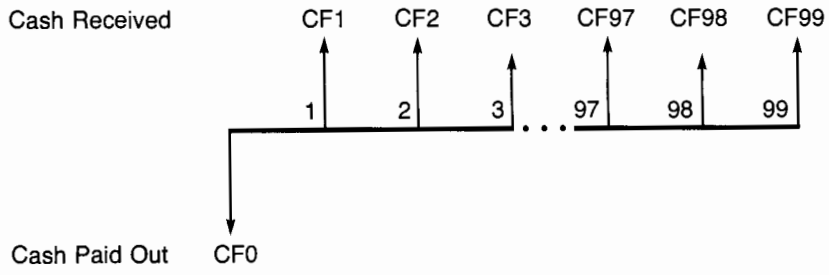


FIGURE 1

Cash flows may also be entered in groups of equal cash flows, and the program will accept up to 100 groups, including the initial group, each group having from 1 to 999 equal cash flows. Figure 2 is representative of problems with grouped cash flows. (For more information on cash flow diagrams see *Compound Interest Solutions: The Cash Flow Diagram and Sign Convention.*)

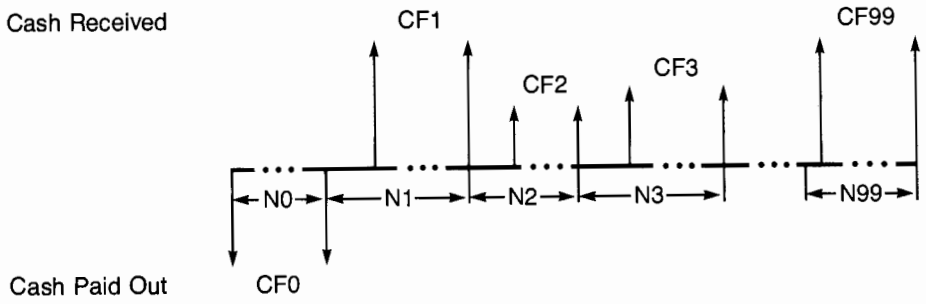


FIGURE 2

For individual cash flows, the initial cash flow (CF_0) occurs in period zero and may be treated as an initial investment. For grouped cash flows, the first cash flow in group zero (N_0) may be treated as an initial investment. If group zero has more than one cash flow, all except the first will occur in sequential future periods.

The cash flow sign convention is used when entering cash flows. A positive value represents cash received and a negative value represents cash paid out.

Zeros should be entered for periods or groups with no cash flows.

The program works with dollars and cents, and cash flow values cannot have more than 14 digits. The largest acceptable value is $999,999,999,999.49. After the cash flows have been entered, they are displayed. You may then perform any or all of the three types of discounted cash flow analysis in the program. You may display and then modify the cash flows by adding, deleting or changing individual cash flows or groups, and you may also print the cash flows or store them in a data file for future reference.

Internal Rate of Return

The Internal Rate of Return (IRR) is the interest rate which equates the present value of a set of future cash flows with an initial cash flow. The IRR is also called the yield or discounted rate of return.

When IRR is selected, a scanning routine examines the cash flows, to insure that an IRR calculation is feasible, before calculation begins. The IRR calculation requires that the cash flows change at least once from a negative value to a positive value or vice versa. This is called a sign change. Cash flows with multiple sign changes may have multiple answers.

Solutions to IRR will fall into one of the following categories:

Category 1: A unique IRR is calculated. The vast majority of solutions will fall into this category.

Category 2: There are possibly multiple IRR values. If there are multiple sign changes there may be more than one mathematically correct IRR. It is possible to continue the IRR calculation by making a guess for the interest rate and entering it as prompted. If an answer can be found near your guess, that answer will be displayed. You can hasten this process by using NPV, since a correct IRR solution will make the calculated NPV close to zero. By trial and error, enter discount rates and solve for NPV until your answer is reasonably close to zero. Then, with this interest rate, use IRR to calculate the IRR value near your guess. Use of the FMRR is recommended for this category of solution.

Category 3: The IRR equals zero. If there is only one sign change, and the sum of the negative cash flows equals the sum of the positive cash flows, then the IRR value is zero. If there is more than one sign change and all cash flows sum to zero, then there may be multiple IRR values, one of which is zero (refer to Category 2).

Category 4: There is no IRR. If there is no sign change, an IRR cannot be calculated. Since this generally results from data entry error, you should display the cash flows to check for wrong values and sign changes.

The calculated answers are the periodic internal rate of return and the annual internal rate of return. The latter value is the periodic rate of return times the number of compounding periods per year.

Net Present Value

The Net Present Value (NPV) method uses a given discount rate (cost of capital) to find the present value of all future cash flows and then adds it to an initial cash flow. Typically, the discount rate used is the minimum desired investment rate of return. If the final NPV is a positive value, then the investment rate of return exceeds the minimum desired. If the final NPV is a negative value, then the rate of return is less than the minimum desired. If the final NPV equals zero, then the investment rate of return and the discount rate are equal. The discount rate corresponding to a zero NPV is the IRR.

The discount rate which is used to find the NPV must coincide with the period between cash flows. For example, a 15% annual discount rate applied to monthly cash flows may be entered as 15/12 or 1.25.

The NPV method may be used to search for an investment IRR. You enter a series of increasing (or decreasing) values for the discount rate and observe the sign of the NPV. When a sign change occurs, the NPV has passed through zero, and the IRR value lies between the last two discount rates entered. This method is particularly useful when there are multiple IRR values.

Financial Management Rate of Return

The Financial Management Rate of Return (FMRR) was developed to compensate for the inherent shortcomings in the IRR technique when the latter is used in evaluating unconventional investments. As opposed to conventional investments which have an initial cash flow (in or out) followed by a series of future cash flows in the opposite direction, unconventional investments may have cash flows in or out at any time during the investment life cycle.

From a mathematical point of view it is possible to have as many IRR values as the number of cash flow sign changes (positive to negative and vice versa) and while technically correct, none of these values have meaning as an investment measure.

Another limitation of IRR is that the technique implicitly assumes that all cash flows are either reinvested or discounted at the calculated IRR. This is a financially sound assumption so long as the rate is within a reasonable range (5-15%). However the assumption becomes less valid when the IRR is significantly greater or smaller, and the IRR value itself becomes less sound as an investment measure.

A third limitation of IRR is the assumption that positive cash flows of any amount and at any time may be reinvested, at the calculated IRR, for the remainder of the life of the investment. Obviously, real-world investment opportunities have definite limits both on investment timing and amount.

The FMRR technique avoids the drawbacks of the IRR technique by eliminating the sign change problem, the reinvestment (or discounting) rate assumption and the reinvestment timing and amount assumption. The user is allowed to specify the short and long-term reinvestment rates and the minimum reinvestment amount.

FMRR assumes that short-term liquid investments may be made at any time, in any amount and for any period. These liquid investments are made to cover anticipated negative cash flows, and are made at a safe, short-term interest rate, such as a bank savings account rate.

Another assumption made by FMRR is that any positive intermediate cash flows, which are not needed to cover future negative cash flows may be reinvested in similar investments at comparable risk and at a long-term rate somewhat higher than the safe rate. The two requirements for these reinvestments are: (1) that they may not be disturbed for the remainder of the original investment period, and (2) that they must be in minimum dollar amounts, the amount to be specified by the user. Positive cash flows not meeting the specified minimum amount will be reinvested at the short-term rate.

In summary, using the FMRR requires three pieces of information about the investment environment:

1. The short-term, safe interest rate, such as a savings account rate, to cover future negative cash flows;
2. The long-term, risk interest rate for reinvesting excess positive cash flows in similar investments;
3. The minimum dollar amount before positive cash flows can be reinvested at the long-term rate.

The FMRR solution is a unique investment rate of return reflecting the realities of the market place as the user sees them.

Note: See Appendix D for a more detailed explanation of the mechanics of solving a discounted cash flow problem using FMRR.

User Instructions

1. To load the program:
   a. Insert the Financial Decisions Pac cartridge into the tape transport.
   b. Type: (REW LOAD) "CASHFL" (END LINE)
2. To start the program:
   a. Press: (RUN)
3. When the keys are labeled:

   ```
   ----------------------------------
            GUIDE
   ENTER
   ```

   a. Press: KEY #6 (GUIDE) to display the guidelines.
   b. Press: (CONT) when prompted, to continue.
   c. Go to step 3.

   OR:

   a. Press: KEY #1 (ENTER) to enter a problem.
4. When NAME OF PROBLEM(6 CHAR. MAX)? is displayed:
   a. Enter: The name of the problem (END LINE).
5. When ENTER PROBLEM FROM KEYBOARD OR TAPE CARTRIDGE(K/T)? is displayed:

a. Enter: K (END LINE) to enter the problem from the keyboard.
b. Go to step 8.

OR:

a. Enter: T (END LINE) to enter the problem from a tape cartridge.

Note: If problem data file is stored on another tape cartridge, insert the cartridge before pressing (END LINE).

6. When the cash flows are displayed, go to step 13.
7. If (problem name) NOT FOUND ON TAPE
SELECT ANOTHER PROBLEM NAME/TAPE
NAME OF PROBLEM(6 CHAR. MAX)? is displayed:
   a. Enter: The new problem name (END LINE).
   b. Go to step 5.

   OR:

   a. Insert: The correct tape cartridge in the tape transport.
   b. Enter: The same problem name (END LINE).
   c. Go to step 5.
8. When ARE CASH FLOWS INDIVIDUAL OR GROUPED (I/G)? is displayed:
   a. Enter: I (END LINE) if cash flows are individual.
   b. Go to step 9.

   OR:

   a. Enter: G (END LINE) if cash flows are grouped.
   b. Go to step 10.
9. When CASH FLOW AMOUNT IN PERIOD (period number) ?
(PRESS END LINE IF DONE) is displayed:
   a. Enter: The cash flow amount (END LINE).
   b. Repeat step 9 for each cash flow.

   OR:

   a. Press (END LINE) if there are no more cash flows to enter.
   b. Go to step 12.
10. When # OF CASH FLOWS IN GROUP (group number) ?
(PRESS END LINE IF DONE) is displayed:
   a. Enter: The number (END LINE) of equal cash flows in the group.
   b. Go to step 11.

   OR:

   a. Press: (END LINE) if there are no more cash flows to enter.
   b. Go to step 12.
11. When AMOUNT OF EACH FLOW IN GROUP (group number) ? is displayed:
   a. Enter: The amount (END LINE) of each cash flow in the group.
   b. Go to step 10.
12. When # OF COMPOUNDING PERIODS/YEAR? is displayed:
   a. Enter: The value (END LINE).
   b. After the cash flows are displayed, go to step 13.
13. When the keys are labeled:

HELP	GUIDE	PRINT	STORE
IRR	NPV	FMRR	DISP/MOD

   a. Press: KEY #5 (HELP) to display key functions.
   b. Go to step 13.

   OR:

   a. Press: KEY #6 (GUIDE) to display the guidelines.
   b. Press: (CONT) when prompted, to continue.
   c. Go to step 13.

   OR:

   a. Press: KEY #1 (IRR) to calculate the Internal Rate of Return.
   b. Go to step 14.

   OR:

   a. Press: KEY #2 (NPV) to calculate the Net Present Value.
   b. Go to step 24.

OR:

a. Press: KEY #3 (FMRR) to calculate the Financial Management Rate of Return.

b. Go to step 25.

OR:

a. Press: KEY #4 (DISP/MOD) to display or modify the cash flows.

b. Go to step 28.

OR:

a. Press: KEY #7 (PRINT) to print the cash flows.

b. Go to step 13.

OR:

a. Press: KEY #8 (STORE) to store this problem on tape cartridge.

b. Go to step 47.

14. The cash flows are then scanned to insure that calculation of an IRR is feasible.

15. When

PERIODIC IRR = (value) %
ANNUAL IRR = (value) %

are displayed:

a. Go to step 13.

Note: If the iterative IRR calculation routine cannot find an IRR value, go to step 23.

16. If THERE ARE POSSIBLY MULTIPLE IRRS followed by ALL OF WHICH ARE POSITIVE or ONE OF WHICH IS POSITIVE or ALL OF WHICH ARE NEGATIVE is displayed:

a. Go to step 20.

Note: This condition may occur when the cash flows have multiple sign changes.

17. If THE CASH FLOWS SUM TO ZERO and
PERIODIC IRR = 0.000%
ANNUAL IRR = 0.000% are displayed:

a. Go to step 13.

Note: This condition may occur when cash flows have one sign change and the sum of all cash flows is zero.

18. If THE CASH FLOWS SUM TO ZERO
THERE ARE POSSIBLY MULTIPLE IRR
ALL OF WHICH ARE POSITIVE
(ONE OF WHICH IS ZERO) is displayed:

a. Go to step 20.

Note: This condition may occur when the cash flows have multiple sign changes and the sum of all cash flows is zero.

19. If THERE IS NO IRR is displayed:

a. Go to step 13.

Note: This condition may occur when the cash flows have no sign change.

20. When USE OF THE FMRR IS SUGGESTED and
TO CALCULATE IRR YOU MUST ENTER AN ESTIMATE FOR AN IRR VALUE
DO YOU WISH TO CONTINUE(Y/N)? is displayed:

a. Enter: Y (END LINE) to continue the IRR calculation.

b. Go to step 21.

OR:

a. Enter: N (END LINE) to end the IRR calculation.

b. Go to step 13.

21. When IRR ESTIMATE (IN PERCENT)? is displayed:

a. Enter: The IRR estimate (END LINE).

22. When PERIODIC IRR = (value) %
ANNUAL IRR = (value) %
and ENTER ANOTHER IRR ESTIMATE(Y/N)? are displayed:

a. Enter: Y (END LINE) to enter another IRR estimate.

b. Go to step 21.

OR:

a. Enter: N (END LINE) to end the IRR calculation.

b. Go to step 13.

Note: If the iterative IRR calculation routine cannot find an IRR value, go to step 23.

23. If the iterative IRR calculation routine continues for an extended period of time without displaying an IRR value, you may wish to interrupt the routine. This may be done as follows:

a. To end the IRR calculation:

1) Press: (STEP PAUSE)

2) Type: CONT 1250 (END LINE)

3) Go to step 13.

OR:

a. To view the current value of the IRR in the iterative routine:

1) Press: (STEP PAUSE)

2) Type: I*100 (END LINE)

3) The value, in percent, will be displayed:

4) Press: (CONT) to continue.

5) Go to step 23.

OR:

a. To enter a guess for the interest rate to hasten the iterative search process:

1) Press: (STEP PAUSE)

2) Type: CONT 1190 (END LINE)

3) Go to step 21.

24. When PERIODIC DISCOUNT RATE, PERCENT? is displayed:

a. Enter: The discount rate (END LINE) in percent.

b. After the results are displayed, go to step 13.

25. When THE PERIODIC RATE FOR SHORT-TERM SAFE LIQUID INVESTMENT TO COVER NEGATIVE CASH FLOWS, PERCENT? is displayed:

a. Enter: The value (END LINE) in percent.

26. When THE PERIODIC RATE FOR LONG-TERM RISK REINVESTMENT OF POSITIVE INTERMEDIATE CASH FLOWS, PERCENT? is displayed:

a. Enter: The value (END LINE) in percent.

27. When THE MINIMUM AMOUNT FOR LONG-TERM REINVESTMENT AT (long-term risk rate) PERCENT(ENTER 0 IF NO MINIMUM)? is displayed:

a. Enter: The amount (END LINE).

b. After the results are displayed, go to step 13.

OR:

a. Enter: 0 (END LINE) if there is no minimum reinvestment amount.

b. After the results are displayed, go to step 13.

28. When MODIFY CASH FLOWS (Y/N)? is displayed:

a. Enter: Y (END LINE) to modify the cash flows.

b. Go to step 29.

OR:

a. Enter: N (END LINE), then go to step 13.

29. When DISPLAY MODIFY GUIDELINES(Y/N)? is displayed:

a. Enter: Y (END LINE) to display the guidelines.

b. Press: (CONT) when prompted, to continue.

OR:

a. Enter: N (END LINE) if guidelines are not needed.

30. When YOU MAY ADD (0 to 98) OR DELETE (98 to 0) CASH FLOWS OR GROUPS and ADD/DELETE/CHANGE CASH FLOWS OR GROUPS? (A/D/C/END LINE IF DONE) are displayed:

a. Enter: A (END LINE) to add a flow/group.

b. Go to step 31 for individual cash flows or to step 33 for grouped cash flows.

OR:

a. Enter: D (END LINE) to delete a flow/group.
b. Go to step 37 for individual cash flows or to step 38 for grouped cash flows.

OR:

a. Enter: C (END LINE) to change a flow/group.
b. Go to step 40 for individual cash flows or to step 42 for grouped cash flows.

OR:

a. Press: (END LINE) to end the modify routine.
b. Go to step 45.

31. When PERIOD # FOR NEW CASH FLOW? is displayed:
    a. Enter: The period number (END LINE) for the new cash flow.
32. When CASH FLOW AMOUNT? is displayed:
    a. Enter: The amount (END LINE) of the new cash flow.
    b. Go to step 30.
33. When GROUP # FOR NEW CASH FLOW GROUP? is displayed:
    a. Enter: The group number (END LINE) for the new cash flow group.
34. When # OF CASH FLOWS IN GROUP (new group #) ? is displayed:
    a. Enter: The number (END LINE) of equal cash flows in the new group.
35. When AMOUNT OF EACH FLOW IN GROUP (new group #) ? is displayed:
    a. Enter: The amount (END LINE) of each cash flow in the new group.
    b. Go to step 30.
36. If NO FLOWS/GROUPS MAY BE ADDED is displayed:
    a. The problem has 100 cash flows or groups.
    b. Go to step 30.
37. When PERIOD #? is displayed:
    a. Enter: The period number (END LINE) for the cash flow to be deleted.
    b. Go to step 30.
38. When GROUP #? is displayed:
    a. Enter: The group number (END LINE) for the group to be deleted.
    b. Go to step 30.
39. If NO FLOWS/GROUPS MAY BE DELETED is displayed:
    a. The problem has only two cash flows or groups.
    b. Go to step 30.
40. When PERIOD #? is displayed:
    a. Enter: The period number (END LINE) for the cash flow to be changed.
41. When OLD AMOUNT FOR PERIOD (period #) = (old amount) ;NEW AMOUNT = ? is displayed:
    a. Enter: The amount (END LINE) of the new cash flow.
    b. Go to step 30.
42. When GROUP #? is displayed:
    a. Enter: The group number (END LINE) for the group to be changed.
43. When OLD # OF CASH FLOWS IN GROUP (group #) = (old number of cash flows) ;NEW # = ? is displayed:
    a. Enter: The new number (END LINE) of cash flows in the group.
44. When OLD AMOUNT OF EACH FLOW,GROUP (group #) = (old amount) ;NEW AMOUNT = ? is displayed:
    a. Enter: The new amount (END LINE) of each cash flow in the group.
    b. Go to step 30.
45. When CHANGE PROBLEM NAME (Y/N)? is displayed:
    a. Enter: Y (END LINE) to change the problem name.
    b. Go to step 46.

OR:

a. Enter: N (END LINE) to retain the same name.
b. Go to step 13.

46. When NEW NAME FOR PROBLEM (6 CHAR.MAX)? is displayed:
    a. Enter: The new problem name (END LINE).
    b. Go to step 13.
47. To store the problem on a second tape cartridge:
    a. Remove the Financial Decisions Pac cartridge.
    b. Insert a second cartridge.

    Note: If not done previously, you may initialize the second cartridge with the ERASE TAPE command while the HP-85 is in PAUSE status.

48. Press: (CONT) when ready, to continue.
49. When (problem name) STORED ON TAPE is displayed:
    a. Go to step 13.
50. If (problem name) ALREADY EXISTS ON TAPE
    USE (problem name) AND ERASE ORIGINAL PROBLEM(Y/N)? is displayed:
    a. Enter: Y (END LINE) to use the current problem name and erase the problem on tape which uses the same name.
    b. Go to step 49.

    OR:
    a. Enter: N (END LINE) to use another name for the current problem.
51. When NEW NAME FOR PROBLEM (6 CHAR.MAX)? is displayed:
    a. Enter: The new problem name (END LINE).
    b. Go to step 49.

Example 1:

An investor pays $125,000 for a vacant duplex in need of repairs. He plans to perform some repairs, find tenants and sell the duplex at the end of one year for $150,000. Cash flows by months are:

Month	Cash Flow	Month	Cash Flow
0	-125000		
1	-3500	7	400
2	200	8	400
3	200	9	400
4	200	10	400
5	400	11	400
6	400	12	150000

First the cash flows are entered. Entry in groups is easier than entering individual cash flows. The cash flows are monthly, so the number of compounding periods per year is 12.

The cash flows are displayed, and may be printed by pressing KEY #7 (PRINT).

```
                DUPLEX

          NUMBER OF     AMOUNT OF
GROUP     CASHFLOWS   EACH CASHFLOW
  0           1          -125000.00
  1           1            -3500.00
  2           3               200.00
  3           7               400.00
  4           1            150000.00
```

Will the investor realize an annual yield of 20% before taxes? (Solve for NPV and enter the periodic discount rate as 20/12.)

```
              DUPLEX

          NPV =$          -2404.86

PERIODIC DISC=             1.667 %
  ANNUAL DISC=            20.000 %
```

Since the NPV is negative, the investment does not achieve the desired 20% yield. What is the IRR?

```
              DUPLEX

PERIODIC IRR =             1.505 %
  ANNUAL IRR =            18.056 %
```

What is the FMRR assuming an annual interest rate for safe, short-term liquid investments of 6%, a long-term annual rate for comparable risk investments of 9.6% and a minimum reinvestment amount of $1000? (Enter the short-term periodic rate as 6/12 and the long-term periodic rate as 9.6/12.)

```
              DUPLEX

PERIODIC FMRR=             1.495 %
  ANNUAL FMRR=            17.939 %

SAFE,SHORTTRM=               .500 %
RISK,LONGTERM=               .800 %
MIN REINV AMT=$             1000.00
```

Example 2:

The investor in the previous example decides that he can sell the duplex after one year for $160,000. What is the new IRR? (Press KEY #4 (DISP/MOD) and change cash flow group 4, then change the problem name to DUPLX2.)

```
              DUPLX2

PERIODIC IRR =             2.046 %
  ANNUAL IRR =            24.549 %
```

Example 3:

An investor has this unconventional investment opportunity. The cash flows are:

# of Months	Amount of Each Cash Flow ($)
1	-180,000
5	100,000
5	-100,000
9	0
1	200,000

The cash flows are entered and then printed.

```
                INVEST

          NUMBER OF      AMOUNT OF
GROUP     CASHFLOWS   EACH CASHFLOW
  0           1          -180000.00
  1           5           100000.00
  2           5          -100000.00
  3           9                0.00
  4           1           200000.00
```

What are the possible IRR values? There are three IRR values. To obtain the results shown below, enter 2%, 15% or 30% when you are asked for an IRR estimate.

```
                INVEST

PERIODIC IRR =              1.860 %
  ANNUAL IRR =             22.326 %

                INVEST

PERIODIC IRR =             14.348 %
  ANNUAL IRR =            172.177 %

                INVEST

PERIODIC IRR =             29.022 %
  ANNUAL IRR =            348.258 %
```

What is the FMRR assuming the same investment conditions as in example 1?

```
                INVEST

PERIODIC FMRR=               .873 %
  ANNUAL FMRR=             10.479 %

SAFE,SHORTTRM=               .500 %
RISK,LONGTERM=               .800 %
MIN REINV AMT=$             1000.00
```

Notes

Depreciation

Tangible assets such as buildings, machines, tools, trucks, etc. gradually decline in value over time through usage, technological obsolescence, environmental deterioration or a combination of all of these. Depreciation is a method of periodically accounting for the declining value of an asset. Depreciation is an annual deduction from net operating income, before taxable income and income tax liability are calculated, and is an accounting expense item.

The three most commonly used depreciation methods are: Straight Line (SL), Sum-of-the-Years'-Digits (SOYD), and Declining Balance (DB). SOYD and DB are methods of accelerated depreciation whereby higher annual amounts of depreciation are charged during the early years of an asset's life than with the straight line depreciation method, reflecting the fact that many assets decline in value most during the early part of their lives.

The program computes depreciation based on fiscal or calendar year. When the purchase date of an asset does not coincide with the beginning of a year—which is the rule rather than the exception—the amount of depreciation in the first and last years are computed as fractions of a full year's depreciation. The program recognizes this and prompts you to enter the number of months from purchase until the end of the first fiscal or calendar year. The program also prompts you to enter starting book value and salvage value.

Often a complete depreciation schedule for the asset's entire life is not needed. You are also given prompts to enter the first and last period for which a printed depreciation schedule is desired.

Calculated output for each year includes the depreciation expense, the remaining depreciable value and the remaining book value. Total depreciation is also calculated.

Straight Line Depreciation (SL) Method

The annual amount of depreciation using this method is determined by dividing the total depreciable amount (starting book value less salvage value) by the useful life expectancy. This amount is subtracted each year from the previous year's ending book value or ending depreciable value.

Sum-of-the-Years'-Digits (SOYD) Method

The SOYD method is based on the sum of the digits from year one to the number of years in the asset's life. For instance an asset with a 6 year life would have a SOYD total of 21. (6 + 5 + 4 + 3 + 2 + 1 = 21.) Theoretically, $^{6}/_{21}$ of the asset's life is used up during the first year, $^{5}/_{21}$ during the second year, etc. The annual amount of depreciation for each year is the asset's total depreciable amount multiplied by that year's use factor. Partial first year SOYD depreciation is correctly treated, based on formulas in Appendix A.

Declining Balance (DB) Method

With the DB method, a constant percentage is applied each year to the remaining book value to find the annual amount of depreciation. The salvage value is not subtracted initially, however, the asset may not be depreciated below this salvage value.

Since income tax regulations allow for the use of more than one declining balance percentage rate, you are prompted for the percentage rate you wish to use. A rate of 150% means 150% declining balance and 200% means double-declining balance. This percentage rate divided by the asset life, in years, gives the constant rate applied each year to the remaining book value. For instance, 150% declining balance applied to an asset with a 6 year life would give a constant rate of 150%/6 or 25% each year.

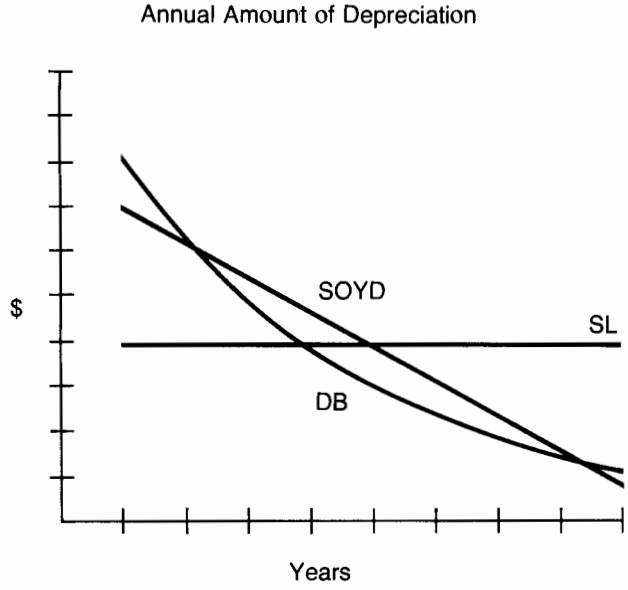
The annual amount of depreciation declines over time and the DB method frequently will not depreciate an asset fully in the asset's lifetime. In these situations there is an optimum point in the asset's life where a change from the DB method to the straight line method should be used. This is the "crossover point," the first year in which the amount of depreciation by the SL method is greater than if depreciation were continued using the DB method. The annual SL amount of depreciation is determined by dividing the remaining depreciable value by the remaining asset life.

A program prompt will allow you to determine whether or not you want to crossover to the SL method. If you elect to "crossover," the calculated output will give the crossover point, if it occurs in any year up to and including the last year of the printed depreciation schedule.

Graphical Representation

The program will also generate a graphical representation of the solution using each of the three depreciation methods. When the annual amount of depreciation is plotted versus time, the general form of the output is shown in the illustration below:

SL depreciation is a horizontal straight line; SOYD depreciation is a negatively-sloped straight line; DB depreciation is a line with concave curvature. The x-axis is in years and the y-axis is in dollars ($).



The program performs the graph scaling tasks automatically. Note that the graph labels for dollars are limited to six digits (or five digits and the decimal point). If your variable values exceed these limits, divide your book and salvage values by thousands or millions.

User Instructions

1. To load the program:
   a. Insert the Financial Decisions Pac cartridge into the tape transport.
   b. Type: (REW LOAD) "DEPREC" (END LINE).
2. When the program has been loaded:
   a. Press: (RUN).
3. When DISPLAY GUIDELINES (Y/N)? is displayed:
   a. Enter: Y (END LINE) to display the guidelines.
   b. Press: (CONT) when prompted, to continue.

   OR:

   a. Enter: N (END LINE) if guidelines are not needed.
4. When PRINT OR DISPLAY OUTPUT (P/D)? is displayed:
   a. Enter: P (END LINE) to print the output.

   OR:

   a. Enter: D (END LINE) to display the output.

   Note: Contents of the display screen may be output to the printer at any time by pressing (SHIFT) (COPY). Printer output may be dis-

played on the CRT by typing:
PRINTER IS 1 (END LINE).

5. When ASSET DEPRECIABLE LIFE,IN YEARS? (VALUE FROM 1/12 TO 98 YEARS) is displayed:
   a. Enter: The asset depreciable life in years (END LINE).
6. When INTEGER NUMBER OF MONTHS TO END OF FIRST FISCAL OR CALENDAR YEAR (ENTER 12 IF FULL FIRST YEAR) is displayed:
   a. Enter: The integer value (END LINE) for the number of months in the first fiscal or calendar year.
   b. Go to step 8.
7. If MONTHS IN 1ST YEAR EXCEED TOTAL ASSET LIFE is displayed:
   a. Go to step 6.
8. When STARTING BOOK VALUE? is displayed:
   a. Enter: The starting book value (END LINE), less than $10,000,000.
9. When SALVAGE VALUE? is displayed:
   a. Enter: The asset salvage value (END LINE); must be less than the starting book value.
   b. Go to step 11.
10. If BOOK VAL LESS THAN SALVAGE VAL is displayed:
    a. Go to step 8.
11. When FIRST YEAR TO PRINT DEPRECIATION SCHEDULE? (INTEGER FROM 1 TO (largest year)) is displayed:
    a. Enter: The first year (END LINE) for which a printed depreciation schedule is desired.
12. When LAST YEAR TO PRINT DEPRECIATION SCHEDULE? (INTEGER FROM (first year) TO (largest year)) is displayed:
    a. Enter: The last year (END LINE) for which a printed depreciation schedule is desired.
13. The problem variables are now displayed.
14. When the keys are labeled:

HELP	DISP	MODIFY	GRAPH
ENTER	SL	SOYD	DB

    a. Press: KEY #5 (HELP) to display the key functions.
15. To calculate depreciation, display or modify problem variables, generate a graph or enter a new problem:
    a. Press: KEY #2 (SL) to calculate the straight line method depreciation schedule.
    b. Go to step 14.

    OR:

    a. Press: KEY #3 (SOYD) to calculate the sum-of-the-years'-digits method depreciation schedule.
    b. Go to step 14.

    OR:

    a. Press: KEY #4 (DB) to calculate the declining balance method depreciation schedule.
    b. Go to step 16.

    OR:

    a. Press: KEY #6 (DISP) to display the problem variables.
    b. Go to step 13.

    OR:

    a. Press: KEY #7 (MODIFY) to modify the problem variables.
    b. Go to step 18.

    OR:

    a. Press: KEY #8 (GRAPH) to generate a graphical representation of the annual amounts of depreciation using all three methods.
    b. Go to step 21.

    OR:

    a. Press: KEY #1 (ENTER) to enter a new problem.

b. Go to step 4.

16. When DECLINING BALANCE RATE, PERCENT? is displayed:
    a. Enter: The declining balance rate (END LINE) in percent.
17. When CROSSOVER TO STRAIGHT LINE DEPRECIATION DESIRED (Y/N)? is displayed:
    a. Enter: Y (END LINE) if crossover to the SL method is desired.
    b. After the results are printed or displayed, go to step 14.

    OR:

    a. Enter: N (END LINE) if you do not want crossover to the SL method.
    b. After the results are printed or displayed, go to step 14.
18. The problem variables are now displayed.
19. When the keys are labeled:

```
--------------------------------
HELP      DISP            GRAPH
LIFE    BOOK/SAL          SOLVE
```

    a. Press: KEY #5 (HELP) to display the key functions.

20. To display or modify problem variables, solve the problem or generate a graph:
    a. Press: KEY #1 (LIFE) to modify the asset depreciable life, partial first year and inclusive years of depreciation schedule.
    When ASSET DEPRECIABLE LIFE, IN YEARS? (VALUE FROM 1/12 TO 98 YEARS) is displayed:
        1) Enter: The asset depreciable life in years (END LINE).
        When INTEGER NUMBER OF MONTHS TO END OF FIRST FISCAL OR CALENDAR YEAR (ENTER 12 IF FULL FIRST YEAR) is displayed:
        2) Enter: The integer value (END LINE) for the number of months in the first fiscal or calendar year.
        When FIRST YEAR TO PRINT DEPRECIATION SCHEDULE? (INTEGER FROM 1 TO (largest year)) is displayed:
        3) Enter: The first year (END LINE) for which a printed depreciation schedule is desired.
        When LAST YEAR TO PRINT DEPRECIATION SCHEDULE? (INTEGER FROM (first year) TO (largest year)) is displayed:
        4) Enter: The last year (END LINE) for which a printed depreciation schedule is desired.
        5) Go to step 18.

    OR:

    a. Press: KEY #2 (BOOK/SAL) to modify the book or salvage value.
    When STARTING BOOK VALUE? is displayed:
        1) Enter: The starting book value (END LINE), less than $10,000,000.
        When SALVAGE VALUE? is displayed:
        2) Enter: The salvage value (END LINE), less than the starting book value.
        3) Go to step 18.

    OR:

    a. Press: KEY #4 (SOLVE) to solve the current problem.
    b. Go to step 13.

    OR:

    a. Press: KEY #6 (DISP) to display the problem variables, then go to step 18.

    OR:

    a. Press: KEY #8 (GRAPH) to generate a

graphical representation of the solution.

b. Go to step 21.

21. When PRINT OR DISPLAY OUTPUT(P/D)? is displayed:

a. Enter: P (END LINE) to print the output.

OR:

a. Enter: D (END LINE) to display the output.

Note: Contents of the display screen may be output to the printer at any time by pressing (SHIFT) (COPY →).

22. When DECLINING BALANCE RATE, PERCENT? is displayed:

a. Enter: The declining balance rate (END LINE) in percent.

23. When CROSSOVER TO STRAIGHT LINE DEPRECIATION DESIRED (Y/N)? is displayed:

a. Enter: Y (END LINE) if crossover to the SL method is desired.

OR:

a. Enter: N (END LINE) if you do not want crossover to the SL method.

24. After the graph is printed and/or displayed:

a. Press: (SHIFT) (COPY →) to obtain a printed output of the graph.

b. Press: (CONT) to continue.

c. Go to step 13.

OR:

a. Press: (CONT) to continue.

b. Go to step 13.

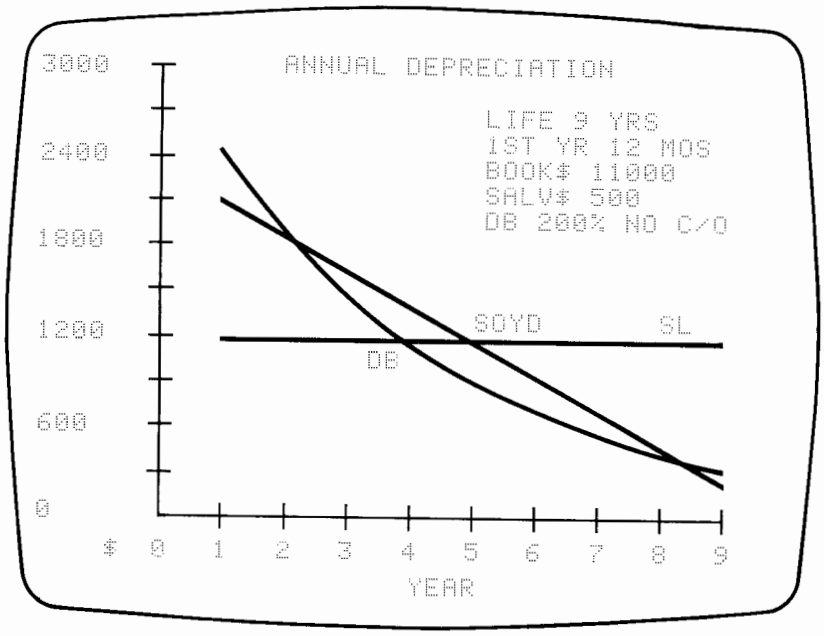
Note: The graphics screen may be displayed by pressing (SHIFT) (GRAPH ←).

Example 1:

An electronic instrument is purchased for $11,000 and has a useful life of 9 years after which the salvage value is expected to be $500. The instrument was purchased at the start of the fiscal year. Generate a depreciation schedule using the sum-of-the-years'-digits method.

```
LIFE=   9.00YRS   BOOK=$   11000.00
 1ST=  12    MOS  SALV=$     500.00

SOYD  DEPREC   REMAINING  REMAINING
YR      EXP     DEPR VAL   BOOK VAL

 1    2100.00    8400.00    8900.00
 2    1866.67    6533.33    7033.33
 3    1633.33    4900.00    5400.00
 4    1400.00    3500.00    4000.00
 5    1166.67    2333.33    2833.33
 6     933.33    1400.00    1900.00
 7     700.00     700.00    1200.00
 8     466.67     233.33     733.33
 9     233.33       0.00     500.00

TOTAL DEPRECIATION  =$   10500.00
```

Generate a graphical representation of the solution to this problem. Use 200% declining balance rate, with no crossover to straight line depreciation.

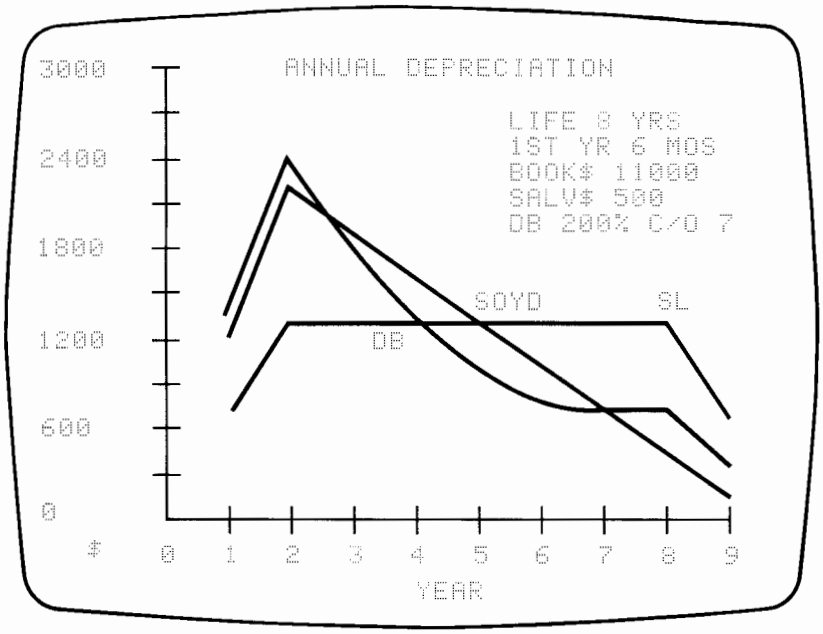


Example 2:

The instrument in example 1 is purchased with 6 months remaining in the current fiscal year. The useful life is expected to be 8 rather than 9 years. Generate a depreciation schedule using the declining balance method with crossover to straight line depreciation. Use a 200% DB rate.

```
LIFE=   8.00YRS   BOOK=$   11000.00
 1ST=   6    MOS  SALV=$     500.00

DB    DEPREC   REMAINING REMAINING
YR      EXP     DEPR VAL   BOOK VAL

 1    1375.00    9125.00    9625.00
 2    2406.25    6718.75    7218.75
 3    1804.69    4914.06    5414.06
 4    1353.52    3560.55    4060.55
 5    1015.14    2545.41    3045.41
 6     761.35    1784.06    2284.06
 7     713.62    1070.43    1570.43
 8     713.62     356.81     856.81
 9     356.81       0.00     500.00

TOTAL DEPRECIATION   =$   10500.00

DB RATE = 200%  CROSSOVER= 7 YRS
```

Generate a graphical representation, using a 200% DB rate with crossover to straight line depreciation.



The short sloping line segments at the left and right ends of the lines are caused by the partial first year depreciation. The horizontal portion of the DB curve is SL depreciation following crossover.

Simple Interest and Interest Conversions

This program allows you to solve for any variable of an accrued simple interest calculation, and to convert nominal to effective interest rate, and vice-versa.

Simple Interest

Four variables are involved in an accrued simple interest calculation. They are: principal or beginning dollar amount, accrued interest, annual interest rate, and the number of days the interest has accrued. Given any three variables, the program will solve for the fourth variable for either a 360-day or 365-day year. In addition, the program will add the calculated accrued interest to the principal amount to give the final amount. The results of all calculations may be printed and/or displayed.

Interest Conversions

By definition, an annual effective interest rate demonstrates the effect of compounding for a full year of compounding periods at a particular periodic interest rate. The periodic interest rate to be used is determined by dividing the annual nominal interest rate by the number of compounding periods per year. The effect is such that if the nominal rate is held constant, as the number of compounding periods per year is increased, the annual effective interest rate will increase. The ultimate, or upper limit, in this process is to have an infinite number of compounding periods in a year, commonly called continuous compounding.

For finite compounding, that is, quarterly compounding, monthly compounding, etc., if given the number of compounding periods in a year, and one of the rates (nominal or effective), the other rate can be calculated. After calculating the annual nominal rate, the periodic nominal rate will also be calculated.

User Instructions

1. To load the program:
   a. Insert the Financial Decisions Pac cartridge into the tape transport.
   b. Type: (REW LOAD) "SIMPLE" (END LINE).

2. When the program has been loaded:
   a. Press: (RUN).

3. When the keys are labeled:

   ```
   SIMPLE  INT CONV
   ```

   a. Press: KEY #1 (SIMPLE) to perform accrued simple interest calculations.
   b. Go to step 4.

   OR:

a. Press: KEY #2 (INT CONV) to perform nominal to effective interest rate conversions, and vice-versa.

b. Go to step 13.

4. When PRINT OR DISPLAY OUTPUT(P/D)? is displayed:

a. Enter: P (END LINE) to print and display the output.

OR:

a. Enter: D (END LINE) to display the output.

Note: Contents of the display screen may be output to the printer at any time by pressing (SHIFT) (COPY →).

5. When the keys are labeled:

```
 HELP    GUIDE    RESTART
$PRINC   $INT       DAYS      RATE,%
```

a. Press: KEY #5 (HELP) to display the key functions.

OR:

a. Press: KEY #6 (GUIDE) to display the guidelines.

OR:

a. Press: KEY #7 (RESTART) to restart the program.

6. To solve for the unknown variable:

Principal Amount:

a. Press: KEY #1 ($PRINC) to calculate the principal amount.

b. Go to step 7.

Accrued Interest:

a. Press: KEY #2 ($INT) to calculate the accrued interest.

b. Go to step 7.

Days Interest Accrued:

a. Press: KEY #3 (DAYS) to calculate the number of days the interest has accrued.

b. Go to step 7.

Annual Interest Rate:

a. Press: KEY #4 (RATE,%) to calculate the annual interest rate in percent.

b. Go to step 7.

7. If PRINCIPAL AMOUNT, IN DOLLARS? is displayed:

a. Enter: The principal amount (END LINE).

8. If ACCRUED DOLLAR INTEREST? is displayed:

a. Enter: The accrued interest (END LINE).

9. If NUMBER OF DAYS INTEREST ACCRUED? is displayed:

a. Enter: The number of days which interest has accrued (END LINE).

10. If NUMBER OF DAYS IN YEAR (360/365)? is displayed:

a. Enter: The number of days in the year (END LINE). Enter 360 or 365.

11. If ANNUAL INTEREST RATE, IN PERCENT? is displayed:

a. Enter: The annual interest rate (END LINE).

12. When all required data has been entered, the result will be printed and/or displayed.

a. Go to step 5.

13. When PRINT OR DISPLAY OUTPUT(P/D)? is displayed:

a. Enter: P (END LINE) to print and display the output.

OR:

a. Enter: D (END LINE) to display the output.

Note: Contents of the display screen may be output to the printer at any time by pressing (SHIFT) (COPY →).

14. When the keys are labeled:

```
HELP     GUIDE    RESTART   C%65/60
P NOM%   P EFF%   C NOM%    C EFF%
```

a. Press: KEY #5 (HELP) to display the key functions.

OR:

a. Press: KEY #6 (GUIDE) to display the guidelines.

OR:

a. Press: KEY#7(RESTART) to restart the program.

15. To solve for the unknown interest rate:

Annual Nominal Rate, Periodic Compounding:

a. Press: KEY#1(P NOM%) to calculate the annual nominal interest rate, in percent, with periodic compounding.
When ANNUAL EFFECTIVE RATE, PERCENT? is displayed:
1) Enter: The annual effective rate (END LINE).
When # OF COMPOUNDING PERIODS/YEAR? is displayed:
1) Enter: The number of compounding periods (END LINE).
2) After the results are printed and/or displayed, go to step 14.

Annual Effective Rate, Periodic Compounding:

a. Press: KEY#2(P EFF%) to calculate the annual effective interest rate, in percent, with periodic compounding.
When ANNUAL NOMINAL RATE, PERCENT? is displayed:
1) Enter: The annual nominal rate (END LINE).
When # OF COMPOUNDING PERIODS/YEAR? is displayed:
1) Enter: The number of compounding periods (END LINE).
2) After the results are printed and/or displayed, go to step 14.

Annual Nominal Rate, Continuous Compounding:

a. Press: KEY#3(C NOM%) to calculate the annual nominal interest rate, in percent, with continuous compounding.
When ANNUAL EFFECTIVE RATE, PERCENT? is displayed:
1) Enter: The annual effective rate (END LINE).
2) After the results are printed and/or displayed, go to step 14.

Annual Effective Rate, Continuous Compounding:

a. Press: KEY#4(C EFF%) to calculate the annual effective interest rate, in percent, with continuous compounding.
When ANNUAL NOMINAL RATE, PERCENT? is displayed:
1) Enter: The annual nominal rate (END LINE).
2) After the results are printed and/or displayed, go to step 14.

Annual Effective Rate, Continuous Compounding (365/360 basis):

a. Press: KEY#8(C%65/60) to calculate the annual effective interest rate, in percent, with continuous compounding on a 365/360 day basis.
When ANNUAL NOMINAL RATE, PERCENT? is displayed:
1) Enter: The annual nominal rate (END LINE).
2) After the results are printed and/or displayed, go to step 14.

Example 1:

Calculate the accrued interest, and the principal plus interest for a $30,000, 8%, 90 day interest at maturity note; use a 360-day year.

```
   $PRINC      DAYS   YR       RATE,%
    30000.00     90  360          8.00

ACCRUED INTEREST   = $        600.00
PRINCIPAL & INT.   = $      30600.00
```

Perform the same calculation using a 365-day year.

```
   $PRINC     DAYS  YR      RATE,%
    30000.00    90 365         8.00

ACCRUED INTEREST   = $      591.78
PRINCIPAL & INT.   = $    30591.78
```

Example 2:

What is the annual nominal rate if the annual effective rate is 13% compounded quarterly?

```
PERIODIC COMPOUNDING
ANNUAL EFFECTIVE RATE=    13.000%
COMPOUNDING PERIODS   =         4

ANNUAL NOMINAL RATE   =    12.410%
       PERIODIC RATE  =     3.103%
```

Example 3:

What is the annual effective rate if the annual nominal rate is 7.5% and compounding is monthly (12 compoundings/year)?

```
PERIODIC COMPOUNDING
ANNUAL NOMINAL RATE   =     7.500%
COMPOUNDING PERIODS   =        12

ANNUAL EFFECTIVE RATE=     7.763%
```

Example 4:

What is the annual effective rate in example 3 above if compounding is continuous?

```
CONTINUOUS COMPOUNDING
ANNUAL NOMINAL RATE   =     7.500%

ANNUAL EFFECTIVE RATE=     7.788%
```

Example 5:

In example 3 above, compounding is continuous on a 365/360 day basis. What is the annual effective rate?

```
CONTINUOUS COMPOUNDING(365/360)
ANNUAL NOMINAL RATE   =     7.500%

ANNUAL EFFECTIVE RATE=     7.897%
```

Bonds

In the securities market there are numerous interest and non-interest bearing obligations: notes, bonds, certificates, debentures, warrants, certificates of deposit, etc. Each of these investments can be placed in one of three categories according to the procedure by which interest is paid to the investor. Interest is either paid periodically (semi-annually or annually), at maturity, or as a result of discounting the purchase price.

This program computes either price and accrued interest or yield for a security obligation which pays interest (coupons) either semi-annually or annually. Since the most common obligation of this kind is often called a "bond," the term will be used in that context. Note, however, that in the securities market there are periodic interest only obligations which are not called bonds and there are bonds which do not pay interest periodically.

Program options available for price and yield computation include before tax (BTX) or after tax (ATX), semi-annual (SEMI) or annual (AN) coupons, redemption at maturity (MAT) or at call (CALL) and 30/360 (360) or actual/365 (365) calendar basis. The correct mode for each option is selected with special function keys.

The calendar basis mode can often be difficult to determine. There is seldom any indication from an obligation's name which calendar basis is appropriate. For this reason the following table has been included. It lists common U.S. bonds and the appropriate calendar basis.

Type 1: Semi-Annual Coupon, 30/360 Day Basis
Type 2: Semi-Annual Coupon, Actual/365 Day Basis

	Type
Assessment Supported Bonds	1
Certificates of Deposit (CD's)	1
Commodity Credit Corporation (CCC)	1
Corporate Bonds	1
Export-Import Bank (Ex-Im) Participation Certificates	1
Farmers Home Administration (FHDA) Insured Notes	2
Federal Home Loan Bank (FHLB) Notes and Bonds	1
Federal Housing Administration (FHA) Debentures	2
Federal Intermediate Credit Bank (FICB) Debentures	1
Federal Land Bank (FLB) Bonds	1
Federal National Mortgage Association (FNMA) Debentures	1
Foreign Bonds	2
General National Mortgage Association (GNMA) Bonds and Participation Certificates	1
Inter-American Development Bank Bonds	1

User Instructions

1. To load the program:
   a. Insert the Financial Decisions Pac cartridge into the tape transport.
   b. Type: (REW LOAD) "BOND" (END LINE).
2. When the program has been loaded:
   a. Press: (RUN).
3. When DISPLAY GUIDELINES (Y/N)? is displayed:
   a. Enter: Y (END LINE) to display the guidelines.
   b. Press: (CONT) when prompted, to continue.
   OR:
   a. Enter: N (END LINE) if guidelines are not needed.
4. When PRINT OR DISPLAY OUTPUT(P/D)? is displayed:
   a. Enter: P (END LINE) to print the output.
   OR:
   a. Enter: D (END LINE) to display the output.

   Note: Contents of the display screen may be output to the printer at any time by pressing (SHIFT)(COPY —).
5. When the keys are labeled:

   ```
   ------------------------------
   HELP    CG TAX% INC TX%   TOGGLE
   BTX/ATX SEMI/AN MAT/CALL 360/365
   ```

   a. Press: KEY #5(HELP) to display the key functions.
      1) Press: (CONT) when ready, to continue.
6. Select program option modes by toggling keys K1 through K4. Current modes are underlined.
   a. Toggle: KEY #1 (BTX/ATX) or (BTX/ATX) to select before tax mode or after tax mode.
   b. Toggle: KEY #2 (SEMI/AN) or (SEMI/AN) to select semi-annual coupon mode or annual coupon mode.
   c. Toggle: KEY #3 (MAT/CALL) or (MAT/CALL) to select redemption at maturity mode or redemption at call mode.

   Note: Redemption at maturity is assumed to be at a value of $100. For redemption at maturity at other values, use the redemption at call mode (MAT/CALL) and enter the redemption value as a call price.
   d. Toggle: KEY #4 (360/365) or (360/365) to select the 30/360 day calendar mode or the actual/365 day calendar mode.
7. Enter tax rates if desired.

   Capital Gains Tax:
   a. Press: KEY #6 (CG TAX%) to enter the capital gains tax rate.
   When EFFECTIVE CAPITAL GAINS TAX RATE IN PERCENT? is displayed:

1) Enter: The value (END LINE) for the tax rate, in percent.

Income Tax:

a. Press: KEY #7 (INC TX%) to enter the income tax rate.
When INCOME TAX RATE, PERCENT? is displayed:
1) Enter: The value (END LINE) for the tax rate, in percent.

Note: For after tax calculations, select the after tax (BTX/ATX) mode.

8. Toggle: KEY #8 (TOGGLE) to display the other set of key labels, and go to step 9.
9. When the keys are labeled:

```
HELP     MATURITY  CALL$    TOGGLE
COUPON%  SETTLE    PRICE    YIELD%
```

a. Press: KEY #5 (HELP) to display the key functions.
1) Press: (CONT) when ready, to continue.

10. To enter the known values, or solve for price or yield:

Annual Coupon Rate:

a. Press: KEY #1 (COUPON%) to enter the annual coupon rate.
When ANNUAL COUPON RATE, PERCENT? is displayed:
1) Enter: The value (END LINE) for the annual coupon rate, in percent.

Settlement Date:

a. Press: KEY #2 (SETTLE) to enter the settlement date.
When SETTLEMENT DATE (MM.DDYYYY)? is displayed:
1) Enter: The date (END LINE) for settlement, using format MM.DDYYYY.

Maturity Date or Call Date:

a. Press: KEY #6 (MATURITY) to enter the maturity or call date.
When MATURITY/CALL DATE (MM.DDYYYY)? is displayed:
1) Enter: The date (END LINE) for maturity or call, using format MM.DDYYYY.

Call Price:

a. Press: KEY #7 (CALL$) to enter the call price.
When CALL PRICE? is displayed:
1) Enter: The call price (END LINE) as a percent of $100 par value.

Note: For calculations using call price, select the redemption at call (MAT/CALL) mode.

Note: Use algebraic operators to enter fractional prices. Examples:
88+3/32, 95+1/8.

Price:

a. Press: KEY #3 (PRICE) to enter the price or solve for the price, and go to step 12.

Yield:

a. Press: KEY #4 (YIELD%) to enter the yield or solve for the yield, and go to step 13.

11. Toggle: KEY #8 (TOGGLE) to display the other set of key labels, and go to step 5.
12. When PRICE? (PRESS END LINE TO SOLVE) is displayed:
a. Enter: The price (END LINE) as a percent of $100 par value.
b. Go to step 9.

Note: Use algebraic operators to enter fractional prices. Examples:
88+3/32, 95+1/8.

OR:

a. Press: (END LINE) to solve for the price.
b. After the answer is displayed or printed, go to step 9.

13. When YIELD, PERCENT? (PRESS END LINE TO SOLVE) is displayed:
a. Enter: The value (END LINE) for the bond yield, in percent.

b. Go to step 9.

OR:

a. Press: (END LINE) to solve for the yield.

b. After the answer is displayed or printed, go to step 9.

Example:

What is the before tax yield of the following corporate bond? Settlement date August 10, 1977; Call date May 1, 1992; Price $88 3/32; Call Price $102; Coupon 6¾%. Hint: Assume a semi-annual coupon, redemption at call mode and 30/360 calendar basis.

```
BIX/ATX SEMI/AN MAT/CALL 360/365

SETLDT= 8.101977 MATDT= 5.011992
COUPON=    6.75% PRICE=$  88.094
                  CALL =$ 102.000

YIELD             =      8.230 %
```

What is the after tax yield if the marginal income tax rate is 45%, and the effective capital gains tax rate is 25%? Hint: Toggle to the other set of key labels, assume after tax mode and enter the tax rates.

```
BTX/AIX SEMI/AN MAT/CALL 360/365

SETLDT= 8.101977 MATDT= 5.011992
CG TAX=   25.00% INCTX=   45.00%
COUPON=    6.75% PRICE=$  88.094
                  CALL =$ 102.000

YIELD             =      4.777 %
```

What is the purchase price required to obtain an after tax yield of 5.5%?

```
BTX/AIX SEMI/AN MAT/CALL 360/365

SETLDT= 8.101977 MATDT= 5.011992
CG TAX=   25.00% INCTX=   45.00%
COUPON=    6.75% YIELD=    5.50%
                  CALL =$ 102.000

PRICE             =$   80.606
ACCRUED INTEREST  =$    1.856
PRICE (INCL. INT.)=$   82.463
```

Notes

In the securities market there are numerous interest and non-interest bearing obligations: notes, bonds, certificates, debentures, warrants, certificates of deposit, etc. Each of these instruments can be placed in one of three categories according to the procedure by which interest is paid to the investor. Bonds are obligations which pay interest periodically (semi-annually or annually) and notes are obligations which pay interest at maturity or as a result of discounting the purchase price.

This program calculates before tax price, yield and coupon equivalent yield for notes. Coupon equivalent yield, also known as coupon issue yield equivalents, allows the investor to compare a note purchased at a discount (such as a Treasury Bill) with a semi-annual coupon bond. Coupon equivalent yield may be calculated for any maturity period up to one year.

In calculating note price and yield, a mode for interest and calendar basis must be selected. Four modes are available: (1) interest at maturity, 30/360 day basis; (2) interest at maturity, actual/360 day basis; (3) interest at maturity, actual/365 day basis; and (4) discounted securities, actual/360 day basis. Selecting the correct mode can often be difficult. There is seldom any indication from an obligation's name which mode is appropriate. For this reason, the following table has been included. It lists common U.S. notes and the appropriate mode.

Type 1: Interest at Maturity, 30/360 Day Basis
Type 2: Interest at Maturity, Actual/360 Day Basis
Type 3: Interest at Maturity, Actual/365 Day Basis
Type 4: Discounted Securities, Actual/360 Day Basis

	Type
Assessment Supported Notes	1
Assessment Supported Warrants	1
Bankers' Acceptances (B/A, BAC's)	4
Banks for Cooperatives (Co-op's) Debentures	1
Certificates of Deposit	2, 4
Certificates of Indebtedness	3
Commercial Paper	2, 4
Federal Intermediate Credit Bank (FICB) Debentures	1
Federal National Mortgage Association (FNMA) Short Term Notes	4
Repurchase Agreements (Repos)	2
Revenue Supported Notes	1
Revenue Supported Warrants	1
Special Supported Notes	1
Special Supported Warrants	1

User Instructions

1. To load the program:
   a. Insert the Financial Decisions Pac cartridge into the tape transport.
   b. Type: (REW LOAD) "NOTE" (END LINE).
2. When the program has been loaded:
   a. Press: (RUN).
3. When DISPLAY GUIDELINES (Y/N)? is displayed:
   a. Enter: Y (END LINE) to display the guidelines.
   b. Press: (CONT) when prompted, to continue.
   OR:
   a. Enter: N (END LINE) if guidelines are not needed.
4. When PRINT OR DISPLAY OUTPUT(P/D)? is displayed:
   a. Enter: P (END LINE) to print the output.
   OR:
   a. Enter: D (END LINE) to display the output.

   Note: Contents of the display screen may be output to the printer at any time by pressing (SHIFT) (COPY →).

5. When the keys are labeled:

```
--------------------------------
HELP                       TOGGLE
ISSUE  SETTLE  MATURITY  INT/CAL
```

   a. Press: KEY #5 (HELP) to display the key functions.
6. To enter the issue, settlement and maturity dates:
   Issue Date:
   a. Press: KEY #1 (ISSUE) to enter the issue date.
   When ISSUE DATE (MM.DDYYYY)? is displayed:
   1) Enter: The date (END LINE) for issue, using format MM.DDYYYY.

   Note: No issue date is required for discounted securities.

   Settlement Date:
   a. Press: KEY #2 (SETTLE) to enter the settlement date.
   When SETTLEMENT DATE (MM.DDYYYY)? is displayed:
   1) Enter: The date (END LINE) for settlement, using format MM.DDYYYY.

   Maturity Date:
   a. Press: KEY #3 (MATURITY) to enter the maturity date.
   When MATURITY DATE (MM.DDYYYY)? is displayed:
   1) Enter: The date (END LINE) for maturity, using format MM.DDYYYY.
7. To select the mode for interest and calendar basis:
   a. Press: KEY #4 (INT/CAL) to enter the mode:
   When the following is displayed:

```
FOUR INTEREST/CALENDAR MODES
1=INTEREST AT MATURITY;
  30/360
2=INTEREST AT MATURITY;
  ACT/360
3=INTEREST AT MATURITY;
  ACT/365
4=DISCOUNTED SECURITIES;
  ACT/360
WHICH MODE?(ENTER
1,2,3 OR 4)
```

   1) Enter: The value (END LINE) for the mode which you select.

8. Toggle: KEY #8 (TOGGLE) to display the other set of key labels, and go to step 9.

9. When the keys are labeled:

```
HELP     REDEEM$  CPN EQ%  TOGGLE
PRICE    YIELD%     INT%     DISC%
```

   a. Press: KEY #5 (HELP) to display the key functions.

10. To enter the known values, or solve for price, yield or coupon equivalent yield:

Annual Interest Rate:

a. Press: KEY #3 (INT%) to enter the annual interest rate.
   When ANNUAL INTEREST RATE, PERCENT? is displayed:
   1) Enter: The value [END LINE] for the interest rate, in percent.

Discount Rate:

a. Press: KEY #4 (DISC%) to enter the discount rate.
   When DISCOUNT RATE, PERCENT? is displayed:
   1) Enter: The value [END LINE] for the discount rate, in percent.

Redemption Value:

a. Press: KEY #6 (REDEEM$) to enter the redemption value, if other than 100.
   When REDEMPTION VALUE? is displayed:
   1) Enter: The value [END LINE] for the redemption value.

   Note: A redemption value of $100 does not need to be entered.

Price:

a. Press: KEY #1 (PRICE) to enter the price or solve for the price, and go to step 12.

Yield:

a. Press: KEY #2 (YIELD%) to enter the yield or solve for the yield, and go to step 13.

Coupon Equivalent Yield:

a. Press: KEY #7 (CPN EQ%) to solve for the coupon equivalent yield.
b. After the answer is displayed or printed, go to step 9.

11. Toggle: KEY #8 (TOGGLE) to display the other set of key labels and go to step 5.

12. When PRICE? (PRESS END LINE TO SOLVE) is displayed:
   a. Enter: The value [END LINE] for the note price.
   b. Go to step 9.

   Note: Use algebraic operators to enter fractional prices. Examples: 88+3/32, 95+1/8.

   OR:
   a. Press: [END LINE] to solve for the price.
   b. After the answer is displayed or printed, go to step 9.

13. When YIELD, PERCENT? (PRESS END LINE TO SOLVE) is displayed:
   a. Enter: The value [END LINE] for the note yield, in percent.
   b. Go to step 9.

   OR:
   a. Press: [END LINE] to solve for the yield.
   b. After the answer is displayed or printed, go to step 9.

Example 1:

What is the price of this security: Bank for Cooperatives Debenture; issued May 3, 1979; settlement date June 25, 1979; maturity date September 10, 1979; annual interest rate 8.50%; yield 8.72%. Assume interest at maturity and a 30/360 day basis.

```
MATURITY  30/360 ISSDT= 5.031979
SETLDT= 6.251979 MATDT= 9.101979
INT    =    8.50% YIELD=    8.72%

PRICE             =$   99.933
```

What is the yield of this security if the price is $99.65?

```
MATURITY  30/360 ISSDT= 5.031979
SETLDT= 6.251979 MATDT= 9.101979
INT    =    8.50% PRICE=$  99.650

YIELD             =    10.091 %
```

Example 2:

Calculate the yield of this U.S. Treasury Bill: settlement date September 28, 1979; maturity date August 1, 1980; price $93.51200. Assume a discounted security, and an actual/360 day basis.

```
DISCOUNT ACT/360
SETLDT= 9.281979 MATDT= 8.011980
PRICE=$   93.512

YIELD             =     8.136 %
```

Example 3:

Calculate the price and the effective annual yield on this U.S. Treasury Bill: settlement date October 8, 1980; maturity date March 21, 1981; discount rate 7.80%.

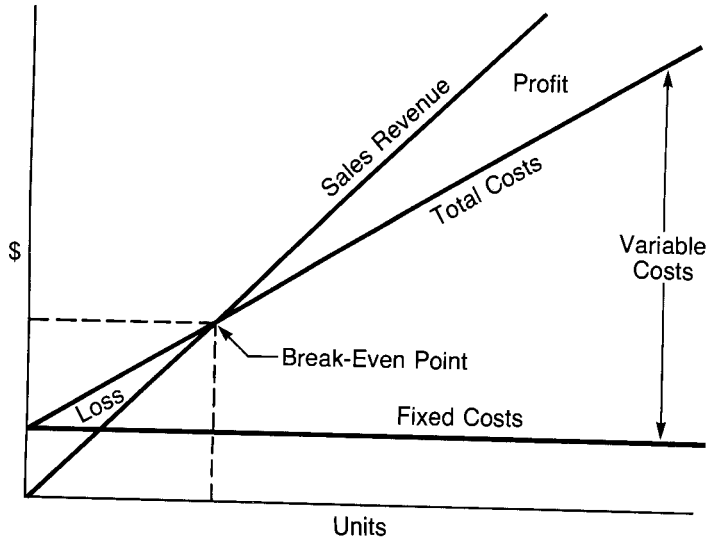
```
DISCOUNT ACT/360
SETLDT=10.081980 MATDT= 3.211981
DISC   =    7.80%

PRICE             =$   96.447


DISCOUNT ACT/360
SETLDT=10.081980 MATDT= 3.211981
PRICE=$   96.447

YIELD             =     8.087 %
```

What is the coupon equivalent yield on this security?

```
COUPON EQUIVALENT YIELD
SETLDT=10.081980 MATDT= 3.211981
DISC   =    7.80% PRICE=$  96.447

YIELD             =     8.200 %
```

Break-Even Analysis

Break-even analysis is a technique for analyzing the relationships among fixed costs, variable costs, and sales revenue. Until the break-even point is reached, at the intersection of the total sales revenue and total costs lines, the producer operates at a loss. After the break-even point, each unit produced and sold makes a profit. Break-even analysis may be represented as follows:



Five variables are involved in break-even analysis. They are: sales price per unit, variable costs per unit, fixed costs, number of units sold, and gross profit. Given any four variables, the program solves for the fifth. To calculate the break-even values, simply let the gross profit equal zero.

Known values may be entered in any sequence. Also, when modifying an initial problem, only the *new* data need be entered.

The degree of operating leverage at a point is defined as the ratio of the percentage change in net operating income to the percentage change in units sold. The greatest degree of operating leverage is found near the break-even point, where a small change in sales may produce a very large percentage increase in profits. This happens because the profits are close to zero near the break-even point. Likewise, firms with a small degree of operating leverage are operating farther from the break-even point, and they are relatively insensitive to changes in sales volume.

All variables except gross profit are involved in calculating the degree of operating leverage.

The program will also generate a graphical representation of the solution similar in appearance to the illustration above. For a graphical representation only three variables are required: sales price per unit, variable costs per unit and fixed costs. When entering these values, note that the graph labels for units and dollars are limited to six digits (or five digits and the decimal point). If your variable values exceed these limits, divide your values by thousands or millions.

You may control the graph scaling values, or allow the program to perform the scaling task for you, automatically.

The graphical representation includes the sales revenue line (S), the total costs line (TC) and the fixed costs line (FC). The x-axis is in number of units and the y-axis is in dollars ($).

User Instructions

1. To load the program:
   a. Insert the Financial Decisions Pac cartridge into the tape transport.
   b. Type: (REW LOAD) "BREAK" (END LINE).
2. When the program has been loaded:
   a. Press: (RUN).
3. When DISPLAY GUIDELINES (Y/N)? is displayed:
   a. Enter: Y (END LINE) to display the guidelines.
   b. Press: (CONT) when prompted, to continue.
   OR:
   a. Enter: N (END LINE) if guidelines are not needed.
4. When PRINT OR DISPLAY OUTPUT(P/D)? is displayed:
   a. Enter: P (END LINE) to print the output.
   OR:
   a. Enter: D (END LINE) to display the output.

   Note: Contents of the display screen may be output to the printer at any time by pressing (SHIFT) (COPY →).

5. When the keys are labeled:

```
--------------------------------
HELP      VAR       GRAPH     OP LVG
SALES$  FIXED     UNITS     PROFIT
```

   a. Press: KEY #5 (HELP) to display the key functions.
6. To enter the known values or solve for the unknown value:

   Sales Price Per Unit:
   a. Press: KEY #1 (SALES$) to enter or solve for the sales price per unit.
   When SALES PRICE PER UNIT? (PRESS END LINE TO SOLVE) is displayed:
   1) Enter: The sales price per unit (END LINE).
   OR:
   1) Press: (END LINE) to solve for the sales price per unit.
   2) After the answer is displayed or printed, go to step 23.

   Fixed Costs:
   a. Press: KEY #2 (FIXED) to enter or solve for the fixed costs.
   When FIXED COSTS? (PRESS END LINE TO SOLVE) is displayed:
   1) Enter: The fixed costs (END LINE).
   OR:
   1) Press: (END LINE) to solve for the fixed costs.
   2) After the answer is displayed or printed, go to step 23.

   Number of Units Sold:
   a. Press: KEY #3 (UNITS) to enter or solve for the number of units sold.
   When NUMBER OF UNITS SOLD? (PRESS END LINE TO SOLVE) is displayed:
   1) Enter: The number of units sold (END LINE).
   OR:
   1) Press: (END LINE) to solve for the number of units sold.
   2) After the answer is displayed or printed, go to step 23.

   Gross Profit:
   a. Press: KEY #4 (PROFIT) to enter or solve for gross profit.
   When GROSS PROFIT?

(PRESS END LINE TO SOLVE) is displayed:

1) Enter: The gross profit (END LINE).

OR:

1) Press: (END LINE) to solve for the gross profit.

2) After the answer is displayed or printed, go to step 23.

Note: To calculate break-even values, let gross profit equal zero.

Variable Costs Per Unit:

a. Press: KEY#6(VAR) to enter or solve for variable costs per unit.

When VARIABLE COSTS PER UNIT? (PRESS END LINE TO SOLVE) is displayed:

1) Enter: The variable costs per unit (END LINE)

OR:

1) Press: (END LINE) to solve for variable costs per unit.

2) After the answer is displayed or printed, go to step 23.

Operating Leverage:

a. Press: KEY#8(OP LVG) to calculate the degree of operating leverage.

When NUMBER OF UNITS SOLD? is displayed:

1) Enter: The number of units (END LINE).

2) After the answer is displayed or printed, go to step 23.

7. Graphical Break-Even Representation:

a. Press: KEY #7 (GRAPH) to generate a graphical break-even representation.

8. If AUTOMATIC GRAPH SET-UP (Y/N)? is displayed:

a. Press: Y (END LINE) to have the graph set-up values set automatically.

b. Go to step 21.

OR:

a. Press: N (END LINE) if you want to select the graph set-up values.

b. Go to step 10.

9. If THE GRAPH SET-UP VALUES FROM THE LAST PROBLEM ARE BEING USED is displayed:

a. Go to step 21.

10. When AUTOMATIC UNITS (X-AXIS) SCALING(Y/N)? is displayed:

a. Enter: Y (END LINE) to have the units scaled automatically.

b. Go to step 13.

OR:

a. Enter: N (END LINE) if you wish to select the minimum and maximum units scale values.

Note: Automatic units scaling uses a minimum value of zero and a maximum value of approximately twice the units at break-even.

11. When MINIMUM # OF UNITS FOR SCALING? is displayed:

a. Enter: The minimum units value for scaling (END LINE).

12. When MAXIMUM # OF UNITS FOR SCALING? is displayed:

a. Enter: The maximum units value for scaling (END LINE).

13. When UNITS (X-AXIS) LABELS VERTICAL OR HORIZONTAL (V/H)? is displayed:

a. Enter: V (END LINE) if the units labels are to be displayed vertically.

OR:

a. Enter: H (END LINE) if the units labels are to be displayed horizontally.

14. When # OF UNITS (X-AXIS) INTERVALS? (INTEGER FROM 1 TO 16) is displayed:

a. Enter: The number of units intervals or tic marks (END LINE).

15. When # OF INTERVALS BETWEEN LABELS? (ENTER VALUE BETWEEN 1 AND (units intervals) OR PRESS END LINE TO DELETE LABELS) is displayed:
    a. Enter: The number of units intervals, or tics, between labels [END LINE].

    OR:

    a. Press: [END LINE] if no units labels are desired.

    Note: As an example: if labels are desired at every other tic, the number of intervals between labels is 2.

16. When AUTOMATIC COST (Y-AXIS) SCALING(Y/N)? is displayed:
    a. Enter: Y [END LINE] to have the cost axis scaled automatically.
    b. Go to step 19.

    OR:

    a. Enter: N [END LINE] if you wish to select the minimum and maximum cost axis scale values.

    Note: Automatic cost scaling uses a minimum value of zero and a maximum value of approximately twice the total cost at break-even.

17. When MINIMUM TOTAL COST FOR SCALING? is displayed:
    a. Enter: The minimum total cost value for scaling [END LINE].

18. When MAXIMUM TOTAL COST FOR SCALING? is displayed:
    a. Enter: The maximum total cost value for scaling [END LINE].

19. When # OF COST (Y-AXIS) INTERVALS? (INTEGER FROM 1 TO 12) is displayed:
    a. Enter: The number of cost intervals or tic marks [END LINE].

20. When # OF INTERVALS BETWEEN LABELS? (ENTER VALUE BETWEEN 1 AND (cost intervals) OR PRESS END LINE TO DELETE LABELS) is displayed:
    a. Enter: The number of cost intervals, or tics, between labels [END LINE].

    OR:

    a. Press: [END LINE] if no cost labels are desired.

21. After the graph is printed and/or displayed:
    a. Press: [SHIFT] [COPY —] to obtain a printed output of the graph.
    b. Press: [CONT] to continue.

    OR:

    a. Press: [CONT] to continue.

22. When CLEAR GRAPH SET-UP VALUES(Y/N)? is displayed:
    a. Enter: Y [END LINE] to clear graph set-up values.

    OR:

    a. Enter: N [END LINE] to retain the current graph set-up values for use in your next graphical representation.

23. When CLEAR PROBLEM VALUES (Y/N)? is displayed:
    a. Press: Y [END LINE] to reset the five break-even variables to zero.
    b. Go to step 5.

    OR:

    a. Press: N [END LINE] to retain the current variable values.
    b. After the variable values are displayed, go to step 5.

Example 1:

The Farraday Publishing Company publishes textbooks and sells them through college bookstores. The retail price of a college finance textbook is $17. Given costs and revenues below, how many textbooks must be sold to break even?

Sales Price Per Copy	$17.00
Fixed Costs	
Editing	$ 3000.00
Graphics production	5000.00
Typesetting	20000.00
Lithography preparation	10000.00
TOTAL Fixed Costs	$38000.00
Variable Costs Per Copy	
Printing and Binding	$2.00
Commissions	5.00
Royalties	2.00
TOTAL Variable Costs Per Copy	$9.00

Note: At the break-even point, gross profit equals zero. Enter the sales revenue and cost data and solve for the number of units sold.

```
SALES$/UNIT    =$          17.00
FIXED COSTS    =$       38000.00
GROSS PROFIT   =$           0.00
VAR COSTS/UNIT=$           9.00

UNITS SOLD     =        4750.00
```

What is the company's degree of operating leverage at 5000 units? At 7500 units?

```
DEGREE OF OPERATING LEVERAGE AT
 5000 UNITS
                =          20.00
```

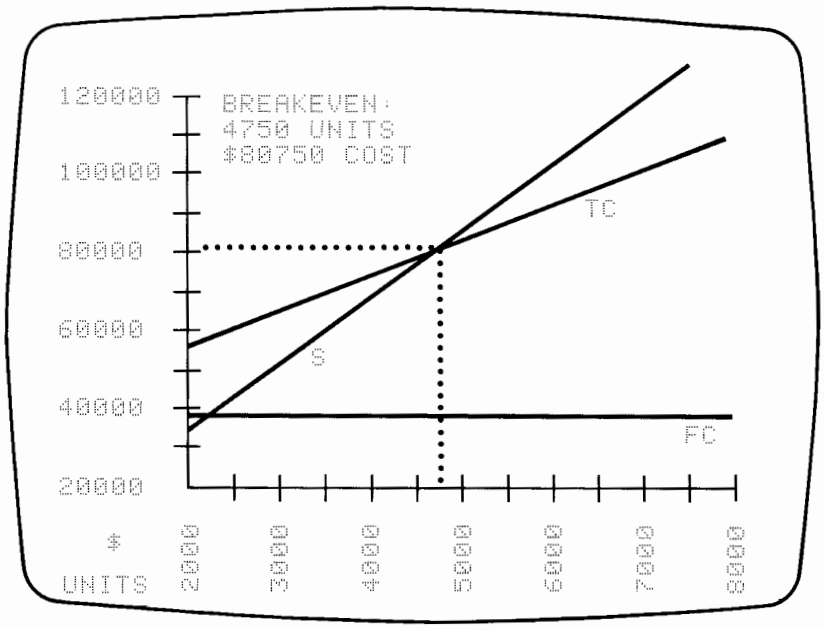
This is close to the break-even point.

```
DEGREE OF OPERATING LEVERAGE AT
 7500 UNITS
                =           2.73
```

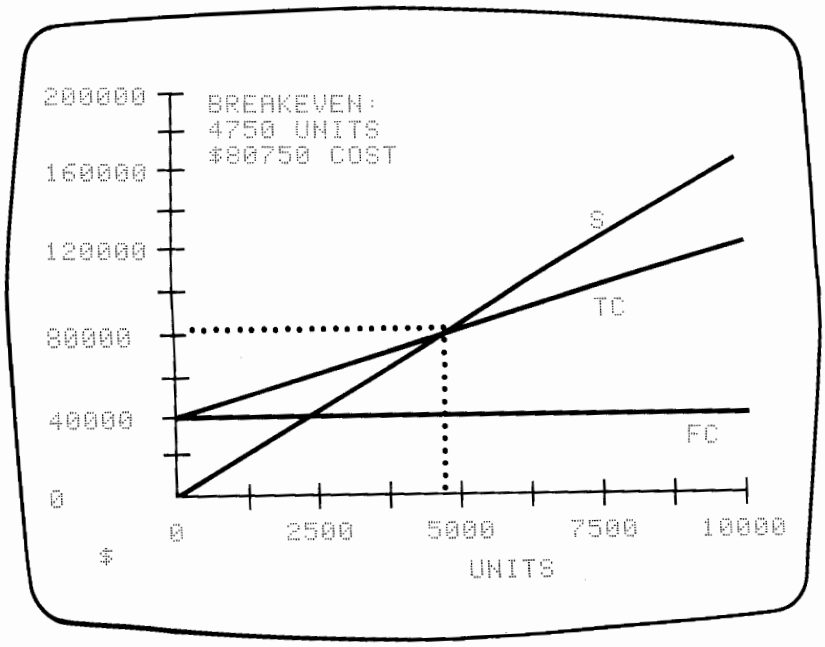
The company is farther from the break-even point and is less sensitive to changes in sales volume.

Print a graph of the break-even analysis, using the responses shown in the table below:

Question	Response
AUTOMATIC GRAPH SET-UP(Y/N)	N
AUTOMATIC UNITS (X-AXIS) SCALING(Y/N)	N
MINIMUM # OF UNITS FOR SCALING	2000
MAXIMUM # OF UNITS FOR SCALING	8000
UNITS (X-AXIS) LABELS VERTICAL OR HORIZONTAL(V/H)	V
# OF UNITS (X-AXIS) INTERVALS (INTEGER FROM 1 TO 16)	12
# OF INTERVALS BETWEEN LABELS	2
AUTOMATIC COST (Y-AXIS) SCALING(Y/N)	N
MINIMUM TOTAL COST FOR SCALING	20000
MAXIMUM TOTAL COST FOR SCALING	120000
# OF COST (Y-AXIS) INTERVALS	10
# OF INTERVALS BETWEEN LABELS	2



After the graph has been printed, press (CONT). Clear the graph set-up values, but not the problem values. Now print a graph of the break-even analysis using the automatic graph set-up feature.



Example 2:

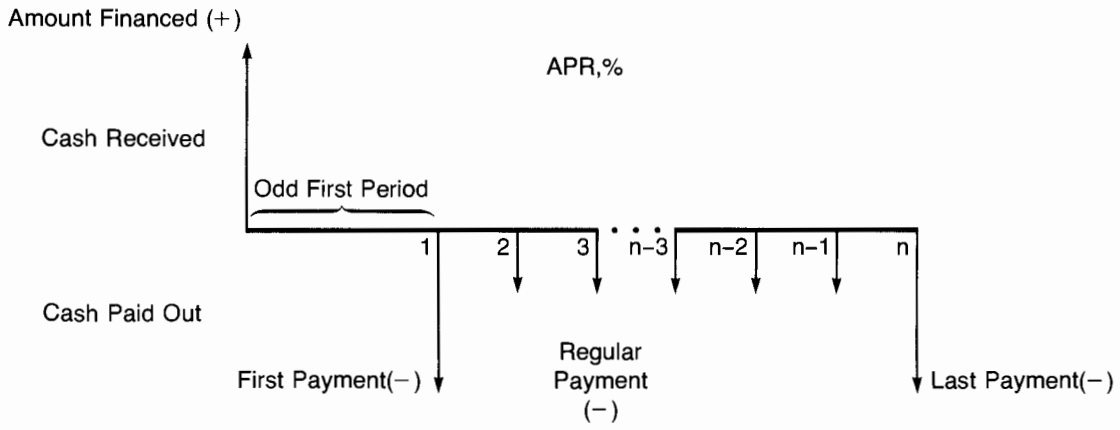
In the previous example, the company estimates that a total of 6500 copies will be sold over the life of the textbook. What is the gross profit?

```
SALES$/UNIT    =$        17.00
FIXED COSTS    =$     38000.00
UNITS SOLD     =       6500.00
VAR COSTS/UNIT=$          9.00

GROSS PROFIT   =$     14000.00
```

Notes

Odd Days Interest

This program will enable you to calculate the annual percentage rate (APR) and the payment amounts for a single advance, regular payment transaction which may include any combination of an odd first period, an odd first payment or an odd last payment. Single advance means that the amount financed is advanced to the borrower all at one time. This type of transaction can be represented by the following cash flow diagram:



The odd first period is the length of time, from the borrower's viewpoint, between receiving the amount financed and making the first payment. This may include one or more full compounding periods, one or more "odd days" in the first compounding period, or both. An odd first period indicates that payments are made at the end of the compounding period and is an ordinary annuity problem. On the other hand, if the first payment is made immediately upon receipt of the amount financed, there are *zero* full compounding periods and *zero* odd days. This is an annuity due problem.

The program uses ten variables. Those which may be the solution variables (unknown) are noted below (*). The variables are:

Annual percentage rate, APR (*)
Amount financed
First payment amount (*)
Regular payment amount (*)
Last payment amount (*)
Total number of payments
Days per compounding period
Compounding periods per year
Number of full compounding periods until the first payment
Number of odd days in the first compounding period

The cash flow sign convention should be observed. Cash received (arrow pointing up on the cash flow diagram) is represented by a positive (+) value. Cash paid out (arrow pointing down) is represented by a negative (−) value.

For more information on cash flow diagrams, see *Compound Interest Solutions: The Cash Flow Diagram and Sign Convention.*

Loan Amortization

Most mortgages and installment loans are called direct reduction loans. The debt is discharged by periodic payments paid at equal intervals. As each payment is received by the note holder, interest is calculated on the outstanding balance since the last payment, subtracted from the payment amount and the remainder applied to the balance. As the balance drops with each payment so does the interest. With a smaller portion of each payment being deducted for interest, the amount remaining to pay off the balance increases. The breakdown of each payment into the principal reduction portion and interest portion over the life of a loan is called an amortization schedule.

This program calculates the principal and interest portion of each periodic payment and the remaining balance after the payment has been made, for any series of periodic amortization payments from any first period to any last period. An odd first period, odd first payment and odd last payment are all correctly treated.

For tax purposes and certain financial analyses, payments to principal and interest are desirable on an annual basis rather than on an individual payment basis. The amortization program calculates accumulated principal and accumulated interest from the first period to the last period and allows you to output these summary totals with or without the full amortization schedule.

User Instructions

1. To load the program:
   a. Insert the Financial Decisions Pac cartridge into the tape transport.
   b. Type: (REW LOAD) "ODD" (END LINE).
2. When the program has been loaded:
   a. Press: (RUN).
3. When `DISPLAY GUIDELINES (Y/N)?` is displayed:
   a. Enter: Y (END LINE) to display the guidelines.
   b. Press: (CONT) when prompted, to continue.
   OR:
   a. Enter: N (END LINE) if guidelines are not needed.
4. When `PRINT OR DISPLAY OUTPUT(P/D)?` is displayed:
   a. Enter: P (END LINE) to print the output.
   OR:
   a. Enter: D (END LINE) to display the output.
   Note: Contents of the display screen may be output to the printer at any time by pressing (SHIFT) (COPY −).
5. When `YOU MAY SOLVE FOR ANY ONE OF THE FOLLOWING VARIABLES:`
   `1=ANNUAL PERCENTAGE RATE`

(APR)
2=FIRST PAYMENT
3=REGULAR PAYMENT
4=LAST PAYMENT
WHICH ONE?(ENTER 1,2,3 OR 4) is displayed:

a. Enter the value corresponding to the unknown variable (END LINE).

6. If ANNUAL PERCENTAGE RATE (APR)? is displayed:
   a. Enter: The APR, in percent (END LINE).
7. When AMOUNT FINANCED? is displayed:
   a. Enter: The amount to be financed (END LINE).
8. If AMOUNT OF FIRST PAYMENT? is displayed:
   a. Enter: The first payment amount (END LINE).
9. If AMOUNT OF REGULAR PAYMENT? is displayed:
   a. Enter: The regular payment amount (END LINE).
10. If AMOUNT OF LAST PAYMENT? is displayed:
    a. Enter: The last payment amount (END LINE).
11. When TOTAL NUMBER OF PAYMENTS?
    (INTEGER FROM 2 TO 9999)
    is displayed:

    a. Enter: The total number of payments (END LINE).
12. When DAYS PER COMPOUNDING PERIOD?

```
EXAMPLE: WEEKLY      =  7
         BIWEEKLY    = 14
         SEMIMONTHLY = 15
         MONTHLY     = 30
         SEMIANNUALLY=180
```

    is displayed:
    a. Enter: The days per compounding period (END LINE).
13. When COMPOUNDING PERIODS PER YEAR?

```
EXAMPLE: WEEKLY      = 52
         BIWEEKLY    = 26
         SEMIMONTHLY = 24
         MONTHLY     = 12
         SEMIANNUALLY=  2
```

    is displayed:
    a. Enter: The number of compounding periods per year (END LINE).
14. When NUMBER OF FULL COMPOUNDING PERIODS UNTIL THE FIRST PAYMENT? is displayed:
    a. Enter: The number of periods (END LINE).
15. When NUMBER OF ODD DAYS IN FIRST COMPOUNDING PERIOD? is displayed:
    a. Enter: The number of odd days (END LINE).
16. The problem variables and the answer will now be printed and displayed. The calculated value for the unknown variable is stored.
17. When the keys are labeled:

```
------------------------------
HELP
ENTER   MODIFY   AMORT    PRINT
```

    a. Press: KEY #5 (HELP) to display the key functions.
18. To modify, print or compute an amortization schedule, or enter a new problem:
    a. Press: KEY #1 (ENTER) to enter a new problem.
    b. Go to step 4.

    OR:

    a. Press: KEY #2 (MODIFY) to modify the current problem.
    b. Go to step 19.

    OR:

    a. Press: KEY #3 (AMORT) to compute an amortization schedule.
    b. Go to step 25.

    OR:

    a. Press: KEY #4 (PRINT) to print the current problem variables.

b. After the problem variables are printed, go to step 17.

19. When the keys are labeled:

```
                                  TOGGLE
HELP    AMOUNT
APR     1STPMT  REGPMT   LASTPMT
```

a. Press: KEY #5 (HELP) to display the key functions.

20. Toggle KEY #8 (TOGGLE) to display the other set of key labels, and go to step 22.

21. To modify a variable or solve the modified problem:

Annual Percentage Rate (APR):

a. Press: KEY #1 (APR) to enter or solve for the APR value.
When OLD ANNUAL PERCENTAGE RATE = (old value) ; NEW =? (PRESS END LINE TO SOLVE) is displayed:
1) Enter: The new APR value (END LINE).
2) Go to step 19.
OR:
1) Press: (END LINE) to solve for the APR value.
2) Go to step 16.

First Payment Amount:

a. Press: KEY #2 (1STPMT) to enter or solve for the first payment amount.
When OLD FIRST PAYMENT AMOUNT = $ (old amount) ; NEW =? (PRESS END LINE TO SOLVE) is displayed:
1) Enter: The new first payment amount (END LINE).
2) Go to step 19.
OR:
1) Press: (END LINE) to solve for the first payment amount.
2) Go to step 16.

Regular Payment Amount:

a. Press: KEY #3 (REGPMT) to enter or solve for the regular payment amount.
When OLD REGULAR PAYMENT AMOUNT = $ (old amount) ; NEW =? (PRESS END LINE TO SOLVE) is displayed:
1) Enter: The new regular payment amount (END LINE).
2) Go to step 19.
OR:
1) Press: (END LINE) to solve for the regular payment amount.
2) Go to step 16.

Last Payment Amount:

a. Press: KEY #4 (LASTPMT) to enter or solve for the last payment amount.
When OLD LAST PAYMENT AMOUNT = $ (old amount) ; NEW =? (PRESS END LINE TO SOLVE) is displayed:
1) Enter: The new last payment amount (END LINE).
2) Go to step 19.
OR:
1) Press: (END LINE) to solve for the last payment amount.
2) Go to step 16.

Amount Financed:

a. Press: KEY #6 (AMOUNT) to enter the amount financed.
When OLD AMOUNT FINANCED = $ (old amount) ; NEW =? is displayed:
1) Enter: The new amount financed (END LINE).
2) Go to step 19.

22. When the keys are labeled:

```
                                  TOGGLE
HELP
#PMTS   DYS/PER  PER/YR  ODD PER
```

a. Press: KEY #5 (HELP) to display the key functions.

23. Toggle KEY #8 (TOGGLE) to display the other set of key labels, and go to step 19.

24. To modify a variable:

Total Number of Payments:

a. Press: KEY #1 (#PMTS) to enter the total number of payments.
When OLD TOTAL NUMBER OF PAYMENTS = (old value) ; NEW =? is displayed:
1) Enter: The new total number of payments (END LINE).
2) Go to step 22.

Days Per Compounding Period:

a. Press: KEY #2 (DYS/PER) to enter the days per compounding period.
When OLD DAYS PER COMPOUNDING PERIOD = (old value) ; NEW =? is displayed:
1) Enter: The new days per compounding period (END LINE).
2) Go to step 22.

Compounding Periods Per Year:

a. Press: KEY #3 (PER/YR) to enter the compounding periods per year.
When OLD COMPOUNDING PERIODS PER YEAR = (old value) ; NEW =? is displayed:
1) Enter: The new compounding periods per year (END LINE).
2) Go to step 22.

Odd First Period:

a. Press: KEY #4 (ODD PER) to enter the odd first period data.
When OLD NUMBER OF FULL COMPOUNDING PERIODS UNTIL THE FIRST PAYMENT = (old value) ; NEW =? is displayed:
1) Enter: The new number (END LINE) of full compounding periods until the first payment.
When OLD NUMBER OF ODD DAYS IN FIRST COMPOUNDING PERIOD = (old value) ; NEW =? is displayed:
2) Enter: The new number (END LINE) of odd days in the first compounding period.
3) Go to step 22.

25. When PRINT OR DISPLAY OUTPUT(P/D)? is displayed:
a. Enter: P (END LINE) to print the output.
OR:
a. Enter: D (END LINE) to display the output.

26. When FIRST PERIOD OF SCHEDULE? (INTEGER FROM 1 TO (# of payments)) is displayed:
a. Enter: The first period number (END LINE).

27. When LAST PERIOD OF SCHEDULE? (INTEGER FROM (first period) TO (# of payments)) is displayed:
a. Enter: The last period number (END LINE).

28. When SCHEDULE OR TOTALS ONLY(S/T)? is displayed:
a. Enter: S (END LINE) to display or print the variable values and the amortization schedule for each period.
b. The variable values, amortization schedule and summary totals are now displayed or printed.
OR:
a. Enter: T (END LINE) to display or print only the summary totals, over the selected time period, for principal, interest and remaining balance.
b. The summary totals are now displayed or printed.

29. When CHANGE FIRST & LAST PERIODS(Y/N)? is displayed:

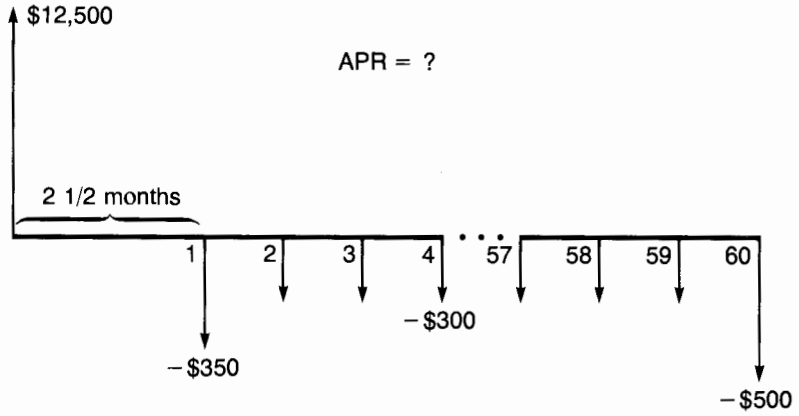
a. Enter: Y (END LINE) to enter new first and last amortization periods.
b. Go to step 26.

OR:

a. Enter: N (END LINE) if no more schedules or totals are desired.
b. After the problem variables are displayed, go to step 17.

Example 1:

A homeowner is negotiating a home improvement loan with his banker. He needs $12,500 and would like to repay the loan in 60 monthly payments, beginning in 2½ months. If his first payment is $350, the 58 regular payments are $300 and the last payment is $500, what APR is he being charged?



Enter the data as follows:

Question	Response
Solve for Which Variable	1
Amount Financed	12500
First Payment	-350
Regular Payment	-300
Last Payment	-500
Total Number of Payments	60
Days Per Compounding Period	30
Compounding Periods Per Year	12
Full Compounding Periods Until First Payment	2
Odd Days in First Compounding Period	15

```
AMOUNT FINANCED =$     12500.000
FIRST PAYMENT   =$      -350.000
REGULAR PAYMENT =$      -300.000
LAST PAYMENT    =$      -500.000

TOTAL PAYMENTS  =          60
DAYS/PERIOD     =          30
PERIODS/YEAR    =          12
FIRST PAYMENT   =           2 PER
                           15 DAYS

CALCULATED APR  =      15.0647 %
PERIODIC RATE   =       1.2554 %
```

The banker would like to reduce the first payment amount so that the APR is exactly 15%. What is the new first payment amount? (Use the modify routine to avoid reentering all the data. Change the APR value to 15 and solve for the first payment amount.)

```
ANNUAL RATE(APR)=        15.0000 %

AMOUNT FINANCED =$     12500.000
REGULAR PAYMENT =$      -300.000
LAST PAYMENT    =$      -500.000

TOTAL PAYMENTS  =           60
DAYS/PERIOD     =           30
PERIODS/YEAR    =           12
FIRST PAYMENT   =            2 PER
                            15 DAYS

FIRST PAYMENT   =$      -330.436
```

The banker would like repayment to begin after 1½ months. The final payment will be reduced to $300. The APR remains at 15%. What is the amount of the new first payment? (Change the odd period data to 1 full period and 15 odd days. Change the last payment amount to -$300. Then solve for the first payment amount.)

```
ANNUAL RATE(APR)=        15.0000 %

AMOUNT FINANCED =$     12500.000
REGULAR PAYMENT =$      -300.000
LAST PAYMENT    =$      -300.000

TOTAL PAYMENTS  =           60
DAYS/PERIOD     =           30
PERIODS/YEAR    =           12
FIRST PAYMENT   =            1 PER
                            15 DAYS

FIRST PAYMENT   =$      -267.344
```

Compute an amortization schedule for the first six payments.

```
        AMORTIZATION SCHEDULE

ANNUAL RATE(APR)=        15.0000 %

AMOUNT FINANCED =$     12500.000
REGULAR PAYMENT =$      -300.000
LAST PAYMENT    =$      -300.000

TOTAL PAYMENTS  =           60
DAYS/PERIOD     =           30
PERIODS/YEAR    =           12
FIRST PAYMENT   =            1 PER
                            15 DAYS

FIRST PAYMENT   =$      -267.344

 P   PRINCIPAL  INTEREST    BALANCE

 1       31.99    235.35   12468.01
 2      144.15    155.85   12323.86
 3      145.95    154.05   12177.91
 4      147.78    152.22   12030.13
 5      149.62    150.38   11880.51
 6      151.49    148.51   11729.02

TOTALS FOR PERIODS 1 TO 6 :
 PRINCIPAL    INTEREST     BALANCE

    770.98      996.36    11729.02
```

Appendix A

Financial Formulas

Compound Interest

$$PV + (1+i)^{\delta}\ PMT\left[\frac{1-(1+i)^{-n}}{i}\right] + FV(1+i)^{-n} = 0$$

where:

$$\delta = \begin{matrix} 0 \text{ ordinary annuity or END payment} \\ 1 \text{ annuity due or BEGIN payment} \end{matrix}$$

The equation above is solved for i using Newton's method where:

$$i_n = i_{n-1} - \frac{f(i_{n-1})}{f'(i_{n-1})}$$

Amortization Schedules

$$INT_j = \left|RND\left[BAL_{j-1} \cdot i\right]\right|$$

$$PRN_j = \left|PMT_j\right| - INT_j$$

$$BAL_j = BAL_{j-1} - PRN_j$$

$$\Sigma INT = \sum_{j=P1}^{P2} INT_j$$

$$\Sigma PRN = \sum_{j=P1}^{P2} PRN_j$$

For annuity due or BEGIN payment

$$INT_1 = 0$$

where:

INT_j = interest portion of j^{th} payment

PRN_j = principal portion of j^{th} payment

BAL_j = remaining balance after the j^{th} payment

PMT = payment amount

i = interest rate (as a decimal)

ΣINT = accumulated interest from P1 to P2 inclusive

ΣPRN = accumulated principal from P1 to P2 inclusive

P1 = first period of schedule

P2 = last period of schedule

RND = value rounded to the nearest cent

Internal Rate of Return

Solve for IRR

$$0 = \sum_{j=1}^{k} CF_j \left[\frac{1 - (1 + IRR)^{-n_j}}{IRR} \right] \left[(1 + IRR)^{-\sum_{\ell<j} n_\ell} \right] - CF_0$$

where:

n = number of cash flows

CF_j = j^{th} cash flow

and

$n_\ell = 0$ for $\ell = 0$

Net Present Value

$$NPV_k = CF_0 + \sum_{k=1}^{n} \frac{CF_k}{(1 + i)^k}$$

where:

CF_k = k^{th} cash flow

i = discount rate (as a decimal)

NPV_k = net present value after k^{th} cash flow

Financial Management Rate of Return

$$\text{FMRR, \%} = \left(\left[\frac{T}{-D} \right]^{\frac{1}{n}} - 1 \right) \cdot 100$$

where:

D = modified initial investment

n = number of compounding periods

T = modified terminal value of the investment

FMRR Procedure:

1. Negative cash flows are discounted, using the short-term safe interest rate, and netted against prior cash flows until a non-negative balance or period zero is reached. Addition to the initial cash flow gives D.

2. Remaining positive cash flows are compounded at the safe rate until they reach the minimum reinvestment amount, and then compounded at the long-term risk rate. This is repeated for subsequent positive cash flows toward repeated reinvestments. The sum of these compounded flows at the end of the investment life is T.

Note: See Appendix D for a more detailed explanation of the mechanics of solving a discounted cash flow problem using FMRR.

Straight Line Depreciation

$$\text{Dep}_n = \frac{A - S}{N}$$

For Partial First Year

$$\text{Dep}_1 = \frac{A - S}{N} \cdot \left(\frac{Y_1}{12} \right)$$

$$\text{Dep}_{N+1} = B_N$$

Sum-of-the-Years'-Digits Depreciation

$$Dep_n = d_{n-1} - x_{n-1} + x_n$$

where:

$$x_n = d_n \left(\frac{Y_1}{12} \right)$$

$$d_n = \frac{N - n + 1}{(INT\,(N) + 1)\left(N - \frac{INT\,(N)}{2} \right)} \cdot (A - S)$$

For Partial First Year

$$Dep_1 = d_1 \left(\frac{Y_1}{12} \right)$$

$$Dep_{N+1} = d_N - x_N$$

Declining Balance Depreciation

$$Dep_n = B_{n-1} \left(\frac{R}{N\,(100)} \right)$$

For Partial First Year

$$Dep_1 = A \left(\frac{R}{N\,(100)} \right) \cdot \left(\frac{Y_1}{12} \right)$$

Crossover Point: Declining Balance to Straight Line

$$\frac{B_{n-1} - S}{\left(\frac{12 - Y_1}{12} \right) + N - n + 1} \geqslant B_{n-1} \left(\frac{R}{N\,(100)} \right)$$

where:

A = starting book value

B_n = remaining depreciable amount

n = year number

N = useful life

R = declining balance rate, in percent

S = salvage value

Y_1 = number of months in partial first year

Simple Interest Solutions

$$I = P \cdot \left(\frac{R}{100}\right) \cdot \left(\frac{T}{Y}\right)$$

where:

I = accrued interest

P = principal amount

R = annual interest rate, in percent

T = number of days interest has accrued

Y = number of days in year (360 or 365)

Interest Conversions

periodic compounding

$$E = \left[\left(1 + \frac{N}{100 \cdot C}\right)^{C} - 1\right] \cdot 100$$

continuous compounding

$$E = (e^{\frac{N}{100}} - 1) \cdot 100$$

continuous compounding (365/360 basis)

$$E = (e^{\frac{N}{100}} - 1) \cdot \left(\frac{365}{360}\right) \cdot 100$$

where:

C = number of compounding periods per year

E = annual effective interest rate, percent

N = annual nominal interest rate, percent

Bonds

For $\frac{n \cdot a}{b} > 1$

$$\text{Price} = \frac{RV\left(1 + \frac{i}{a}\right)^{\frac{-n \cdot a}{b}}(1 - T_C)}{1 - T_C\left(1 + \frac{i}{a}\right)^{\frac{-n \cdot a}{b}}} + \frac{(1 - T_I)\frac{CR}{i}\left[\left(1 + \frac{i}{a}\right)^{j} - \left(1 + \frac{i}{a}\right)^{\frac{-n \cdot a}{b}}\right] - \frac{CR \cdot j \cdot (1 - T_I)}{a}}{1 - T_C\left(1 + \frac{i}{a}\right)^{\frac{-n \cdot a}{b}}}$$

For $\frac{n \cdot a}{b} \leq 1$

$$\text{Price} = \frac{(1 - T_I) \cdot \left[RV + \frac{CR}{a} - \frac{CR \cdot j}{a} \cdot \left(1 + \frac{i \cdot n}{b}\right)\right]}{1 + \frac{i \cdot n}{b} - T_I}$$

where:

a = number of coupons per year (1 or 2)

b = day basis (360 or 365)

i = yield as a decimal

CR = coupon rate, in percent

RV = redemption value per $100 par value

n = days, settlement to maturity

$j = 1 - \text{FRAC}\left(\frac{n \cdot a}{b}\right)$

T_C = capital gains tax rate as a decimal

T_I = income tax rate as a decimal

$$\text{FRAC}\left(\frac{n \cdot a}{b}\right) = \text{fractional portion of the number of remaining coupon periods.}$$

Bond Price is quoted as a percent of par value ($100).

Notes: Interest at Maturity

$$P = \frac{100 \cdot \left(R + \frac{DIM}{b} \cdot \overline{CR}\right)}{\left(100 + \frac{DSM}{b} \cdot i\right)} - \left(\frac{DIS}{b} \cdot \overline{CR}\right)$$

$$i = 100\left[\frac{R + \frac{DIM}{b} \cdot \overline{CR}}{P + \frac{DIS}{b} \cdot \overline{CR}} - 100\right] \cdot \frac{b}{DSM}$$

Notes: Discounted Securities

$$P = RV - \frac{DR}{100} \cdot \frac{RV \cdot DSM}{b}$$

$$i = 100 \cdot (RV - P) \cdot \frac{b}{P \cdot DSM}$$

where:

b = day basis (360 or 365)

C = annual interest rate, percent

$\overline{CR}$ = (C · RV)/100

DIM = days, issue to maturity; DIM = DIS + DSM

DIS = days, issue to settlement

DR = discount rate, percent

DSM = days, settlement to maturity

i = yield, percent

P = price

RV = redemption value

Days Between Dates in Bonds and Notes

Actual Basis

$$\text{Days} = f(D_2) - f(D_1)$$

where:

$f(D_n) = 365\,(YYYY) + 31\,(MM - 1) + DD - x$

$D_n = MM.DDYYYY$

$x = 0$ given $MM \leq 2$

$x = INT\,(.4\,MM + 2.3)$ given $MM > 2$

$INT =$ Integer portion

30/360 Basis

$$\text{Days} = f(D_2) - f(D_1)$$

where:

$f(D_n) = 360\,(YYYY) + 30\,MM + z$

$D_n = MM.DDYYYY$

for $f(D_1)$

$z = 30$ given $DD_1 = 31$

$z = DD_1$ given $DD_1 \neq 31$

for $f(D_2)$

$z = 30$ given $DD_2 = 31$ and $DD_1 = 30$ or 31

$z = DD_2$ given $DD_2 = 31$ and $DD_1 < 30$

$z = DD_2$ given $DD_2 < 31$

Break-Even Analysis

$$P = U \cdot (S - V) - F$$

$$OL = \frac{U \cdot (S - V)}{U \cdot (S - V) - F}$$

where:

F = fixed costs

OL = degree of operating leverage

P = profit

S = sales revenue per unit

U = units sold

V = variable costs per unit

Odd Days Interest

$$A = \frac{-P_1 - P \cdot \left[\frac{1 - (1 + i)^{-n+2}}{i}\right] - \frac{P_n}{(1 + i)^{n-1}}}{\left[1 + \left(\frac{f}{d}\right) \cdot i\right] \cdot (1 + i)^t}$$

and

$$APR, \% = i \cdot w \cdot 100$$

where:

A = amount financed

APR = annual percentage rate, in percent

d = days per compounding period

f = odd days in first compounding period

i = periodic interest rate, as a decimal

n = total number of payments

P_1 = first payment amount

P = regular payment amount

P_n = last payment amount

t = number of full compounding periods until the first payment

w = compounding periods per year

Appendix B

To obtain a catalogue of the programs and data files stored on tape:

a. Insert the Financial Decisions Pac cartridge into the tape transport.
b. Type: CAT (END LINE)

To purge a problem (data file) from tape:

a. Insert the Financial Decisions Pac cartridge into the tape transport.
b. Type: PURGE " (problem name) " (END LINE)

To display a listing of one of the Financial Decisions Pac programs:

a. Insert the Financial Decisions Pac cartridge into the tape transport.
b. Type: (REW LOAD) " (program name) " (END LINE)
c. Press: (P LST LIST)

To print a listing of one of the Financial Decisions Pac programs:

a. Insert the Financial Decisions Pac cartridge into the tape transport.
b. Type: (REW LOAD) " (program name) " (END LINE)
c. Press: (SHIFT) (P LST LIST)

Appendix C

Remarks Program

To help you understand the flow of the programs contained in the Financial Decisions Pac, abbreviated remarks for each of the programs in the pac, as well as definitions of variables used, are contained in two programs. The programs are named "FINREM" and "FINRM2," and are chained together.

User Instructions

1. To load the program:
   a. Insert the Financial Decisions Pac cartridge into the tape transport.
   b. Type: (REW LOAD) "FINREM" (END LINE)
2. When the program has been loaded:
   a. Press: (RUN)
3. When PRINT OR DISPLAY OUTPUT(P/D)? is displayed:
   a. Enter: P (END LINE) to print the output.
   OR:
   a. Enter: D (END LINE) to display the output.

   Note: Contents of the display screen may be output to the printer at any time by pressing (SHIFT) (COPY —).
4. When the keys are labeled:

```
BOND     NOTE     BREAK     ODD
MONEY    CASHFL   DEPREC    SIMPLE
```

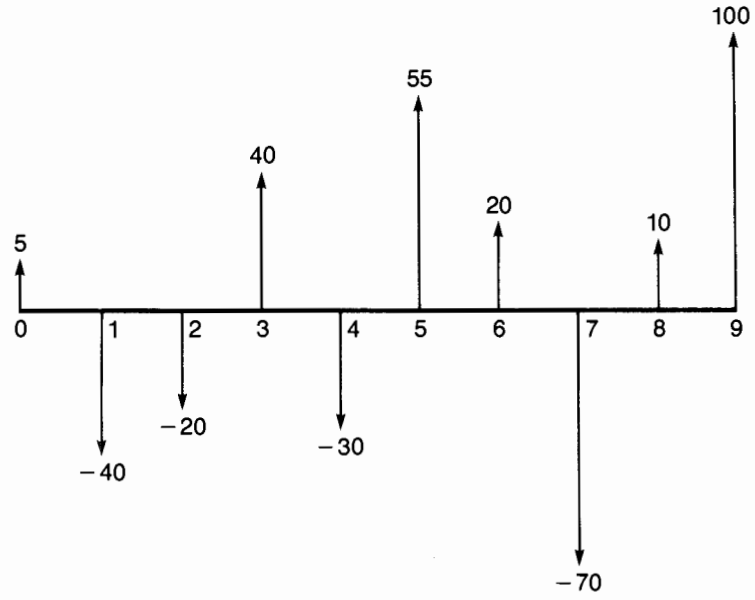
   a. Press: The special function key corresponding to the program name in which you are interested.
   b. After the remarks and variable definitions are printed or displayed, go to step 4.

Appendix D

The Financial Management Rate of Return Method

The following example is presented to demonstrate the FMRR method of solving a discounted cash flow problem. There are ten individual cash flows as depicted in the initial cash flow diagram. The period length is one year.

Initial Cash Flow Diagram:



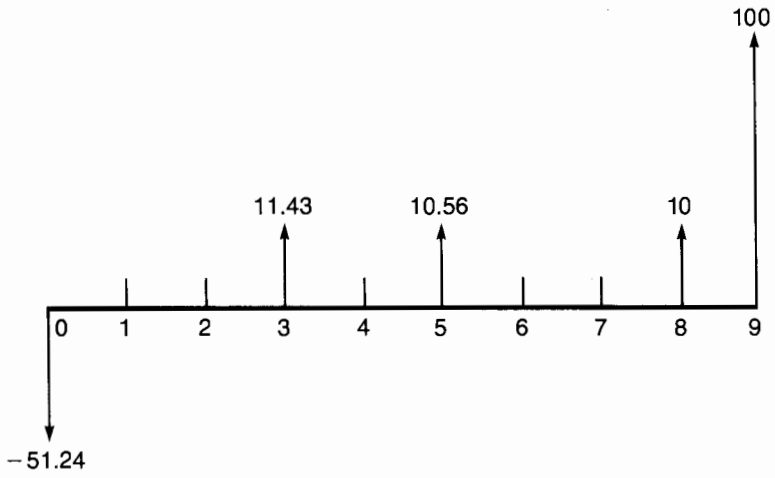
FMRR Conditions:

Short-Term Safe Rate	5%
Long-Term Risk Rate	10%
Min. Reinvestment Amt.	$20

Phase 1 Discount negative cash flows starting with the latest period, using the short-term rate; net them against prior cash flows until a non-negative balance or period zero is reached.

Initial Cash Flows	Discount and Balance	Test	Final Cash Flows
$CF_7 = -70,\ CF_6 = 20$	$\frac{-70}{1.05} + 20 = -46.67$	< 0	$CF_7 = 0, CF_6 = -46.67$
$CF_6 = -46.67, CF_5 = 55$	$\frac{-46.67}{1.05} + 55 = 10.56$	$\geqslant 0$	$CF_6 = 0,\ CF_5 = 10.56$
$CF_4 = -30,\ CF_3 = 40$	$\frac{-30}{1.05} + 40 = 11.43$	$\geqslant 0$	$CF_4 = 0,\ CF_3 = 11.43$
$CF_2 = -20,\ CF_1 = -40$	$\frac{-20}{1.05} + (-40) = -59.05$	< 0	$CF_2 = 0, CF_1 = -59.05$
$CF_1 = -59.05,\ CF_0 = 5$	$\frac{-59.05}{1.05} + 5 = -51.24$	Period zero	$CF_1 = 0, CF_0 = -51.24$

Cash Flow Diagram After Discounting:



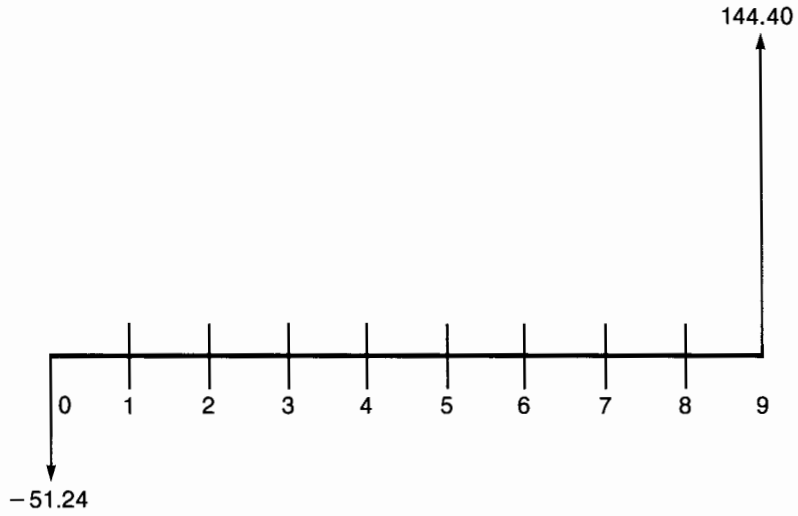
Phase 2 Compound positive cash flows using:

- Short-term safe rate if the cash flow is less than the reinvestment limit.
- Long-term risk rate if the cash flow is equal to or greater than the reinvestment limit.

Cash Flows	Reinvestment limit test on the earlier cash flow	Compound and Balance	Final Cash Flows
$CF_3 = 11.43$, $CF_4 = 0$	$CF_3 < 20$	$11.43 \times 1.05 + 0 = 12.00$	$CF_3 = 0$, $CF_4 = 12.00$
$CF_4 = 12.00$, $CF_5 = 10.56$	$CF_4 < 20$	$12.00 \times 1.05 + 10.56 = 23.16$	$CF_4 = 0$, $CF_5 = 23.16$
$CF_5 = 23.16$, $CF_6 = 0$	$CF_5 \geq 20$	$23.16 \times 1.1 + 0 = 25.47$	$CF_5 = 0$, $CF_6 = 25.47$
$CF_6 = 25.47$, $CF_7 = 0$	$CF_6 \geq 20$	$25.47 \times 1.1 + 0 = 28.02$	$CF_6 = 0$, $CF_7 = 28.02$
$CF_7 = 28.02$, $CF_8 = 10.00$	$CF_7 \geq 20$	$28.02 \times 1.1 = 30.82$	$CF_7 = 0$, $CF_8 = 30.82$* $CF_8' = 10.00$*
$CF_8 = 30.82$,*$CF_9 = 100.00$ $CF_8' = 10.00$*	$CF_8 \geq 20$ $CF_8' < 20$	30.82×1.1 $+ 10.00 \times 1.05$ $+ 100.00 = 144.40$	$CF_8 = 0$, $CF_9 = 144.40$ $CF_8' = 0$

* Two cash flows (CF_8, CF_8') are not merged because CF_8' is less than the $20 minimum reinvestment amount.

Cash Flow Diagram After Compounding:



Phase 3 Solve for the periodic FMRR using the following formula:

$$\text{FMRR, \%} = \left(\left[\frac{T}{-D}\right]^{\frac{1}{n}} - 1\right) \cdot 100$$

where:

D = Modified initial investment

n = Number of compounding periods

T = Modified terminal value of the investment

In the above example

$$\text{FMRR, \%} = \left(\left[\frac{144.40}{51.24}\right]^{\frac{1}{9}} - 1\right) \cdot 100 = 12.20\,\%$$

Values for D and T may be displayed, after the FMRR results are printed, as follows:

a. Press: (STEP PAUSE)
b. Press: (CLEAR -LINE)
c. Enter: The variable name, D or T.
d. Press: (END LINE)

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