

NOTICE

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INTRODUCTION

Each program in this Pac is represented by one program in the Application Module and a section in this manual. The manual provides a description of the program with relevant equations, a set of instructions for using the program, and one or more example problems, each of which includes a list of the keystrokes required for its solution.

Before plugging in your Application Module, **turn your calculator off**, and be sure you understand the section Inserting and Removing Application Modules. And before using a particular program, take a few minutes to read Format of User Instructions and A Word About Program Usage.

You should first familiarize yourself with a program by running it once or twice while following the complete User Instructions in this manual. Thereafter, the program's prompting or the mnemonics on the overlays should provide the necessary instructions, including which variables are to be input, which keys are to be pressed, and which values will be output. A quick-reference card with a brief description of each program's operating instructions has been provided for your convenience.

We hope that Securities Pac I will assist you in the solution of numerous problems in your discipline. We would appreciate knowing your reactions to the programs in this Pac, and to this end we have provided a questionnaire inside the front cover of this manual. Would you please take a few minutes to give us your comments on these programs? It is from your comments that we learn how to increase the usefulness of our programs.


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| Calculates either price and accrued interest or yield for bonds and notes. Options include before or after-tax bonds, 360 or 365 day calendar, redemption at maturity or at call, and coupon equivalent yield. | |
| Stock Portfolio Valuation with Beta Analysis | 15 |
| This program evaluates a portfolio of stocks given the current market price per share and the annual dividend. Calculations include the new portfolio value, the percent change in value, and the current dividend yield as a percent of the current market value. In addition, this program also allows the user to calculate the portfolio's weighted beta coefficient given the beta coefficient for each security. | |
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| Given a bull spread option, this program calculates upside and downside break-even points of both matched and unmatched options. | |

| | |
|---|-----------|
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INSERTING AND REMOVING APPLICATION MODULES

Before you insert an Application Module for the first time, familiarize yourself with the following information.

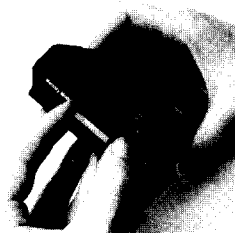
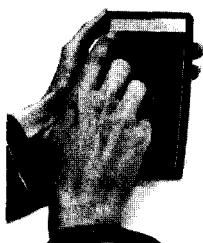
Up to four Application Modules can be plugged into the ports on the HP-41C. While plugged in, the names of all programs contained in the Module can be displayed by pressing  **CATALOG** 2.

CAUTION

Always turn the HP-41C off before inserting or removing any plug-in extension or accessories. Failure to turn the HP-41C off could damage both the calculator and the accessory.

To insert Application Modules:

1. Turn the HP-41C off! Failure to turn the calculator off could damage both the Module and the calculator.
2. Remove the port covers. Remember to save the port covers; they should be inserted into the empty ports when no extensions are inserted.
3. Insert the Application Module with the label facing downward as shown, into any port **after** the last Memory Module. For example, if you have a Memory Module inserted in port 1, you can insert an Application Module in any of ports 2, 3, or 4. (The port numbers are shown on the back of the calculator.) **Never insert an Application Module into a lower numbered port than a Memory Module.**



4. If you have additional Application Modules to insert, plug them into any port after the last Memory Module. Be sure to place port covers over unused ports.
5. Turn the calculator on and follow the instructions given in this book for the desired application functions.

To remove Application Modules:

1. Turn the HP-41C off! Failure to do so could damage both the calculator and the Module.
2. Grasp the desired Module handle and pull it out as shown.



3. Place a port cap into the empty ports.

Mixing Memory Modules and Application Modules

Any optional accessories (such as the HP-82104A Card Reader, or the HP-82143A Printer) should be treated in the same manner as Application Modules. That is, they can be plugged into any port after the last Memory Module. Also, the HP-41C should be turned off prior to insertion or removal of these extensions.

The HP-41C allows you to leave gaps in the port sequence when mixing Memory and Application Modules. For example, you can plug a Memory Module into port 1 and an Application Module into port 4, leaving ports 2 and 3 empty.

FORMAT OF USER INSTRUCTIONS

The completed User Instruction Form—which accompanies each program—is your guide to operating the programs in this Pac.

The form is composed of five labeled columns. Reading from left to right, the first column, labeled STEP, gives the instruction step number.

The INSTRUCTIONS column gives instructions and comments concerning the operations to be performed.

The INPUT column specifies the input data, the units of data if applicable, or the appropriate alpha response to a prompted question. Data input keys consist of 0 to 9 and the decimal point (the numeric keys), **EEX** (enter exponent), and **CHS** (change sign).


The FUNCTION column specifies the keys to be pressed after keying in the corresponding input data.

The DISPLAY column specifies prompts, intermediate and final answers, and their units, where applicable.

Above the DISPLAY column is a box which specifies the minimum number of data storage registers necessary to execute the program. Refer to the Owner's Handbook for information on how the SIZE function affects storage configuration.

A WORD ABOUT PROGRAM USAGE







Catalog


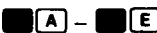
When an Application Module is plugged into a port of the HP-41C, the contents of the Module can be reviewed by pressing  **CATALOG** 2 (the Extension Catalog). Executing the **CATALOG** function lists the name of each program or function in the Module, as well as functions of any other extensions which might be plugged in.

Overlays

Overlays have been included for some of the programs in this Pac. To run the program, choose the appropriate overlay, and place it on the calculator. The mnemonics on the overlay are provided to help you run the program. The program's name is given vertically on the left side. When the calculator is in USER mode, a blue mnemonic identifies the key directly above it. Gold mnemonics are similar to blue mnemonics, except that they are above the appropriate key and the shift (gold) key must be pressed before the re-defined key. Once again, USER mode must be set.

ALPHA and USER Mode Notation

This manual uses a special notation to signify ALPHA mode. Whenever a statement on the User Instruction Form is printed in gold, the  key must be pressed before the statement can be keyed in. After the statement is input, press  again to return the calculator to its normal operating mode, or to begin program execution. For example,  BONDS means press the following keys:   BONDS .

When the calculator is in USER mode, this manual will use the symbols  and  to refer to the reassigned keys in the top two rows. These key designations will appear on the User Instruction Form and in the keystroke solutions to sample problems.

Optional HP-82143A Printer

When the optional printer is plugged into the HP-41C along with the Securities Application Module, all results will be printed automatically. You may also want to keep a permanent record of the value input to a certain program. A convenient way to do this is to set the Print Mode switch to NORMAL before running the program. In this mode, all input values and the corresponding keystrokes will be listed on the printer, thus providing a record of the entire operation of the program.

Downloading Module Programs

If you wish to trace execution, to modify, to record on magnetic cards, or to print a program in this Application Module, it must first be copied into the HP-41C's program memory. For information concerning the HP-41C's COPY function, see the Owner's Handbook. It is not necessary to copy a program in order to run it.

Program Interruption

These programs have been designed to operate properly when run from beginning to end, without turning the calculator off (remember, the calculator may turn itself off). If the HP-41C is turned off, it may be necessary to set flag 21 (SF 21) to continue proper execution.

Use of Labels

You should generally avoid writing programs into the calculator memory that use program labels identical to those in your Application Module. In case of a label conflict, the label within program memory has priority over the label within the Application Pac program.

Assigning Program Names

Key assignments to keys **A**–**J** and **■A**–**■E** take priority over the automatic assignments of local labels in the Application Module. Be sure to clear previously assigned functions before executing a Module program.

Incompatible Application Module

This Pac contains a type X Application Module. Type X Modules have incompatible XROM instructions. You should never plug two type X Application Modules into your HP-41C at the same time. Type X Modules may be identified by an "X" on the Application Module label.

NOTES

BONDS AND NOTES

| | | | | | |
|-------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | BOND/NOTE | 360/365 | B/ATA X | CALL | DISC |
| BONDS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | ST | MT | CPN | PRICE | YIELD |
| | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | IS | CYIELD | LIST | CL FIN | |
| | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

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

This program can be used to calculate yield, or price* and accrued interest for all three categories. If the security involves semi-annual interest payments, it is a bond. If the security is sold at a discount or pays interest at maturity, it is a note.

Program options available for the price and yield computation include redemption at maturity or at call, price and yield before and after tax, and a calendar basis of 30/360 or Actual/365. In addition, notes are also evaluated on an Actual/360 basis when in 30/360 mode. When BONDS is first executed, the program is initialized for the following conditions: bonds, 30/360 day calendar, before tax, and a redemption value of 100 (call price = 100).

Coupon equivalent yield is also provided so that an investor can determine which of two investments of similar maturity will provide a higher return—a non-interest bearing obligation purchased at a discount (i.e., Treasury Bills) or a semi-annual coupon bond on a 365-day basis.

Often the calendar basis is difficult to determine. There is seldom any indication from an obligation's name which calendar basis is appropriate. For this reason, the following alphabetical index has been included. It gives the most common U.S. securities and their classification.

Type 1: Semi-Annual Coupon, 30/360 Day Basis (Bonds)

Type 2: Semi-Annual Coupon, Actual/365 Day Basis (Bonds)

Type 3: Interest at Maturity, 30/360 Day Basis (Notes)

* Bond price is quoted as a percent of par value (\$100).

- Type 4: Interest at Maturity, Actual/360 Day Basis (Notes)
- Type 5: Interest at Maturity, Actual/365 Day Basis (Notes)
- Type 6: Discount, Actual/360 Day Basis (Notes)

| | TYPE |
|---|-------------|
| Assessment Supported Bonds | 1 |
| Assessment Supported Notes | 3 |
| Assessment Supported Warrants | 3 |
| Bankers' Acceptances | 6 |
| Banks for Cooperatives Debentures | 3 |
| Certificates of Deposit | 1, 4, 6 |
| Certificates of Indebtedness | 5 |
| Commercial Paper | 4, 6 |
| Commodity Credit Corporation | 1 |
| Corporate Bonds | 1 |
| Export-Import Bank Participation Certificates | 1 |
| Farmers Home Administration Insured Notes | 2 |
| Federal Home Loan Bank Notes and Bonds | 1 |
| Federal Housing Administration (FHA) Debentures | 2 |
| Federal Intermediate Credit Bank Debentures | 1, 3 |
| Federal Land Bank Bonds | 1 |
| FNMA Debentures | 1 |
| FNMA Short Term Notes | 6 |
| GNMA Bonds and Participation Certificates | 1 |
| Inter-American Development Bank Bonds | 1 |
| International Bank for Reconstruction and Development Bonds | 1 |
| Merchant Marine Bonds | 1 |
| New Communities Act Debentures | 1 |
| Repurchase Agreements | 4 |
| Revenue Supported Bonds | 1 |
| Revenue Supported Notes | 3 |
| Revenue Supported Warrants | 3 |
| Special Supported Bonds | 1 |
| Special Supported Notes | 3 |
| Special Supported Warrants | 3 |
| Tax Supported Bonds | 1 |
| Tax Supported Notes | 3 |
| Tax Supported Warrants | 3 |
| Tennessee Valley Authority Bonds | 1 |
| Tennessee Valley Authority Notes | 6 |
| U.S. Postal Service Bonds | 1 |
| U.S. Treasury Bills | 6 |
| U.S. Treasury Bonds | 2 |
| U.S. Treasury Notes | 2 |
| U.S. Treasury Tax-Anticipation Bills | 6 |

12 Bonds and Notes

| | | | | SIZE: 021 |
|------|--|--------------|--|------------------|
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Place overlay on calculator and initialize program | | <input type="checkbox"/> EQ BONDS | 0.00 |
| 2. | Select Bond or Note | | <input type="checkbox"/> A | BOND or NOTE |
| 3. | Select calendar basis (toggles between 360 and 365 mode). | | <input type="checkbox"/> B | 360 or 365 |
| 4. | Select tax basis (toggles between before-tax and after-tax mode). | | <input type="checkbox"/> C | BTAX or INC TAX? |
| 5. | For after-tax calculations, key in marginal income tax rate | INC TAX (%) | <input type="checkbox"/> R/S | GAINS TAX? |
| 6. | Key in capital gains tax rate | GAINS TAX(%) | <input type="checkbox"/> R/S | |
| 7. | The following steps may be performed in any order: | | | |
| | Key in issue date | MM.DDYYYY | <input type="checkbox"/> F | |
| | Key in settlement date | MM.DDYYYY | <input type="checkbox"/> A | |
| | Key in maturity date | MM.DDYYYY | <input type="checkbox"/> B | |
| | Key in annual coupon rate | CPN (%) | <input type="checkbox"/> C | |
| | Key in price | PRICE | <input type="checkbox"/> D | |
| | Key in yield | YIELD (%) | <input type="checkbox"/> E | |
| | Key in call price if other than 100 | CALL | <input type="checkbox"/> D | |
| | Key in discount rate | DISC (%) | <input type="checkbox"/> E | |
| 8. | Calculate: | | | |
| | Price and accrued interest** | | <input type="checkbox"/> D | PRICE = |
| | Yield to maturity † | | <input type="checkbox"/> R/S * | AI = |
| | Coupon equivalent yield | | <input type="checkbox"/> E | YIELD = |
| | | | <input type="checkbox"/> G | CYIELD = |
| 9. | To list the values being used press <input type="checkbox"/> H , then <input type="checkbox"/> R/S * for successive values | | <input type="checkbox"/> H | |
| 10. | To clear appropriate registers and set to Bond mode | | <input type="checkbox"/> I | 0.00 |
| * | Press <input type="checkbox"/> R/S if you are not using a printer. | | | |
| ** | Price and accrued interest are for 30/360 or Actual/365 calendar basis bonds or notes. For Actual/360 notes, press <input type="checkbox"/> R/S * two additional times for price and accrued interest. | | | |
| † | When calculating note yield in 365 mode, the display contains the yield. In 360 mode, the display contains the yield on a 30/360 basis; press <input type="checkbox"/> R/S * to obtain note yield on an actual/360 basis. | | | |

Example 1:

Given the following U.S. Treasury Bond, find its price and accrued interest:
 Settlement date April 9, 1979; maturity date December 14, 1990; coupon rate 4.75%; yield 5%; calendar basis Actual/365.

Keystrokes:

XEQ **ALPHA** SIZE **ALPHA** 021
XEQ **ALPHA** BONDS **ALPHA**
■ **B**
 4.091979 **A**
 12.141990 **B**
 4.75 **C**
 5 **E**
D
R/S

Display:

Minimum size
0.00
365 Calendar basis

PRICE=97.80
AI=1.51 Accrued interest

Example 2:

Using the previous example, what is the yield if the bond is purchased for \$96?

Keystrokes:

96 **D** **E**

Display:

YIELD=5.21 Yield-to-maturity

Example 3:

Calculate the yield of the following U.S. Treasury Bill:

Settlement date July 2, 1979; maturity date October 30, 1979; price \$97.50; no coupons; Actual/360 basis.

Keystrokes:

I
■ **A**
 7.021979 **A**
 10.301979 **B**
 97.5 **D**
 0 **C** **E**

R/S

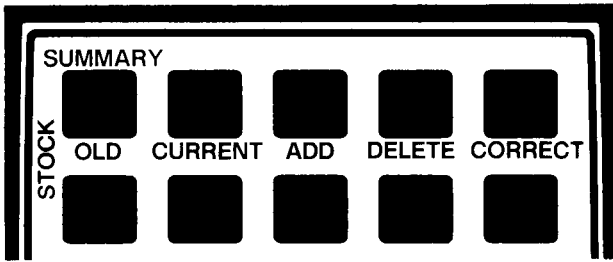
Display:

0.00 Clear registers
NOTE

YIELD=7.82 % annual yield (30/360 basis)

YIELD=7.69 % annual yield (Act/360 basis)

STOCK PORTFOLIO VALUATION WITH BETA ANALYSIS



The fundamental concern of all investors is the expected return from an investment for a given level of risk. The riskier the investment, the greater the expected return should be. This program provides the measures of risk and return necessary for evaluating an investment portfolio of as many as 56 stocks.

This program uses the beta coefficient as a measure of risk. Beta reflects the extent to which an investment's rate of return tends to vary with changes in the market's rate of return. The return of the investment is expected to be greater than that of the market if the beta is greater than one, and less than the market if beta is less than one.

The program requires the following data for each share: original purchase price per share, the number of shares owned, the annual dividends per share, and the beta coefficient. Once this data has been entered, the user enters the current (or expected) price of each stock. The program then provides the following information for the current (or expected) portfolio: total value, percentage change in value, current annual yield, and weighted beta coefficient.

With an optional card reader (HP-82104A) the user may create data cards containing the portfolio information. The data is stored (beginning with register 01 (R_{01})) and must use the format SSSS.XXXXX, where S denotes the number of shares of a particular stock and X denotes the stock's price. For example, 250 shares of XYZ stock purchased for \$42.50 would be stored as 250.04250. Because all five decimal digits are used for stock price, the price must be less than \$1000.00. The registers which are used for computation (R_{57} - R_{62}) must contain zero.

| | | | | SIZE: 063 |
|------|---|-------|--------------------------------|-----------|
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Place overlay on calculator and initialize program. | | <input type="checkbox"/> STOCK | 0.00 |

16 Stock Portfolio Valuation With Beta Analysis

| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
|------|---|---------------------------------|---|---|
| 2. | To load historical data†. | | [A] | NO GROUPS=? |
| 3. | Key in number of groups of historical data. | # GROUPS | [R/S] | NO SHS _n =? |
| 4. | Key in number of shares in group n | # SHS _n | [R/S] | PRC=? |
| 5. | Key in price per share. | PRC | [R/S] | NO SHS _n =? |
| 6. | Repeat steps 4 and 5 until each group of stock is entered. | | | |
| 7. | If an error is made while entering historical data, press [E] and continue keying in data as in steps 4-5. | | [E] | NO SHS _n =? |
| 8. | To delete a group from the portfolio. | | [D] | DELETE NO=? |
| 9. | Input group number to be deleted. | n | [R/S] | 0.00 |
| 10. | To add a group to an already established portfolio (the program counter stops at the first storage register containing zero). | | [C] | NO SHS _n =? |
| | | # SHS _n | [R/S] | PRC=? |
| | | PRC | [R/S] | 0.00 |
| 11. | To load current data and calculate % change in stock value: Key in current price of stock Key in stock's beta coefficient Key in annual dividend per share | PRC _n BETA DIV | [B] [R/S] [R/S] [R/S] [R/S] * | PRC _n =? BETA=? DIV=? %CH= PRC=? |
| 12. | Repeat step 11 for each group in portfolio. | | | |
| 13. | After all current data has been keyed in, prepare a summary and display historical portfolio value. | | [A] | OLD= |
| 14. | Calculate current portfolio value. | | [R/S] * | NEW= |
| 15. | Calculate % change in portfolio value. | | [R/S] * | %CH= |
| 16. | Calculate current annual dividend. | | [R/S] * | DIV= |
| 17. | Calculate portfolio's current dividend yield. | | [R/S] * | YIELD= |
| 18. | Calculate portfolio's weighted beta coefficient. | | [R/S] * | BETA= |
| † | NOTE: If a card reader is in use, the user may input a previously prepared data card containing historical data and proceed to step 7. | | | |
| * | Press [R/S] if you are not using a printer. | | | |

Example:

With the following historical and current information about a portfolio containing four groups of stock, analyze the performance of the portfolio.

| HISTORICAL INFORMATION | | | CURRENT INFORMATION | | |
|------------------------|----------|------------------|---------------------|------|---------------|
| Company | # Shares | Purchase (\$) | Market (\$) | Beta | Dividend (\$) |
| FEXTER | 200 | 14 $\frac{1}{8}$ | 17 | 1.39 | .50 |
| BOAR | 300 | 91 $\frac{3}{4}$ | 75 | 1.28 | .80 |
| ST MAL | 500 | 88 $\frac{3}{8}$ | 91 $\frac{3}{4}$ | 0 | 7.70 |
| TIMCO | 1000 | 40 $\frac{1}{2}$ | 52 $\frac{1}{4}$ | 1.17 | 1.40 |

Keystrokes:

XEQ ALPHA SIZE ALPHA 063
 XEQ ALPHA STOCK ALPHA

Display:

0.00

Minimum size

To enter historical data:

A
 4 R/S
 200 R/S
 14.125 R/S
 300 R/S
 91.75 R/S
 500 R/S
 88.325 R/S

NO GROUPS=?
 NO SHS1=?
 PRC=?
 NO SHS2=?
 PRC=?
 NO SHS3=?
 PRC=?
 NO SHS4=?

Mistake, should be 88.375

E
 500 R/S
 88.375 R/S
 1000 R/S
 40.5 R/S

NO SHS3=?
 PRC=?
 NO SHS4=?
 PRC=?
 0.00

To enter current data:

B
 17 R/S
 1.39 R/S
 .5 R/S

PRC1=?
 BETA=?
 DIV=?
 %CH=20.35

Change in stock 1 value

18 Stock Portfolio Valuation With Beta Analysis

Keystrokes:

R/S

75 **R/S**

1.28 **R/S**

.8 **R/S**

R/S

91.75 **R/S**

0 **R/S**

7.7 **R/S**

R/S

52.25 **R/S**

1.17 **R/S**

1.4 **R/S**

Display:

PRC2=?

BETA=?

DIV=?

%CH=-18.26

Change in stock 2
value

PRC3=?

BETA=?

DIV=?

%CH=3.82

Change in stock 3
value

PRC4=?

BETA=?

DIV=?

%CH=29.01

Change in stock 4
value

To prepare portfolio summary:

A

R/S

R/S

R/S

R/S

R/S

OLD=115,037.50

NEW=124,025.00

%CH=7.81

Change in
portfolio value

DIV=5,590.00

YIELD=4.51

BETA=0.76

From the above calculations, we can see that the portfolio has increased in value by 7.81% and the dividends are currently \$5,590.00 or 4.51% of the portfolio value. Based upon our weighted beta coefficient, the portfolio should be less risky than the market (i.e., $0.76 < 1.00$).

YIELD ON CALL OPTION SALES

| | | | | | |
|------|----------|-------|--------|-----------|--------|
| | CASH/MGN | DAYS | BEP | INCL COMM | ANNUAL |
| CALL | ■ | ■ | ■ | ■ | ■ |
| | # SHS | STOCK | OPTION | EX YLD | UN YLD |
| | ■ | ■ | ■ | ■ | ■ |

This program calculates various yields (actual and annualized) useful in evaluating call option sales (writing): yield if exercised, yield if unexercised, and break-even point¹. Calculations consider whether the stock is purchased on a cash basis (full price) or on a margin basis.

$$\text{exercised} = \frac{\text{net prem.} - \text{net pur.} + \text{net sale} + \text{div.} - \text{int.}}{(1 - \% \text{ margin}) \text{ net pur.} - \text{net prem.}}$$

$$\text{unexercised} = \frac{\text{net prem.} + \text{div.} - [2 \times \text{comm.}]_2 - \text{int.}}{(1 - \% \text{ margin}) \text{ net pur.} - \text{net prem.}}$$

$$\text{break-even} = \frac{\text{net pur.} - \text{net prem.} - \text{div.} + \text{int.}}{\# \text{ shares}}$$

where:

$$\text{net pur.} = (\# \text{ shares} \times \text{stock price}) + \text{comm.}$$

$$\text{net prem.} = (\# \text{ shares} \times \text{option premium}) - \text{option commission}$$

$$\text{net sale} = (\# \text{ shares} \times \text{exercise price}) - \text{exercise commission}$$

$$\text{int.} = \text{interest rate} \times (1 - \% \text{ margin}) (\text{net pur.}) \times T/365$$

$$\text{comm.} = \text{commission on stock purchase}$$

$$T = \# \text{ days}$$

¹ Stock price below which the writer has a loss (the loss point on the downside).

² Stock is purchased for one option period and then sold.

| | | | | SIZE: 021 |
|------|--|----------------|---------------------|------------------|
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Place overlay on calculator and initialize program. | | XEO CALL ([A]) | CASH? |
| 2. | If stock is purchased on cash basis, press [R/S] and go to step 5; otherwise answer no (N) for margin basis. | N | [R/S] | % MARGIN=? |
| 3. | Key in margin percentage rate. | % MARGIN | [R/S] | MARGIN INT=? |
| 4. | Key in interest rate charged on margin account. | MARGIN INT | [R/S] ([A]) | NO SHS=? |
| 5. | Key in number of shares purchased. | # SHS | [R/S] ([B]) | STOCK PRC=? |
| 6. | Key in stock price. | STOCK PRC | [R/S] | DIVIDEND=? |
| 7. | Key in dividends per share before expiration. | DIVIDEND | [R/S] | STOCK COMM%=? |
| 8. | Key in stock commission as a percent. | STOCK COMM% | [R/S] | FLAT FEE=? |
| 9. | Key in additional flat fee. | FLAT FEE | [R/S] ([C]) | OPT EXPRC=? |
| 10. | Key in option exercise price. | OPT EXPRC | [R/S] | OPT PREM=? |
| 11. | Key in option premium. | OPT PREM | [R/S] ([B]) | NO DAYS=? |
| 12. | Key in number of days to expiration. | # DAYS | [R/S] | OPT COMM=? |
| 13. | Key in option commission as a percent. | OPT COMM | [R/S] | FLAT FEE=? |
| 14. | Key in additional flat fee and calculate actual yield if option is exercised. | FLAT FEE | [R/S] ([D]) | ACYLD= |
| 15. | Calculate actual yield assuming stock price remains constant and option expires unexercised (no commissions included). | | [R/S] * ([E]) | UNEX= |
| 16. | Calculate break-even point (loss point on downside). | | [C] | BEP= |
| 17. | Convert actual yield to an annualized yield. | | [E] | ANYLD= |
| 18. | Calculate yield with buy and sell commissions (double) included. Flag 1 is set by program. | | [D] | YLD/C= |
| * | Press [R/S] if you are not using a printer. | | | |

You wish to write 3 calls on 300 shares of XYZ stock, which you intend to buy at \$20. The calls trade at $1\frac{3}{16}$, the exercise price is 25 and the time remaining is 100 days. During that time, the stock pays dividends of \$.50 per share. Stock commissions are 1.20% of the money involved in the transaction plus \$44.50. Option commissions are 1.43% of the money involved plus \$33.00. The margin interest rate is 7.2%.

1. Calculate: the yield if called, the yield if not called (assuming you own the stock), and the break-even point.
2. If the stock is purchased on margin, calculate the yield if called, the yield if not called (assuming you liquidate your shares at time of expiration of option).
3. What is the yield if not called on the same stock, but if the striking price is 30, expiring in 190 days and trading at $2\frac{1}{8}$ (both for margin and cash basis)?

Example 1:

Keystrokes:

XEQ **ALPHA** SIZE **ALPHA** 021

XEQ **ALPHA** CALL **ALPHA**

R/S

300 **R/S**

20 **R/S**

.5 **R/S**

1.2 **R/S**

44.5 **R/S**

25 **R/S**

3 **ENTER** 16 **+** 1 **+** **R/S**

100 **R/S**

1.43 **R/S**

33 **R/S**

R/S

C

Display:

Minimum size

CASH?

NO SHS=?

STOCK PRC=?

DIVIDEND=?

STOCK COMM%=?

FLAT FEE=?

OPT EXPRC=?

OPT PREM=?

NO DAYS=?

OPT COMM%=?

FLAT FEE=?

ACYLD=29.61

Actual yield if exercised

UNEX=8.07

Actual yield if unexercised

BEP=18.83

Break-even point

22 Yield on Call Option Sales

Example 2:

If the stock in Example 1 is purchased on 50% margin, calculate the yield if called and the yield if not called (assuming you liquidate your shares at the time of expiration of the option).

Keystrokes:

A
 N **R/S**
 50 **R/S**
 7.2 **R/S**

Display:

CASH?
% MARGIN=?
MARGIN INT=?
NO SHS=?

Since this data has already been keyed in, calculation is possible

D
 D

ACYLD=60.47
YLD/C=6.38

Yield if not called and shares are sold

Example 3:

Using the previous two examples, what is the yield if not called on the same stock, but if the striking price is 30, expiring in 190 days and trading at 2% (both for margin and cash basis)?

Keystrokes:

A
R/S

 C
 30 **R/S**
 1 **ENTER** 8 **+** 2 **+** **R/S**
 190 **R/S**

Display:

CASH?
NO SHS=?

OPT EXPRC=?
OPT PREM=?
NO DAYS=?
OPT COMM%=?

Number of shares does not change

E

UNEX=13.50

Option commission does not change
Actual yield (cash)

A
 N **R/S**

CASH?
% MARGIN=?

% margin does not change

E

UNEX=25.61

Actual yield (margin)

ROUTINES FOR OPTION WRITERS USING THE BLACK-SCHOLES EVALUATION MODEL

Option writers use many different mathematical models for evaluating the value of an option, among these is the Black-Scholes model.

Using this method, the value of an option, the hedge ratio (which indicates the number of options to write per share), the maximum yield on the investment, the cash flow yield, and the annual rate of return can be calculated. In addition, the low and high break-even points, and the point of maximum profit is found.

Required inputs for these calculations are stock and strike price, interest rate, stock dividend, days to expiration, and volatility.

Volatility is the annual standard deviation of the return on the underlying stock. There are several ways of estimating it. One method is to use the equation:

$$\text{Volatility} = \frac{\text{High} - \text{Low}}{\frac{1}{2} (\text{High} + \text{Low})}$$

where the high and low values are those of the stock over a period of time. However, experience has shown that using this method produces values which are too high. Thus, use 6 month highs and lows (those printed in the newspaper during June and July), or dispense with dividing the denominator by 2.

Be careful not to confuse volatility with beta. The beta of a stock or option measures the variability with respect to the market: i.e., if the market goes up ten points, how far should the stock go? Volatility, on the other hand, measures the stock or option's variability with respect only to itself. How much does this stock tend to move around? Most brokerage houses can provide you with the numbers they are using as of any given date.

References:

Black, Fisher. "Fact and Fantasy in the Use of Options" *Financial Analysts Journal*, July/August 1975.

Black and Scholes. "The Pricing of Options and Corporate Liabilities" *Journal of Political Economy*, May/June 1973.

McGinley, John R. Jr. HP-67/97 Users' Library program #00869D.

| | | | | SIZE: 015 |
|------|---|-------|-------------------|-----------|
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Initialize program. | | XEQ OPTION | PRC=? |
| 2. | Key in stock price. | PRC | R/S | STRK=? |
| 3. | Key in strike price. | STRK | R/S | INT=? |
| 4. | Key in interest rate. | INT | R/S | DIV=? |
| 5. | Key in stock dividend. | DIV | R/S | DAYS=? |
| 6. | Key in days to expiration. | DAYS | R/S | VOL=? |
| 7. | Key in stock volatility and calculate option's theoretical value. | VOL | R/S | VAL= |
| 8. | Calculate hedge ratio. | | R/S * | HR= |
| 9. | Calculate number of options to write per 100. | | R/S * | SHS= |
| 10. | Calculate maximum yield on investment and cash flow yield in percent. | | R/S * | MYOI= |
| | | | R/S * | CFYLD= |
| 11. | Calculate annualized return. | | R/S * | %RTN= |
| 12. | Determine high and low break-even points and point of maximum profit. | | R/S * | LO= |
| | | | R/S * | MAX= |
| | | | R/S * | HI= |
| * | Press R/S if you are not using a printer. | | | |

Example:

Given the stock of XYZ Corporation at \$118.25 per share, a \$120 option with 35 days to go, a dividend expected of \$1.50, the stock's volatility at .28, and an interest rate of 6%, what is the expected value of the option now? How many options should be written against 100 shares of the stock given its hedge ratio? What are the variously figured returns which should be expected? Where is the most money made? Where are the break-even points?

Keystrokes:

XEQ **ALPHA** SIZE **ALPHA** 015
XEQ **ALPHA** OPTION **ALPHA**
 118.25 **R/S**
 120 **R/S**
 6 **R/S**
 1.5 **R/S**
 35 **R/S**

Display:

PRC=?
STRK=?
INT=?
DIV=?
DAYS=?
VOL=?

Minimum size

Keystrokes:

.28 **R/S**

R/S

R/S

R/S

R/S

R/S

R/S

R/S

R/S

Display:

VAL=3.80

HR=0.48

SHS=200.00

MYOI=8.83

CFYLD=6.09

%RTN=63.47

LO=128.95

MAX=120.00

HI=111.05

Option's theoretical value

Hedge ratio

Number of options to write per 100

Maximum yield on investment

Cash flow yield (%)

Annualized return

Low break-even point

Maximum profit

Hi break-even point

WARRANT AND OPTION HEDGING

A certificate that entitles the holder to purchase shares of stock at a specified price is a warrant. Generally, warrants sell for less than the actual cost of the stock, so the percentage increase is higher for the warrant than for the stock, thus the warrant tends to sell at a premium. This program evaluates the investment value of the warrant premium, presuming that the warrant is sold short and the stock is bought.

gross return =

$$\frac{\frac{\text{conversion price}}{\text{conversion rate}} + \text{warrant price} \times \text{number sold} - \text{stock price}}{\text{warrant price} \times \text{number sold} + (1 - \% \text{ margin}) \text{ stock price} + \text{interest}}$$

lower break-even point = $\max(0, \text{stock price} - \text{warrant price} \times \text{number sold})$

upper break-even point =

$$\frac{\text{stock price} - \text{number warrants sold} \times (\text{warrant price} + \text{conversion price})}{1 - \text{conversion rate} \times \text{number of warrants sold}}$$

Remarks:

The dividends should be the expected amount to be received over a year. Since the time of payment is not used the calculated rate of return is the apparent rate rather than the true rate (a very small difference here).

The program assumes equity of 100% of the price or \$5, whichever is greater on the short sales.

References:

Kassouf, Sheet T., and Thorp, Edward O. *Beat the Market*, New York: Random House, 1967.

Latone, Henry P. and Tuttle, Donald L. *Securities Analysis and Portfolio Management*, New York: The Ronald Press, 1970.

| | | | | SIZE: 010 |
|------|---|----------|--|-----------------------|
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Initialize program. | | <input type="button" value="XEQ"/> HEDGING | DIV=? |
| 2. | Key in stock's annual dividend. | DIV | <input type="button" value="R/S"/> | DAYS=? |
| 3. | Key in number of days to expiration. | DAYS | <input type="button" value="R/S"/> | SPRC=? |
| 4. | Key in stock price. | SPRC | <input type="button" value="R/S"/> | WPRC=? |
| 5. | Key in warrant price. | WPRC | <input type="button" value="R/S"/> | CPRC=? |
| 6. | Key in convertible price. | CPRC | <input type="button" value="R/S"/> | CRATE=? |
| 7. | Key in convertible rate. | CRATE | <input type="button" value="R/S"/> | % MARGIN=? |
| 8. | Key in margin percentage rate. | % MARGIN | <input type="button" value="R/S"/> | INT=? |
| 9. | Key in margin interest rate (in percent). | INT | <input type="button" value="R/S"/> | MRTN= |
| 10. | Calculate low break-even point. | | <input type="button" value="R/S"/> * | LBE= |
| 11. | Calculate upper break-even point. ** | | <input type="button" value="R/S"/> * | UBE= |
| 12. | Repeat for i+1 warrants sold for each share of stock purchased. † | | <input type="button" value="C"/> <input type="button" value="R/S"/> * <input type="button" value="R/S"/> * | MRTN= LBE= UBE= |
| 13. | Press <input type="button" value="R/S"/> to continue. | | <input type="button" value="R/S"/> * | XPRC=? |
| 14. | Key in hypothetical expiration price to calculate annual return, or press <input type="button" value="R/S"/> alone to return to step 9. | XPRC | <input type="button" value="R/S"/> | ARTN= |
| 15. | Press <input type="button" value="R/S"/> to prompt for another price. | | <input type="button" value="R/S"/> * | XPRC=? |
| 16. | Go to step 14. | | | |
| * | Press <input type="button" value="R/S"/> if you are not using a printer. | | | |
| ** | NOTE: If the calculator displays NO UBE, the upper break-even point is non-existent. | | | |
| † | One, two, ... warrants sold short for each purchase of stock. Each additional press of <input type="button" value="C"/> produces an additional warrant sold. For example, the first <input type="button" value="C"/> you get 2 warrants, second <input type="button" value="C"/> pressed gives 3 warrants, etc. | | | |

28 Warrant and Option Hedging

Example:

XYZ corporation stock, which pays a \$.50 annual dividend, is trading at \$9¾ and a warrant, convertible 1 for 1 at \$34, is selling for \$1.75 expiring in 547 days. For various investment strategies, what is the maximum return (in percent), lower break-even point and upper break-even point assuming 50% margin at 10%? Furthermore, what are the possible annual returns if we assume various stock closing prices on the expiration date (e.g., \$5, \$10 and \$20 closing prices)?

Keystrokes:

XEQ **ALPHA** SIZE **ALPHA** 012

XEQ **ALPHA** HEDGING **ALPHA**

.5 **R/S**

547 **R/S**

9.75 **R/S**

1.75 **R/S**

34 **R/S**

1 **R/S**

50 **R/S**

10 **R/S**

R/S

R/S

R/S

5 **R/S**

R/S

10 **R/S**

R/S

20 **R/S**

C

R/S

R/S

R/S

5 **R/S**

Display:

DIV=?

DAYS=?

SPRC=?

WPRC=?

CPRC=?

CRATE=?

% MARGIN=?

INT=?

MRTN=133.28

LBE=8.00

NO UBE

XPRC=?

ARTN=-15.18

XPRC=?

ARTN=16.93

XPRC=?

ARTN=70.41

MRTN=100.95

LBE=6.25

UBE=61.75

XPRC=?

ARTN=-2.21

Minimum size

Margin interest rate (%)

Low break-even point

No upper break-even point

Annual return

(Typically, these keystrokes would be repeated until a desirable investment strategy is reached.)

BULL SPREAD OPTION STRATEGY

A bull spread option is the purchase of one option with a low exercise price, and another with a high exercise price, both with corresponding expiration dates. This program is used in determining hedging calls in one stock. It calculates upside and downside break-even points, less commissions, for perpendicular spreads. This program can also be used to evaluate matched or unmatched lots, sold or bought.

$$\text{upside break-even} = \frac{R(C_S + E_S) - (C_L + E_L)}{R - 1}$$

$$\text{downside break-even} = RC_S - C_L$$

where:

R = The ratio of the calls with higher exercise price sold short to the calls with lower exercise price purchased

C_S = Market price of calls sold short

E_S = Exercise price of calls sold short

C_L = Market price of calls bought long

E_L = Exercise price of calls bought long

Registers:

R₀₁ number sold short

R₀₂ price (short)

R₀₃ exercise price (short)

R₀₄ number bought (long)

R₀₅ price (long)

R₀₆ exercise price (long)

R₀₇ current price

| | | | | SIZE: 009 |
|------|--|----------|-----------------------------------|-------------|
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Initialize program. | | <input type="checkbox"/> XEQ BULL | NO SOLD=? |
| 2. | Key in number of options sold short. | # SOLD | <input type="checkbox"/> R/S | PRC=? |
| 3. | Key in price of options sold short. | PRC | <input type="checkbox"/> R/S | EXPRC=? |
| 4. | Key in exercise price of options sold short. | EXPRC | <input type="checkbox"/> R/S | NO BOUGHT=? |
| 5. | Key in number of options bought long. | # BOUGHT | <input type="checkbox"/> R/S | PRC=? |
| 6. | Key in price of options bought long. | PRC | <input type="checkbox"/> R/S | EXPRC=? |

30 Bull Spread Option Strategy

| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
|------|--|-------|--------------------------------------|---------|
| 7. | Key in exercise price of options bought long. | EXPRC | <input type="button" value="R/S"/> | CPRC=? |
| 8. | Key in current underlying stock price and calculate downside break-even stock price.** | CPRC | <input type="button" value="R/S"/> | DBE= |
| 9. | Calculate percent change from current stock price to downside break-even price. | | <input type="button" value="R/S"/> * | %CH= |
| 10. | Calculate upside break-even stock price. | | <input type="button" value="R/S"/> * | UBE= |
| 11. | Calculate percent change from current stock price to upside break-even price. | | <input type="button" value="R/S"/> * | %CH= |
| 12. | If the input data is stored in the appropriate registers (R_{01} - R_{07}), the downside and upside break-even stock prices may be calculated by <input type="button" value="XEQ"/> DBEP and <input type="button" value="XEQ"/> UBEP respectively. | | | |
| * | Press <input type="button" value="R/S"/> if you are not using a printer. | | | |
| ** | On matched hedges, the upside break-even is infinite. When this occurs, the HP-41C will display UBE=INT. Press <input type="button" value="R/S"/> to continue. | | | |

Example:

I. Matched:

Buy 5 Oct. ITT 25's @ 6
 Sell 5 Oct. ITT 30's @ 2%

Calculate upside and downside break-even's and what percentage the stock moves.

II. Unmatched:

Buy 7 Oct. ITT 25's @ 6
 Sell 10 Oct. ITT 30's @ 2%

Calculate upside and downside break-even's and what percentage the stock moves.

In both cases the stock is now trading at $28\frac{3}{4}$

Keystrokes:

XEQ **ALPHA** SIZE **ALPHA** 009

XEQ **ALPHA** BULL **ALPHA**

5 **R/S**

2.875 **R/S**

30 **R/S**

5 **R/S**

6 **R/S**

25 **R/S**

28.75 **R/S**

R/S

R/S

R/S

10 **STO** 01

7 **STO** 04

XEQ **ALPHA** DBEP **ALPHA**

R/S

XEQ **ALPHA** UBEP **ALPHA**

R/S

Display:

Minimum size

NO SOLD=?
PRC=?
EXPRC=?
NO BOUGHT=?
PRC=?
EXPRC=?
CPRC=?
DBE=28.13
%CH=-2.17
UBE=INF
%CH=-100.00

DBE=26.89
%CH=-6.46
UBE=37.25
%CH=29.57

BUTTERFLY OPTIONS

A butterfly option is actually the combination of one bull spread option and one bear spread option, i.e., the purchase of one high, one low, and the sale of two middle options on the same underlying stock. If the stock closes between the high and the low strike prices (including consideration of commissions and premiums), the investor will generally profit with the maximum profit occurring at the middle strike price.

The following formulas are used:

$$\text{Maximum profit} = (E_M - E_L - P_L + 2P_M - P_H)(100) - (100 + \text{Commission})$$

Maximum loss =

$$\{ [P_M - (E_H - E_M)] 2 + E_H - E_L - P_L - P_H \} 100 - (200 - \text{Commission})$$

$$\text{Break-even high} = BE_H = 2(E_H + P_M) - E_L - P_L - P_H - (2 - \text{Commission})$$

$$\text{Break-even low} = 2E_M - BE_H + .5$$

where:

E_L = lowest exercise price

P_L = price of low strike option

E_M = middle exercise price

P_M = price of middle strike option

E_H = high exercise price

P_H = price of high strike option

BE_H = high break-even price

Maximum profit may be negative indicating minimum loss. Similarly, if premiums work out right, maximum loss may be positive, equaling minimum profit (and meaning that no cash is needed as an investment).

| | | | | SIZE: 008 |
|------|--|--------|-----------------------------------|-----------|
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Initialize program. | | <input type="checkbox"/> XEQ BFLY | LOEX=? |
| 2. | Key in exercise price of lowest strike option. | LOEX | <input type="checkbox"/> R/S | LOPRC=? |
| 3. | Key in market price of lowest strike option. | LOPRC | <input type="checkbox"/> R/S | MIDEX=? |
| 4. | Key in exercise price of middle strike option. | MIDEX | <input type="checkbox"/> R/S | MIDPRC=? |
| 5. | Key in market price of middle strike option. | MIDPRC | <input type="checkbox"/> R/S | HIEX=? |

| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
|------|--|-------|--------------|---------|
| 6. | Key in exercise price of high strike option. | HIEX | R/S | HIPRC=? |
| 7. | Key in market price of high strike option. | HIPRC | R/S | COMM=? |
| 8. | Key in option commission and calculate maximum profit. | COMM | R/S | MAXPR= |
| 9. | Calculate maximum loss. | | R/S * | MAXLS= |
| 10. | Calculate high break-even point. | | R/S * | BEHI= |
| 11. | Calculate low break-even point. | | R/S * | BELO= |
| * | Press R/S if you are not using a printer. | | | |

Example:

Given XYZ stock with the following options available and due simultaneously:

- strike price 40 selling at 13¼
- strike price 50 selling at 7
- strike price 60 selling at 1%

calculate the maximum profit, maximum loss (investment), and upside and downside break-even prices if a butterfly is developed and commissions are \$25 per option per transaction.

Keystrokes:

XEQ **ALPHA** SIZE **ALPHA** 008
XEQ **ALPHA** BFLY **ALPHA**
 40 **R/S**
 13.25 **R/S**
 50 **R/S**
 7 **R/S**
 60 **R/S**
 5 **ENTER** 8 **+** 1 **+** **R/S**
 25 **R/S**
R/S
R/S
R/S

Display:

LOEX=?
LOPRC=?
MIDEX=?
MIDPRC=?
HIEX=?
HIPRC=?
COMM=?
MAXPR=787.50
MAXLS=-262.50
BEHI=57.38
BELO=42.13

Minimum size

CONVERTIBLE SECURITY ANALYSIS

Given a convertible security (bond or preferred stock), price (CPRC), coupon or dividend rate (CPN or DIV), the underlying common stock's price (PRC), annual dividend (ANNDIV), and shares per conversion (CRATIO), this program computes:

$$\text{indicated convertible price} = (\text{CRATIO})(\text{PRC})$$

$$\text{anticipated stock price} = \frac{\text{CPRC}}{\text{CRATIO}}$$

$$\text{conversion parity price (bonds only)} = \frac{1000}{\text{CRATIO}}$$

$$\text{conversion premium percentage} = \frac{\text{CPRC} - (\text{CRATIO})(\text{PRC})}{\text{CPRC}}$$

$$\text{current convertible yield} = \frac{\text{CPN or DIV}}{\text{CPRC}}$$

$$\text{incremental payout return} = \frac{(\text{CRATIO})(\text{ANNDIV}) - (\text{CPN or DIV})(\text{CPRC})}{\text{CPRC} - (\text{CRATIO})(\text{PRC})}$$

The program assumes that the convertible security pays either interest or dividends. It also assumes that all bonds are \$1,000 par value.

| | | | | SIZE: 007 |
|------|--|------------|------------|----------------|
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Initialize program. | | [XEQ] CSEC | CBOND? |
| 2. | If a convertible bond press [R/S] and go to step 3. Otherwise, key in N and press [R/S]. | N | [R/S] | CPRC=? |
| 3. | Key in convertible price. | CPRC | [R/S] | CPN=? or DIV=? |
| 4. | Key in either coupon or dividend of convertible issue. | CPN or DIV | [R/S] | PRC=? |
| 5. | Key in common price. | PRC | [R/S] | ANNDIV=? |
| 6. | Key in common stock annual dividend. | ANNDIV | [R/S] | CRATIO=? |
| 7. | Key in conversion ratio and calculate indicated convertible price. | CRATIO | [R/S] | CPRC= |

| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
|------|--|-------|--------------|---------|
| 8. | Compute: Anticipated stock price | | R/S * | STPRC= |
| | Conversion parity price (bonds only) | | R/S * | CPAR= |
| | Conversion premium percentage | | R/S * | CPREM= |
| | Current convertible yield | | R/S * | CYLD= |
| | Incremental payout return | | R/S * | POUT= |
| * | Press R/S if you are not using a printer. | | | |

Example 1:

bond price = \$50; coupon rate = 4.5%
 stock price = \$20; annual dividend = \$1.00
 shares per bond = 20

Keystrokes:

XEQ **ALPHA** SIZE **ALPHA** 007
XEQ **ALPHA** CSEC **ALPHA**
R/S
 50 **R/S**
 4.5 **R/S**
 20 **R/S**
 1 **R/S**
 20 **R/S**
R/S
R/S
R/S
R/S
R/S

Display:

CBOND?
CPRC=?
CPN=?
PRC=?
ANNDIV=?
CRATIO=?
CPRC=40.00
STPRC=25.00
CPAR=50.00
CPREM=20.00
CYLD=9.00
POUT=25.00

Minimum size

Example 2:

preferred stock price = \$60¾; dividend = \$5.25
 common stock = \$28.50; annual dividend = \$0.00
 shares per bond = 2.03

Keystrokes:

XEQ **ALPHA** CSEC **ALPHA**
 N **R/S**
 3 **ENTER** 8 **+** 60 **+** **R/S**

Display:

CBOND?
CPRC=?
DIV=?

36 Convertible Security Analysis

Keystrokes:

5.25 **R/S**

28.5 **R/S**

0 **R/S**

2.03 **R/S**

R/S

R/S

R/S

R/S

Display:

PRC=?

ANNDIV=?

CRATIO=?

CPRC=57.86

STPRC=29.74

CPREM=4.17

CYLD=8.70

POUT=208.33

CONVERTIBLE BOND INVESTMENT ANALYSIS

This program calculates the major investment attributes of convertible bonds: the premium of conversion value over stock price (PREM), current yield (CYLD), dividend income per bond (DYLD), income differential between stock and bond (% D), and investment value (IV).

The conversion value is calculated from bond price (expressed as a percent of par), and the conversion factor (the number of shares received per bond on conversion). The premium is then the percentage difference from the current stock price. Given a current bond price and the associated premium, the program assumes a linear decrease in premium to zero, when the bond price reaches par. Using this relationship, the stock price predicts the estimated bond price. The investment value is the price the bond would have without the conversion privilege, and is given by the standard formula which discounts coupon flow and price change at a given yield. A 360 day calendar is used.

$$\text{conversion value} = \frac{\text{bond price}}{\text{conversion factor}}$$

$$\text{premium} = \Delta\% \left(\frac{\text{stock price}}{\text{bond price}} \right)$$

$$\text{current yield} = \frac{\text{coupon}}{\text{bond price}}$$

$$\frac{\text{dividend}}{\text{bond}} = \text{dividend} \cdot \text{conversion factor}$$

$$\text{income differential} = \text{coupon} - \frac{\text{dividend}}{\text{bond}}$$

investment value =

$$\frac{100}{(1+i)^N} + \frac{\text{coupon}}{2i} \left[(1+i)^j - (1+i)^{-N} \right] - \left(\frac{\text{coupon}}{2} \right) j$$

where:

N = number of semiannual periods between settlement date and maturity date.

j = 1 - frac(N).

i = yield as decimal/2

| | | | | SIZE: 016 |
|------|---|-------|--------------------------------|--------------|
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Initialize program. | | (XEQ) CBOND | CFACT=? |
| 2. | Key in convertible bond conversion factor. ** | CFACT | (R/S) | BPRC=? |
| 3. | Key in convertible bond current price to calculate conversion value. | BPRC | (R/S) | CVAL= |
| 4. | Press (R/S) to continue. | | (R/S) * | SPRC=? |
| 5. | Key in stock price to calculate conversion premium. | SPRC | (R/S) | PREM= |
| 6. | Press (R/S) to continue. | | (R/S) * | CPN=? |
| 7. | Key in convertible bond coupon rate to calculate current yield. | CPN | (R/S) | CYLD= |
| 8. | Press (R/S) to continue. | | (R/S) * | DIV=? |
| 9. | Key in current annual dividend to calculate dividend yield and income differential between bond coupon and DYLD. | DIV | (R/S) (R/S) * | DYLD= %D= |
| 10. | Press (R/S) to continue. | | (R/S) * | SPRC=? |
| 11. | Key in projected stock price to calculate estimated bond price. | SPRC | (R/S) | BPRC= |
| 12. | Press (R/S) * to repeat step 11 as desired. To continue, press (R/S) without data entry. | | (R/S) | ST=? |
| 13. | Key in convertible bond settlement date (MM.DDYYYY). | ST | (R/S) | MT=? |
| 14. | Key in maturity date (MM.DDYYYY) to calculate remaining coupon periods and accrued interest. | MT | (R/S) (R/S) * | N= AI= |
| 15. | Press (R/S) to continue. | | (R/S) * | YLD=? |
| 16. | Key in yield (as %) and calculate investment value. | YLD | (R/S) | IV= |
| 17. | Press (R/S) to repeat step 16 as desired. | | (R/S) * | YLD=? |
| * | Press (R/S) if you are not using a printer. | | | |
| ** | If conversion price is known rather than conversion factor, key in price, press (XEQ) CONV, then press (R/S) to continue. | | | |

Example:

A bond has the following attributes:

conversion factor — 24.39 shares/bond
 price — \$88.50
 coupon — 3.125%
 maturity date — August 15, 1980

The common stock has the following attributes:

price — \$22.50
 dividend — \$1.70

1. What is the conversion value, premium, current yield, dividend per bond, and differential income? For a stock price of \$35, what is the projected bond price? For a stock price of \$42, what is the bond price? For a settlement date of March 10, 1977 and a yield of 8%, what is the investment value? For a yield of 9%, what is the investment value?
2. Given the above conversion factor, what is the price/share on conversion?

Keystrokes:

XEQ **ALPHA** SIZE **ALPHA** 016

XEQ **ALPHA** CBOND **ALPHA**

24.39 **R/S**

88.5 **R/S**

R/S

22.5 **R/S**

R/S

3.125 **R/S**

R/S

1.7 **R/S**

R/S

R/S

35 **R/S**

R/S

42 **R/S**

R/S **R/S**

Display:

Minimum size
CFACT=?
BPRC=?
CVAL=36.29 Conversion value
SPRC=?
PREM=61.27 Premium
CPN=?
CYLD=3.53 Current yield
DIV=?
DYLD=41.46 Dividend per bond
%D=-10.21 Differential income
SPRC=?
BPRC=97.36 Projected bond price
SPRC=?
BPRC=102.44 Projected bond price
ST=? Proceed to settlement date

40 Convertible Bond Investment Analysis

Keystrokes:

3.101977 **R/S**

8.151980 **R/S**

R/S

R/S

8 **R/S**

R/S

9 **R/S**

24.39 **XEQ** **ALPHA** CONV **ALPHA**

Display:

MT=?

N=6.86

AI=0.22

YLD=?

IV=85.62

YLD=?

IV=82.98

41.00

of coupons

remaining

Accrued interest

Investment value

Investment value

Conversion price
in dollars/share

BOND SPECULATION USING MARGIN

This program allows the user to rapidly analyze bond issues using data obtained from financial page listings and bond dealers or brokers when the bonds are to be purchased on margin. Inputs required to operate this program include: quoted bond price (PRC), face value interest rate (INT), expected future selling price (SELL), number of months to sale (MOS), percent margin (%MAR), number of days since last coupon payment (DAYS), the broker's interest rate (BINT), and the broker's fee (FEE).

Once this data has been input, the program then calculates the dollars required for speculation (\$REQ), gross sale dollars (SALES\$), borrowed principal plus interest (\$LOAN), dollars net profit (\$NET), percent profit on invested funds (%PROFIT), and the annualized profit earned on invested funds (ANN%).

The equations used are:

$$\$REQ = \frac{(PRC)(\%MAR)}{10} + \frac{(INT)(DAYS)}{36.5} + FEE$$

$$SALES\$ = 10 \left[\left(\frac{MOS}{12} \right) (INT) + SELL \right] - FEE$$

$$\$LOAN = \left[1 + \left(\frac{BINT}{100} \right) \left(\frac{MOS}{12} \right) \right] \left[(PRC) \left(\frac{100 - \%MAR}{10} \right) \right]$$

$$\$NET = SALES\$ - \$LOAN - \$REQ$$

$$\%PROFIT = \left(\frac{\$NET}{\$REQ} \right) (100)$$

$$ANN\% = \left(\frac{12}{MOS} \right) (\%PROFIT)$$

Reference:

HP-67 program #01390D by Wallace Enderle.

| | | | | SIZE: 009 |
|------|--|-------|-----------------------------------|-----------|
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Initialize program. | | <input type="checkbox"/> XEQ SPEC | PRC=? |
| 2. | Key in quoted price of bond as % of par. | PRC | <input type="checkbox"/> R/S | INT=? |
| 3. | Key in face value interest rate. | INT | <input type="checkbox"/> R/S | SELL=? |
| 4. | Key in expected future selling price. | SELL | <input type="checkbox"/> R/S | MOS=? |
| 5. | Key in number of months between purchase and sale. | MOS | <input type="checkbox"/> R/S | %MAR=? |
| 6. | Key in percent margin allowed. | %MAR | <input type="checkbox"/> R/S | DAYS=? |
| 7. | Key in number of days since last semi-annual interest payment. | DAYS | <input type="checkbox"/> R/S | BINT=? |
| 8. | Key in interest rate charged by broker for borrowed money. | BINT | <input type="checkbox"/> R/S | FEE=? |
| 9. | Key in broker's fee for buying and selling. | FEE | | |
| 10. | Compute dollars required for speculation. | | <input type="checkbox"/> R/S | \$REQ= |
| 11. | Compute gross dollars resulting from sale. | | <input type="checkbox"/> R/S * | SALES= |
| 12. | Compute borrowed dollars including the interest due. | | <input type="checkbox"/> R/S * | \$LOAN= |
| 13. | Compute dollars net profit. | | <input type="checkbox"/> R/S * | \$NET= |
| 14. | Compute percent profit. | | <input type="checkbox"/> R/S * | %PROFIT= |
| 15. | Compute annualized net profit. | | <input type="checkbox"/> R/S * | ANN%= |
| * | Press <input type="checkbox"/> R/S if you are not using a printer. | | | |

Example:

Given a soon-to-be issued bond with the following attributes, what amount of money is required to purchase the bond on margin? What is the profit we should expect to realize?

quoted bond price = \$900.00

face interest rate = 5.5%

expected sale price = \$1,000.00

number of months to sale = 24

percent margin allowed = 30%

days since last coupon payment = 45

broker's interest rate = 8%

broker's fee = 5%

Keystrokes:

XEQ **ALPHA** SIZE **ALPHA** 009

XEQ **ALPHA** SPEC **ALPHA**

90 **R/S**

5.5 **R/S**

100 **R/S**

24 **R/S**

30 **R/S**

45 **R/S**

8 **R/S**

5 **R/S**

R/S

R/S

R/S

R/S

R/S

Display:

PRC=?

INT=?

SELL=?

MOS=?

%MAR=?

DAYS=?

BINT=?

FEE=?

\$REQ=281.78

SALE\$=1,105.00

\$LOAN=730.80

\$NET=92.42

%PROFIT=32.80

ANN%=16.40

Minimum size
What is price as
% of par?

PROGRAM DATA

| Program | # Regs. to COPY | Data Registers | Flags | Display Format |
|--------------------------------------|-----------------|----------------|-------------------------|----------------|
| Bonds and Notes | 88 | 00-20 | 00-03, 05 21, 22, 27 | FIX 2/FIX 6 |
| Stock Portfolio Valuation | 49 | 00-62 | 21, 27, 29 | FIX 0/FIX 2 |
| Yield on Call Option Sales | 64 | 00-20 | 00-02 21, 27 | FIX 2 |
| Routines for Option Writers | 48 | 00-14 | 00, 21 | FIX 0/FIX 2 |
| Warrant and Option Hedging | 42 | 00-11 | 21, 22, 27 | FIX 2 |
| Butterfly Options | 30 | 00-07 | 21 | FIX 2 |
| Bull Spread Option Strategy | 27 | 00-08 | 21, 25 | FIX 2 |
| Convertible Security Analysis | 33 | 01-06 | 01, 21 | FIX 2 |
| Convertible Bond Investment Analysis | 50 | 00-02 04-15 | 00, 21, 22 | FIX 0/FIX 2 |
| Bond Speculation Using Margin | 31 | 00-08 | 21 | FIX 2 |
| PRC, ATY, ATP, YLD, JDAY | 90 | 00-20 | 00-03, 05 21, 22, 27 | |

APPENDIX B
FORMULAS

Bonds

6 months or less to maturity

$$\text{Price} = \left[\frac{\left(\frac{\text{CALL}}{100} + \frac{\text{CPN}}{2} \right)}{1 + \left(\frac{\text{YLD}}{2} \cdot \text{PER} \right)} - \left(\frac{\text{CPN}}{2} \right)^J \right] 100$$

more than 6 months to maturity

$$\begin{aligned} \text{Price} = & \frac{\text{CALL}(1 - T_c) \left(1 + \frac{\text{YLD}}{2} \right)^{-\text{PER}}}{1 - T_c \left(1 + \frac{\text{YLD}}{2} \right)^{-\text{PER}}} \\ & + \frac{100(1 - T_1) \frac{\text{CPN}}{\text{YLD}} \left[\left(1 + \frac{\text{YLD}}{2} \right)^J - \left(1 + \frac{\text{YLD}}{2} \right)^{-\text{PER}} \right]}{1 - T_c \left(1 + \frac{\text{YLD}}{2} \right)^{-\text{PER}}} \\ & - \frac{100 \left[\frac{\text{CPN}}{2} (1 - T_1) J \right]}{1 - T_c \left(1 + \frac{\text{YLD}}{2} \right)^{-\text{PER}}} \end{aligned}$$

where:

- CALL = call price
- CPN = annual coupon rate (as decimal)
- YLD = annual yield (as decimal)
- PER = number of coupon periods
- J = 1 - FRAC(PER)
- T₁ = income tax rate (as decimal)
- T_c = capital gains tax rate (as decimal)

Notes

$$\text{Price} = 100 \left[\frac{\text{CALL} + \left(\frac{\text{DIM}}{\text{B}} \cdot \overline{\text{CPN}} \right)}{100 + \left(\frac{\text{DSM}}{\text{B}} \cdot \text{YLD} \right)} \right] - \left(\frac{\text{DIS}}{\text{B}} \cdot \overline{\text{CPN}} \right)$$

$$\text{Price} = \text{CALL} - \left[\text{DISC} \cdot \text{CALL} \cdot \frac{\text{DSM}}{\text{B}} \right]$$

where:

DIM = days from issue to maturity

DSM = days from settlement to maturity

DIS = days issue to settlement

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

YLD = annual yield (as decimal)

$\overline{\text{CPN}} = \frac{\text{annual coupon rate (as decimal)} \times \text{CALL}}{100}$

DISC = discount rate (as decimal)

CALL = call price

$$\text{Price} \left(1 + \frac{i}{2} \right) \left[1 + \left(\frac{2 \cdot \text{DSM} - 365}{365} \right) \frac{i}{2} \right] = 100$$

where i = coupon equivalent yield (as decimal)

Black-Scholes

$$\text{Cash Flow Return} = \frac{\text{Premium}}{\text{Stock Price}}$$

where: Premium = (# options)(price per option received)

$$\text{MYOI} = \frac{\text{Premium} + (\text{strike} - \text{stock prices}) + \text{dividends}}{\text{stock price}}$$

Annualized Return =

$$\left(\frac{\text{days in year}}{\text{days to expiration}} \right) (\text{lessor of cash flow or MYOI return})$$

$$\# \text{ of options to write} = \frac{1}{\text{hedge ratio}}$$

Downside protection point = stock cost price – premium

Maximum profit point = stock cost or strike price, whichever is higher

Upside protection point = premium + absolute difference between the strike and stock cost prices added to the strike price

$$\text{Value} = P_{\text{stock}}N(D_1) - P_{\text{strike}}N(D_2)e^{-R\Delta t}$$

$$\text{where } D_1 = \frac{\ln(P_{\text{stock}} \div P_{\text{strike}}) + (R + \frac{1}{2} V^2) \Delta t}{V\sqrt{\Delta t}}$$

$$D_2 = \frac{\ln(P_{\text{stock}} \div P_{\text{strike}}) + (R - \frac{1}{2} V^2) \Delta t}{V\sqrt{\Delta t}}$$

$$N(D_1) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{D_1} e^{-\frac{1}{2}t^2} dt$$

R = interest rate as a decimal

Δt = time remaining to expiration in years

V = stock's volatility



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local Hewlett-Packard Sales Office or call 800/648-4711.
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