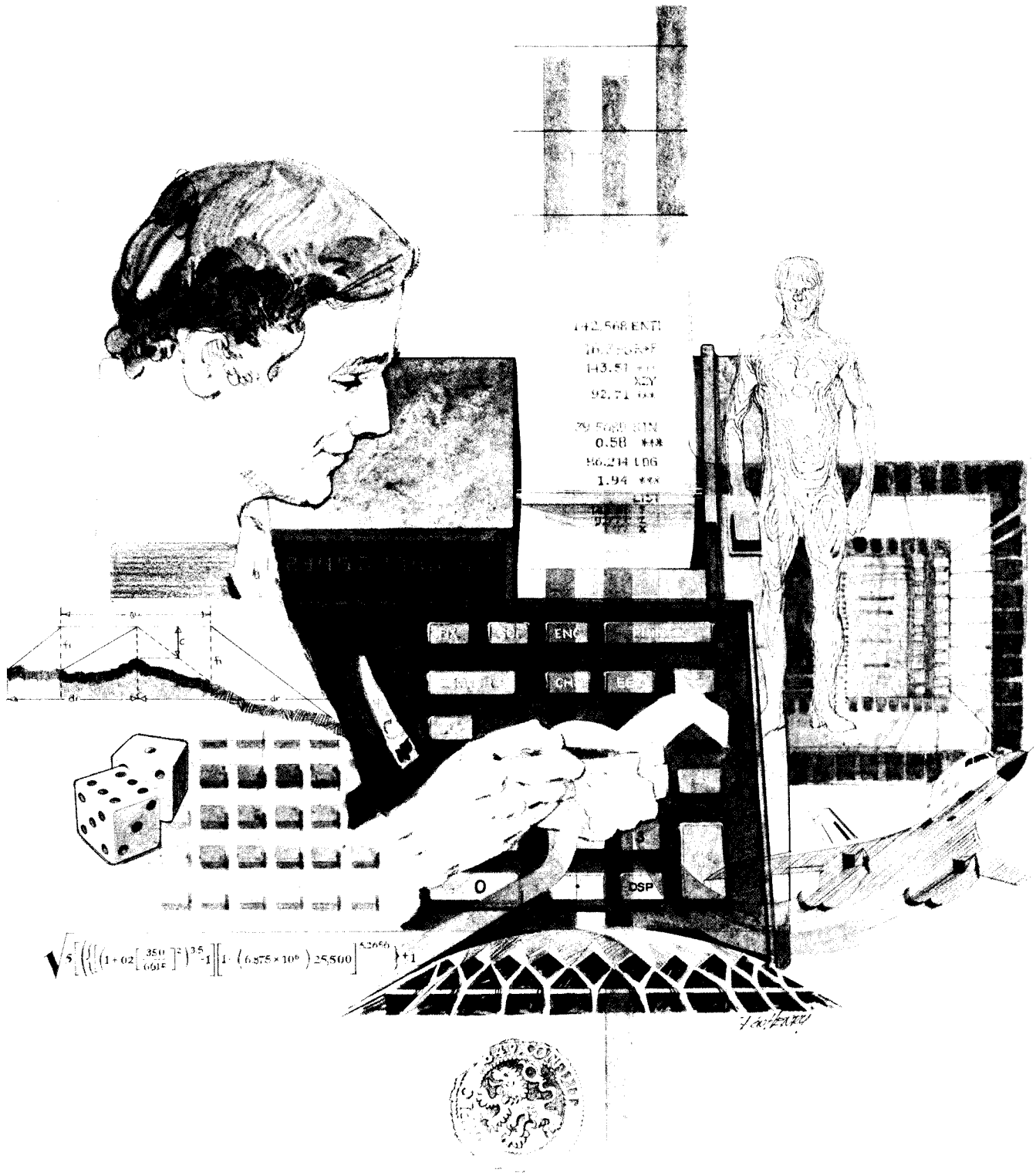


HEWLETT-PACKARD

IHP-67 IHP-97

Users' Library Solutions

Portfolio Management/Bonds and Notes



INTRODUCTION

In an effort to provide continued value to its customers, Hewlett-Packard is introducing a unique service for the HP fully programmable calculator user. This service is designed to save you time and programming effort. As users are aware, Programmable Calculators are capable of delivering tremendous problem solving potential in terms of power and flexibility, but the real genie in the bottle is program solutions. HP's introduction of the first handheld programmable calculator in 1974 immediately led to a request for program **solutions** — hence the beginning of the HP-65 Users' Library. In order to save HP calculator customers time, users wrote their own programs and sent them to the Library for the benefit of other program users. In a short period of time over 5,000 programs were accepted and made available. This overwhelming response indicated the value of the program library and a Users' Library was then established for the HP-67/97 users.

To extend the value of the Users' Library, Hewlett-Packard is introducing a unique service—a service designed to save you time and money. The Users' Library has collected the best programs in the most popular categories from the HP-67/97 and HP-65 Libraries. These programs have been packaged into a series of low-cost books, resulting in substantial savings for our valued HP-67/97 users.

We feel this new software service will extend the capabilities of our programmable calculators and provide a great benefit to our HP-67/97 users.

A WORD ABOUT PROGRAM USAGE

Each program contained herein is reproduced on the standard forms used by the Users' Library. Magnetic cards are not included. The Program Description I page gives a basic description of the program. The Program Description II page provides a sample problem and the keystrokes used to solve it. The User Instructions page contains a description of the keystrokes used to solve problems in general and the options which are available to the user. The Program Listing I and Program Listing II pages list the program steps necessary to operate the calculator. The comments, listed next to the steps, describe the reason for a step or group of steps. Other pertinent information about data register contents, uses of labels and flags and the initial calculator status mode is also found on these pages. Following the directions in your HP-67 or HP-97 **Owners' Handbook and Programming Guide**, "Loading a Program" (page 134, HP-67; page 119, HP-97), key in the program from the Program Listing I and Program Listing II pages. A number at the top of the Program Listing indicates on which calculator the program was written (HP-67 or HP-97). If the calculator indicated differs from the calculator you will be using, consult Appendix E of your **Owner's Handbook** for the corresponding keycodes and keystrokes converting HP-67 to HP-97 keycodes and vice versa. No program conversion is necessary. The HP-67 and HP-97 are totally compatible, but some differences do occur in the keycodes used to represent some of the functions.

A program loaded into the HP-67 or HP-97 is not permanent—once the calculator is turned off, the program will not be retained. You can, however, permanently save any program by recording it on a blank magnetic card, several of which were provided in the Standard Pac that was shipped with your calculator. Consult your **Owner's Handbook** for full instructions. A few points to remember:

The Set Status section indicates the status of flags, angular mode, and display setting. After keying in your program, review the status section and set the conditions as indicated before using or permanently recording the program.

REMEMBER! To save the program permanently, **clip** the corners of the magnetic card once you have recorded the program. This simple step will protect the magnetic card and keep the program from being inadvertently erased.

As a part of HP's continuing effort to provide value to our customers, we hope you will enjoy our newest concept.

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This program computes a number of values useful in analyzing convertible securities. The values include the indicated convertible price and the incremental payout return.	

Program Description I

Program Title Stock Portfolio Valuation

Contributor's Name Hewlett-Packard

Address 1000 NE Circle Blvd

City Corvallis

State OR

Zip Code 97330

Program Description, Equations, Variables Data cards created with the "Portfolio Data Card" program provide initial purchase price of a stock and the number of shares for a portfolio of any size. This program prompts user one stock at a time. User inputs current market price and annual dividend. Price input: 25-5/8 is inputted as 25.58. Program returns the percent change of value of each stock and prompts the user for the next stock. If more than one data card is used the program prompts user by flashing repetitive 18's until a new data card is inserted.

When all current prices have been entered, user initiates the valuation of the total portfolio. Output includes original portfolio value, new portfolio value, % change in value, date original portfolio was created, and annual dividend yield as a percent of current market value.

Operating Limits and Warnings Shares selling for more than 999 dollars @ can not be used (such shares have existed although rare).

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)

Sample Problem(s) Sample data includes the following information:

1) 100 shares at 25-5/8 @, 2) 200 at 30-1/4, 3) 50 at 89-7/8, 4) deleted stock
5) 500 at 65-1/4 [data is packed by data program so that register 1 contains
100.025625] Date portfolio created 10.25 1977.

Current information: 1) \$27-1/4 with \$1.70 dividend 2) 33-1/2 with 2.10
3) 96-1/8 with 4.55 4) none 5) 64-3/8 with 3.50

Solution

Enter data card created by the "Portfolio Data Card" program. Then key in
this program (pages 5 & 6) (or enter previously created program card).

Then:

Prompt	Input	Output	Input
	A		
1	27.14 [↑] 1.7 [R/S]	6.34	[R/S]*
2	33.12 [↑] 2.1 [R/S]	10.74	[R/S]*
3	96.18 [↑] 4.55[R/S]	6.95	[R/S]*
4	(immediately outputs a zero)	0	[R/S]
5	64.38 [↑] 3.50[R/S]	-1.34	[B]
	Original value	45731.25	[R/S]*
	New value	46418.75	[R/S]*

Reference(s)	% change in value	1.5	[R/S]*
	total yearly dividend	2567.50	[R/S]*
	yearly dividend yield	5.53	[R/S]*
	date portfolio created	10.25 1977	

* Only necessary if print option not exercised.

User Instructions

3

1
(Price + Dividends R/S)
2

Initial
Totals
Print

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Clear register: This procedure is not necessary if the calculator has just been switched on.		<input type="checkbox"/> CL REG <input type="checkbox"/> P<S <input type="checkbox"/> CL REG	
2.	Load side 1 and 2 of program		<input type="checkbox"/> <input type="checkbox"/>	
3.	Load 1st data card		<input type="checkbox"/> <input type="checkbox"/>	
4.	Select print option (97) Alternate presses of [E] sets (1) and unsets (0) the print option		<input type="checkbox"/> E <input type="checkbox"/> <input type="checkbox"/>	1
5.	Initialize		<input type="checkbox"/> A <input type="checkbox"/> <input type="checkbox"/>	1
6.	Key in current stock price 27-1/4 would enter as 27.14	27.14	<input type="checkbox"/> ENTER <input type="checkbox"/> <input type="checkbox"/>	27.14
7.	Key in annual dividend Output is % change in this stock	1.7	<input type="checkbox"/> R/S <input type="checkbox"/> <input type="checkbox"/>	6.34
8.	Proceed with steps 6-8 until all prices are entered. If a stock has been deleted (register is filled with zeros) the program displays zero immediately. Continue by pressing R/S. If there are additional data cards (18 stocks per card), the last entry will flash 18 until a new card is entered.		<input type="checkbox"/> R/S* <input type="checkbox"/> <input type="checkbox"/>	2
	* Not necessary if print option has been selected.		<input type="checkbox"/> <input type="checkbox"/>	
	Continued on next page ----->		<input type="checkbox"/> <input type="checkbox"/>	

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
			<input type="text"/> <input type="text"/>	
	After all data is entered: Old portfolio total.		<input type="text"/> B	\$
			<input type="text"/> <input type="text"/>	
	New portfolio total		<input type="text"/> R/S*	\$
			<input type="text"/> <input type="text"/>	
	Change in portfolio value from purchase		<input type="text"/> R/S*	%
			<input type="text"/> <input type="text"/>	
	Total annual dividends		<input type="text"/> R/S*	\$
			<input type="text"/> <input type="text"/>	
	Portfolio dividend yield as a percent of current market value.		<input type="text"/> R/S*	\$
			<input type="text"/> <input type="text"/>	
	Date original portfolio created		<input type="text"/> R/S*	MM.DDYYYY
			<input type="text"/> <input type="text"/>	
			<input type="text"/> <input type="text"/>	
			<input type="text"/> <input type="text"/>	
			<input type="text"/> <input type="text"/>	
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			<input type="text"/> <input type="text"/>	
	* Not necessary if print option has been selected.		<input type="text"/> <input type="text"/>	
			<input type="text"/> <input type="text"/>	
			<input type="text"/> <input type="text"/>	
			<input type="text"/> <input type="text"/>	

97 Program Listing I

5

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA		Set I to 0 for	057	PSE		
002	DSP2		portfolio register	058	F3?		
003	1		run	059	GT0A		
004	STOI			060	GT0c		
005	*LBL1		Recall ith	061	*LBLB		Continue prompting
006	RCLi		historical stock	062	RCLA		with i+18 & loading
007	X=0?		data & check for a	063	GSB5		Original portfolio
008	GT07		deleted stock	064	RCLB		value
009	INT			065	GSB5		New portfolio value
010	STOE			066	%CH		
011	LSTX		Unpack data store	067	GSB5		
012	FRC		# of shares in E,	068	DSP2		
013	EEX		calculate and	069	RCLC		Change in value
014	3		store original	070	GSB5		
015	x		stock value in D,	071	LSTX		Total yearly
016	x		and accumulate	072	=		dividend
017	STOD		original portfolio	073	1		
018	RCLA		value in A	074	0		Total dividend
019	+			075	0		yield as a % of
020	STOA			076	x		current value
021	RCLI		Prompt for current	077	GSB5		
022	RCL0		input	078	P+S		
023	+			079	RCL9		
024	F0?			080	P+S		
025	PRTX			081	DSP6		Date portfolio
026	R/S			082	GSB5		Created
027	RCLC		Accumulate total	083	DSP2		
028	x		dividend in C	084	R/S		
029	RCLC			085	*LBL5		
030	+			086	F0?		
031	STOC			087	GT04		
032	R+			088	SF0		Print/no print
033	GSBc		Normalize price	089	1		flag set
034	RCLC			090	RTN		
035	x			091	*LBL4		
036	RCLB		Accumulate current	092	0		
037	X*Y		value in B	093	CF0		
038	+			094	RTN		
039	STOB			095	*LBL5		
040	LSTX		Calculate and	096	F0?		
041	RCLD		display % change	097	GT06		
042	X*Y		in ith stocks value	098	R/S		Print or no
043	%CH			099	RTN		print decision
044	GSB5		print option	100	*LBL6		
045	*LBL2			101	PRTX		
046	ISZI		Check for end of	102	SPC		
047	1		registers. If	103	RTN		
048	8		less than 18	104	R/S		Print
049	RCLI		continue else:	105	*LBL7		
050	X*Y?			106	RCLI		
051	GT01			107	RCL0		
052	CF3			108	+		
053	X*Y		Data card merge	109	PSE		Display contents
054	STOI		and prompt	110	X*Y		of a 0 register
055	*LBLc			111	R/S		
056	MRC						

REGISTERS

0	1	2	3	4	5	6	7	8	9
Mult Crd	---	---	---	STOCKS	---	---	---	---	---
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
---	---	---	---	---	---	---	---	---	Date
A	B	C	D	E	F	G	H	I	J
Old Port Total	New Port Total	Total Div	Old Stock Val.	# of Shrs.				Used	

[illegible]

Program Description I

7

Program Title	Portfolio Data Card		
Contributor's Name	Hewlett-Packard		
Address	1000 N.E. Circle Blvd.		
City	Corvallis	State Oregon	Zip Code 97330

Program Description, Equations, Variables

This program creates the data card which holds historical stock information used by the "Stock Portfolio Valuation" program. Registers 1 through 18 are used to store historic cost and quantity data on individual stocks. Each register represents one stock. If N represents number shares, C represents the integer dollar cost and F the fractional cost, the register is packed as NNNN.CCCFFF*. Program sequentially prompts user for input. Number of shares and price are entered. User can load prices with fractions: 25-7/8 is 25.78.

Options include deleting stocks (filling a register with 0's), adding stock, and correcting erroneous entries. REGISTER 0 contains the date the portfolio was assembled. MM.DDYYYY.

Operating Limits and Warnings *CCC is limited to three digits. Fractions are limited to single digit denominators.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)

Sample Problem(s) User has a portfolio of 5 stocks which was purchased on October 25, 1977. Stocks are as follows;

Stock No.	No. of Shares	Price
1	100	25-5/8
2	400	66
3	50	89-7/8
4	300	18-3/8
5	500	65-1/4

At a later date stock 2 and 4 are sold. Subsequent to that a new stock is purchased.

200	30-1/4
-----	--------

Solution(s)	Prompts	Input	Output
		10.25 1977 [D]	10.25 1977
		[A]	
1		100 [↑] 25.58 [R/S]	
2		400 [↑] 66 [R/S]	
3		50 [↑] 89.78 [R/S]	
4		300 [↑] 18.38 [R/S]	
5		500 [↑] 65.14 [R/S]	
6 (ignore)		[Write Data] or [W/Data]	

Reference(s)	Later	(Enter program and data cards)
	2 [C]	400.06600 [R/S] 0
	4 [C]	300.018375[R/S] 0
	[B]	
	200 [↑] 30.14 [R/S]	200.030250
	[Write Data] or [W/Data]	

User Instructions

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(# Shares E↑ Price R/S)

NEW PORTFOLIO ADD STOCK DELETE STOCK#? DATE ASSEMBLED CORRECT ENTRY#?

fE Print/No Print

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Clear registers - this is not necessary if calculator has just been switched on		<input type="checkbox"/> CL REG <input type="checkbox"/> P<S <input type="checkbox"/> CL REG <input type="checkbox"/>	
2.	Enter program card			
3.	If you have 97 and wish to have a printed record		f E	1
4.	If portfolio is being created, key in the assembly or purchase date	MM.DDYYYY	D	
5.	If portfolio is being created		A	1
	a) Number of shares		ENTER↑	
	b) Price(25 5/8 keyed in as 25.58)		R/S	Next Reg#
	Repeat a & b until all stocks are entered			
	If more than 18 stocks are being entered, the program will automatically prompt for a data (blank) card after the 18th entry. After the card has been entered a 0 appears. Press [R/S] to continue		R/S	CRD 0 19
	Complete <u>all</u> stock entries before returning to make any corrections. If more than 1 data card is required, re-enter the appropriate card after the <u>all</u> the stocks have been entered. If only one card is used, corrections (etc.) can be done after the last stock is entered.			
	After the last stock has been entered, a data card is created by pressing [f] [WRITE (W/) DATA] and then inserting a blank card.			
	Continued on next page ----->			

97 Program Listing I

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	Initialize Sequential data entry	056	X*Y	-41	Print inputed Data Normalize price
002	0	00		057	F0?	16 23 00	
003	STOI	35 46		058	PRTX	-14	
004	*LBL1	21 01		059	X*Y	-41	
005	ISZI	16 26 46		060	F0?	16 23 00	
006	GSB3	23 03	Initialize sequential register search for first zero register	061	PRTX	-14	Pack register NNN.CCCFFF
007	GSB4	23 16 11		062	GSB6	23 16 12	
008	GT01	22 01		063	EEX	-23	
009	RTN	24		064	3	03	
010	*LBLB	21 12		065	÷	-24	
011	1	01	Recall register to be deleted and display	066	+	-55	Check for end of registers Output data
012	STOI	35 46		067	F0?	16 23 00	
013	*LBL2	21 02		068	SPC	16-11	
014	GSB3	23 03		069	F0?	16 23 00	
015	RCLi	36 45		070	SPC	16-11	
016	X=0?	16-43	Delete (store 0) designed register	071	STOI	35 45	Clear registers and begin loading data for subsequent card
017	GT04	22 16 11		072	RTN	24	
018	ISZI	16 26 46		073	*LBL3	21 03	
019	GT02	22 02		074	1	01	
020	RTN	24		075	8	08	
021	*LBLC	21 13	Store date in register 19	076	RCLi	36 46	Normalize Price CCC.ND becomes CCC + $\frac{N}{D}$ (Avoids ND = 0)
022	DSP6	-63 06		077	X*Y?	16-35	
023	RCL0	36 00		078	RTN	24	
024	-	-45		079	R4	-31	
025	STOI	35 46		080	WDTA	16-61	
026	RCLi	36 45	Set I register to store change	081	0	00	
027	R/S	51		082	R/S	51	
028	0	00		083	R4	-31	
029	STOI	35 45		084	RCL0	36 00	
030	DSP2	-63 02		085	+	-55	
031	RTN	24	Prompt user with register #	086	CLRG	16-53	
032	*LBLD	21 14		087	P*S	16-51	
033	DSP6	-63 06		088	CLRG	16-53	
034	F0?	16 23 00		089	STO0	35 00	
035	PRTX	-14		090	GT0A	22 11	
036	P*S	16-51		091	RTN	24	
037	STO9	35 09		092	*LBL6	21 16 12	
038	P*S	16-51		093	ENT↑	-21	
039	DSP2	-63 02		094	FRC	16 44	
040	F0?	16 23 00		095	X=0?	16-43	
041	SPC	16-11		096	GT06	22 16 13	
042	RTN	24		097	EEX	-23	
043	*LBL E	21 15		098	1	01	
044	DSP6	-63 06		099	X	-35	
045	RCL0	36 00		100	INT	16 34	
046	-	-45		101	LSTX	16-63	
047	STOI	35 46		102	FRC	16 44	
048	GSB4	23 16 11		103	÷	-24	
049	DSP2	-63 02		104	EEX	-23	
050	R/S	51		105	1	01	
051	*LBL4	21 16 11		106	÷	-24	
052	RCLi	36 46		107	X*Y	-41	
053	RCL0	36 00		108	INT	16 34	
054	+	-55		109	*LBL6	21 16 13	
055	GSB5	23 05		110	+	-55	

REGISTERS

0 DATE	1	2	3	4	5 STOCKS	6	7	8	9
S0	S1	S2	S3	S4	S5 STOCKS	S6	S7	S8	S9
A	B	C	D	E	I	USED			

[illegible]

Program Description I

Program Title STOCK PORTFOLIO BETA
COEFFICIENT ANALYSIS
 Contributor's Name DAVE ROSE
 Address 196 GOVERNORS DRIVE
 City FOREST PARK State GEORGIA Zip Code 30050

Program Description, Equations, Variables

PROGRAM DETERMINES A BETA COEFFICIENT FOR AN ENTIRE STOCK PORTFOLIO BASED ON INFORMATION ABOUT THE INDIVIDUAL STOCKS HELD.

FORMULA:

$$B = \sum_{i=1}^n \frac{(P_i)(S_i)(\beta_i)}{T}$$

WHERE n = NUMBER OF ISSUES HELD

P = CURRENT MARKET PRICE/SHR.

S = NUMBER OF SHARES HELD

β = BETA COEFFICIENT

FOR INDIVIDUAL STOCK

T = TOTAL VALUE OF PORTFOLIO

Operating Limits and Warnings PROGRAM WILL NOT WORK FOR PORTFOLIOS OF MORE THAN 46 STOCKS.

IF THE VALUE OF ANY STOCK HELD EXCEEDS 5 DIGITS (\$100,000 OR MORE), IT SHOULD BE BROKEN DOWN INTO ISSUES OF VALUE < \$100,000. FOR

EXAMPLE: \$15 PRICE; 10,000 SHRS; 1.1 BETA
 COULD BE REPORTED AS 2 ISSUES \$15 PRICE; 5,000 SHRS; 1.1 BETA

This program has been verified only with respect to the numerical example given in Program Description II. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)

Sample Problem(s)

WHAT IS THE BETA COEFFICIENT OF THE FOLLOWING STOCK PORTFOLIO?

STOCK	# SHRS HELD	CURRENT MKT. PRICE \$	STOCK BETA
DATAMACK	1000	13	.80
DIGITAL SAFETY PN	300	50	1.2
INT'L HAIRBURN	400	30	1.3

Solution(s) KEYSTROKES: [A] (INIT.)

	-	0.00
13 [B], 1000 [C], .8 [D]	-	0.00
50 [B], 300 [C], 1.2 [D]	-	0.00
30 [B], 400 [C], 1.3 [D]	-	0.00
[E]	-	1.10
		(ANS.)

* AFTER ENTERING # SHRS., VALUE OF THAT STOCK IS DISPLAYED (HERE, \$13000)

Reference(s)

COHEN, ZINBARG, ZEIKEL
INVESTMENT ANALYSIS AND PORTFOLIO
MANAGEMENT

6TH EDITION, PAGE 769

RICHARD D. IRWIN, PUB., 1976

User Instructions

PORTFOLIO BETA ANALYSIS

1
2

INIT.	CURRENT PR/SHR	#SHRS	STOCK BETA	PORTFOLIO BETA
-------	-------------------	-------	---------------	-------------------

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1	LOAD CARD (SIDE 1 ONLY NEEDED)				
2	INITIALIZE		A		0.00
3	ENTER CURRENT PRICE PER SHARE OF STOCK N	PRICE	B		PRICE
4	ENTER NUMBER OF SHARES OF STOCK N IN PORTFOLIO	#SHRS	C		P X S (VALUE OF STOCK N)
5	ENTER BETA OF STOCK N	BETA	D		0.00
— REPEAT STEPS 3, 4, & 5 FOR EACH STOCK IN THE PORTFOLIO (N=1, 2, 3,)					
6	PRESS E TO DETERMINE THE BETA FOR THE PORTFOLIO		E		ANS.

[illegible]

Program Description I

Program Title TRUE ANNUAL GROWTH RATE (DCF) OF INVESTMENT PORTFOLIO

Contributor's Name Ken L. Singer

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Program Description, Equations, Variables, etc. This program finds the true annual growth rate (discounted cash flow rate of return) of an investment portfolio or any unlimited cash flow stream. Inputs are as follows:

1. Evaluation date and market value
2. Lump-sum payments and/or withdrawals: date and amount
3. Series payments and/or withdrawals: starting date of series; number of payments or withdrawals in series; months between each payment or withdrawal; and amount of each payment or withdrawal

(The program can be used to find the DCF rate of return of a standard cash flow stream by treating cash flow investment outlays the same as portfolio withdrawals and cash flow revenues the same as portfolio payments; the date and amount of the initial cash flow investment is input as the portfolio evaluation date and market value.) For an investment portfolio, a dividend which is not reinvested is treated as a withdrawal. For a cash flow stream, a continuous flow can be approximated by many small series payments. For example, \$1000 received continuously over a year can be approximated by 100 revenues, received

Operating Limits and Warnings (1) Total payments cannot equal total withdrawals (including market value), i.e. zero growth rate. (2) As in any discounted cash flow analysis, if the year by year cumulative net cash flow (payments minus withdrawals) changes sign more than once, there may not be a unique rate of return. Such a case will be indicated by widely differing values of i , i_1 , and i_2 ; accordingly, the final rate will be incorrect. (3) The growth rate must be algebraically greater

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description I

Program Title TRUE ANNUAL GROWTH RATE (DCF) OF INVESTMENT PORTFOLIO

Contributor's Name

Address

City

State

Zip Code

Program Description, Equations, Variables, etc. (cont'd)

at intervals of 12/100 months, in the amount of \$1000/100 each.

Input data are entered three times. Program determines its own initial guess for the rate from the first entry of the data (Pass 1). The initial rate is then used to discount the payments/withdrawals input in the second entry, and the resulting ratio of total discounted withdrawals to total discounted payments is used to calculate a refined rate (Pass 2). In the same manner data are entered a third time and discounted using the refined rate to obtain a further refined rate; then the initial, refined, and further refined rates are combined to obtain a final rate (Pass 3). Accuracy averages 99.999 %.

Let: i = initial rate, %	$m = 1 + (i/100)$
i_1 = refined rate, %	$m_1 = 1 + (i_1/100)$
i_2 = further refined rate, %	$m_2 = 1 + (i_2/100)$
i_c = final rate, %	
L = "lump-sum"	S = "series"
W = withdrawal amount	P = payment amount
TW = total withdrawals	TP = total payments

Operating Limits and Warnings (cont'd)

than -100 percent. (4) In some other rare instances a particular set of data could cause division by zero. If this instance should occur, it is suggested that the market value (portfolio) or initial investment outlay (cash flow) be changed by a very small amount; the entire program should then be rerun.

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Program Description I

Program Title TRUE ANNUAL GROWTH RATE (DCF) OF INVESTMENT PORTFOLIO

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Program Description, Equations, Variables, etc. (cont'd)

TDW = total discounted wdl. TDP = total discounted pmts.

n = time (years) of payment/withdrawal (relative to evaluation date)

n' = time (years) series payment/withdrawal starts

I = interval (months) between series pmt./wdl. I' = I/12

N = number of series payments/withdrawals

Pass 1: $\bar{n} = n' + (I'N - I)/2$

$$x_w = \frac{1}{TW} \left[\sum (W_L)(n) + \sum (W_S)(N)(\bar{n}) \right]$$

$$x_p = \frac{1}{TP} \left[\sum (P_L)(n) + \sum (P_S)(N)(\bar{n}) \right]$$

$$a = x_w - x_p \qquad m = (TW/TP)^{\frac{1}{a}}$$

Operating Limits and Warnings

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Program Description I

Program Title TRUE ANNUAL GROWTH RATE (DCF) OF INVESTMENT PORTFOLIO

Contributor's Name

Address

City

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Zip Code

Program Description, Equations, Variables, etc. (cont'd)

$$\text{Pass 2: } TDW = \sum (W_L)(m^{-n}) + \sum (W_S) \left(\frac{m^{I'N} - 1}{m^{I'} - 1} \right) (m^{-(n' + I'N - I')})$$

$$TDP = \sum (P_L)(m^{-n}) + \sum (P_S) \left(\frac{m^{I'N} - 1}{m^{I'} - 1} \right) (m^{-(n' + I'N - I')})$$

$$1/b = (\log \frac{TW}{TP}) / (\log \frac{TW/TP}{TDP/TDW}) \quad m_1 = m^{\frac{1}{b}}$$

Pass 3: TDW_1 = same as Pass 2, except m_1 used instead of m

TDP_1 = same as Pass 2, except m_1 used instead of m

$$1/b_1 = (\log \frac{TW}{TP}) / (\log \frac{TW/TP}{TDP_1/TDW_1}) \quad m_2 = m_1^{\frac{1}{b_1}}$$

$$i_c = (m + \frac{(m_1 - m)^2}{2m_1 - m - m_2} - 1)(100)$$

Operating Limits and Warnings

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Program Description II

Sketch(es)

Sample Problem(s)

(1) Investment portfolio: \$2600 and \$3600 were paid into a fund on 3/1/67 and 5/1/70 respectively. \$2000 was withdrawn on 4/1/73. Five quarterly dividends of \$60 each were paid by the fund (and not reinvested) starting 11/1/68. Additionally, twelve monthly amounts of \$100 each were invested in the fund beginning 2/1/74. What was the true annual growth rate of the fund as of 4/1/76, when it had a value of \$7000?

Solution(s) E 4.1976 ↑ 7000 A
 3.1967 ↑ 2600 B
 5.1970 ↑ 3600 B
 2.1974 ↑ 12 ↑ 1 ↑ 100 C
 4.1973 ↑ 2000 CHS B
 11.1968 ↑ 5 ↑ 3 ↑ 60 CHS C D → 1.0425(965) (Pass 1)
 → 1.0420(671) (Pass 2)
 → 1.0420(730)
 4.2072(893) pct. (Pass 3)

Reference(s)

Program Description II

Sketch(es)

Sample Problem(s)

(2) Cash flow: (All figures, except those with asterisk, are lump-sum at end of year)

Year	0	1	2	3	4	5	6	7	8
Investment	5	0	8	8	8	7	0	0	0
Revenue	0	3	4	4	4	4	4	9*	9*

*continuously received from start of year to end of year

Solution(s) E 0.0000 ↑ 5 A
 0.0001 ↑ 3 B
 0.0002 ↑ 5 ↑ 12 ↑ 4 C
 0.0006 ↑ 200 ↑ .12 ↑ .09 C
 0.0005 ↑ 7 CHS B
 0.0002 ↑ 3 ↑ 12 ↑ 8 CHS C D → 1.0631(700) (Pass 1)
 → 1.0652(102) (Pass 2)
 → 1.0652(778)
 6.5280(152) pct.(Pass 3)

Reference(s) (1) "Changing Times computer service: Find out how your investments are really doing", Changing Times Magazine, March 1970, pgs. 47-49; (2) Wild, N. H., "Return on Investment made easy", Chemical Engineering Magazine, April 12, 1976, pgs. 153-154

User Instructions

1
D C F R A T E
2

START
LUMP
SUM
SERIES
CALC
RATE
NEXT
PASS

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load sides 1 and 2		<input type="text"/> <input type="text"/>	
2	Press E until 1.0000 is displayed		E <input type="text"/>	1 (Pass)
3	Initialize data entry sequence as follows:		<input type="text"/> <input type="text"/>	
	Enter evaluation date for investment portfolio or date of initial capital investment for cash flow	MM.YYYY	<input type="text"/> <input type="text"/>	
	Enter market value of portfolio or initial investment amount of cash flow	Amount	A <input type="text"/>	Amount
4	If there are any lump-sum payments (for portfolio) or revenues (for cash flow), input them as follows:		<input type="text"/> <input type="text"/>	
	Enter date	MM.YYYY	<input type="text"/> <input type="text"/>	
	Enter amount	Amnt (A)	B <input type="text"/>	-(A)(n)
	(Repeat step 4 as necessary)		<input type="text"/> <input type="text"/>	
5	If there are any series payments (for portfolio) or revenues (for cash flow), input them as follows:		<input type="text"/> <input type="text"/>	
	Enter starting date of series	MM.YYYY	<input type="text"/> <input type="text"/>	
	Enter number of payments in series	N	<input type="text"/> <input type="text"/>	
	Enter interval (months) between payments	Months	<input type="text"/> <input type="text"/>	
	Enter amount of each payment	Amnt (A)	C <input type="text"/>	-Amnt
	(Repeat step 5 as necessary)		<input type="text"/> <input type="text"/>	
6	If there are any lump-sum withdrawals (for portfolio) or investment outlays (for cash flow), input them as follows:		<input type="text"/> <input type="text"/>	
	Enter date	MM.YYYY	<input type="text"/> <input type="text"/>	
	Enter amount	Amnt (A)	CHS B <input type="text"/>	(A)(n)
	(Repeat step 6 as necessary)		<input type="text"/> <input type="text"/>	
7	If there are any series withdrawals (for portfolio) or investment outlays (for cash flow), input them as follows:		<input type="text"/> <input type="text"/>	
	Enter starting date of series	MM.YYYY	<input type="text"/> <input type="text"/>	
	Enter number of withdrawals in series	N	<input type="text"/> <input type="text"/>	
	Enter interval (months) between withdrawals	Months	<input type="text"/> <input type="text"/>	
	Enter amount of each withdrawal	Amnt (A)	CHS C <input type="text"/>	(A)(N)(n)
	(Repeat step 7 as necessary)		<input type="text"/> <input type="text"/>	

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
8	To calculate initial rate, press		D	$1+i/100$
9	Press E until 2.0000 is displayed		E	2 (Pass)
10	Repeat step 3			-Amount
11	Repeat step 4			P.Value
12	Repeat step 5			P.Value
13	Repeat step 6			P.Value
14	Repeat step 7			P.Value
15	To calculate refined rate, press		D	$1+i_1/100$
16	Press E until 3.0000 is displayed		E	3 (Pass)
17	Repeat step 3			-Amount
18	Repeat step 4			P.Value ₁
19	Repeat step 5			P.Value ₁
20	Repeat step 6			P.Value ₁
21	Repeat step 7			P.Value ₁
22	To calculate further refined and final rates, press		D	$1+i_2/100$ ***
				i_e (%)
	(If a mistake is made during data entry and noticed before completing the step, it is only necessary to start <u>that</u> step over again.)			
	(If a mistake is made during data entry and noticed after completing a step, it is only necessary to go back to the step immediately following the "Press E until ..." at the start of the pass in which the error was made.)			
	(For another problem, repeat steps 2-22.)			
	*** pause on HP-67; print on HP-97			
	P.Value = Present (discounted) Value			

EVALUATION DATE AND MARKET VALUE (PORTFOLIO)
OR DATE AND AMOUNT OF INITIAL INVESTMENT OUTLAY (CASH FLOW)

DATE	AMOUNT
------	--------

[4] [A]

LUMP-SUM PAYMENTS (PORTFOLIO) OR REVENUES (CASH FLOW)

DATE	AMOUNT
12-1-54	100.00
12-2-54	100.00
12-3-54	100.00
12-4-54	100.00
12-5-54	100.00
12-6-54	100.00
12-7-54	100.00
12-8-54	100.00
12-9-54	100.00
12-10-54	100.00
12-11-54	100.00
12-12-54	100.00
12-13-54	100.00
12-14-54	100.00
12-15-54	100.00
12-16-54	100.00
12-17-54	100.00
12-18-54	100.00
12-19-54	100.00
12-20-54	100.00
12-21-54	100.00
12-22-54	100.00
12-23-54	100.00
12-24-54	100.00
12-25-54	100.00
12-26-54	100.00
12-27-54	100.00
12-28-54	100.00
12-29-54	100.00
12-30-54	100.00
12-31-54	100.00
1-1-55	100.00
1-2-55	100.00
1-3-55	100.00
1-4-55	100.00
1-5-55	100.00
1-6-55	100.00
1-7-55	100.00
1-8-55	100.00
1-9-55	100.00
1-10-55	100.00
1-11-55	100.00
1-12-55	100.00
1-13-55	100.00
1-14-55	100.00
1-15-55	100.00
1-16-55	100.00
1-17-55	100.00
1-18-55	100.00
1-19-55	100.00
1-20-55	100.00
1-21-55	100.00
1-22-55	100.00
1-23-55	100.00
1-24-55	100.00
1-25-55	100.00
1-26-55	100.00
1-27-55	100.00
1-28-55	100.00
1-29-55	100.00
1-30-55	100.00
1-31-55	100.00
2-1-55	100.00
2-2-55	100.00
2-3-55	100.00
2-4-55	100.00
2-5-55	100.00
2-6-55	100.00
2-7-55	100.00
2-8-55	100.00
2-9-55	100.00
2-10-55	100.00
2-11-55	100.00
2-12-55	100.00
2-13-55	100.00
2-14-55	100.00
2-15-55	100.00
2-16-55	100.00
2-17-55	100.00
2-18-55	100.00
2-19-55	100.00
2-20-55	100.00
2-21-55	100.00
2-22-55	100.00
2-23-55	100.00
2-24-55	100.00
2-25-55	100.00
2-26-55	100.00
2-27-55	100.00
2-28-55	100.00
2-29-55	100.00
2-30-55	100.00
2-31-55	100.00
3-1-55	100.00
3-2-55	100.00
3-3-55	100.00
3-4-55	100.00
3-5-55	100.00
3-6-55	100.00
3-7-55	100.00
3-8-55	100.00
3-9-55	100.00
3-10-55	100.00
3-11-55	100.00
3-12-55	100.00
3-13-55	100.00
3-14-55	100.00
3-15-55	100.00
3-16-55	100.00
3-17-55	100.00
3-18-55	100.00
3-19-55	100.00
3-20-55	100.00
3-21-55	100.00
3-22-55	100.00
3-23-55	100.00
3-24-55	100.00
3-25-55	100.00
3-26-55	100.00
3-27-55	100.00
3-28-55	100.00
3-29-55	100.00
3-30-55	100.00
3-31-55	100.00
4-1-55	100.00
4-2-55	100.00
4-3-55	100.00

Line 1	[↑]	[B]
Line 2	[↑]	[B]
Line 3	[↑]	[B]
Line 4	[↑]	[B]
Line 5	[↑]	[B]
Line 6	[↑]	[B]
Line 7	[↑]	[B]
Line 8	[↑]	[B]
Line 9	[↑]	[B]
Line 10	[↑]	[B]
Line 11	[↑]	[B]
Line 12	[↑]	[B]

SERIES PAYMENTS (PORTFOLIO) OR REVENUES (CASH FLOW)

ST.	DATE	NUMBER	INTERVAL	AMOUNT
1	10/1/50	100	100	100
2	10/2/50	200	200	200
3	10/3/50	300	300	300
4	10/4/50	400	400	400
5	10/5/50	500	500	500
6	10/6/50	600	600	600
7	10/7/50	700	700	700
8	10/8/50	800	800	800
9	10/9/50	900	900	900
10	10/10/50	1000	1000	1000
11	10/11/50	1100	1100	1100
12	10/12/50	1200	1200	1200
13	10/13/50	1300	1300	1300
14	10/14/50	1400	1400	1400
15	10/15/50	1500	1500	1500
16	10/16/50	1600	1600	1600
17	10/17/50	1700	1700	1700
18	10/18/50	1800	1800	1800
19	10/19/50	1900	1900	1900
20	10/20/50	2000	2000	2000
21	10/21/50	2100	2100	2100
22	10/22/50	2200	2200	2200
23	10/23/50	2300	2300	2300
24	10/24/50	2400	2400	2400
25	10/25/50	2500	2500	2500
26	10/26/50	2600	2600	2600
27	10/27/50	2700	2700	2700
28	10/28/50	2800	2800	2800
29	10/29/50	2900	2900	2900
30	10/30/50	3000	3000	3000
31	10/31/50	3100	3100	3100
32	11/1/50	3200	3200	3200
33	11/2/50	3300	3300	3300
34	11/3/50	3400	3400	3400
35	11/4/50	3500	3500	3500
36	11/5/50	3600	3600	3600
37	11/6/50	3700	3700	3700
38	11/7/50	3800	3800	3800
39	11/8/50	3900	3900	3900
40	11/9/50	4000	4000	4000
41	11/10/50	4100	4100	4100
42	11/11/50	4200	4200	4200
43	11/12/50	4300	4300	4300
44	11/13/50	4400	4400	4400
45	11/14/50	4500	4500	4500
46	11/15/50	4600	4600	4600
47	11/16/50	4700	4700	4700
48	11/17/50	4800	4800	4800
49	11/18/50	4900	4900	4900
50	11/19/50	5000	5000	5000
51	11/20/50	5100	5100	5100
52	11/21/50	5200	5200	5200
53	11/22/50	5300	5300	5300
54	11/23/50	5400	5400	5400
55	11/24/50	5500	5500	5500
56	11/25/50	5600	5600	5600
57	11/26/50	5700	5700	5700
58	11/27/50	5800	5800	5800
59	11/28/50	5900	5900	5900
60	11/29/50	6000	6000	6000
61	11/30/50	6100	6100	6100
62	12/1/50	6200	6200	6200
63	12/2/50	6300	6300	6300
64	12/3/50	6400	6400	6400
65	12/4/50	6500	6500	6500
66	12/5/50	6600	6600	6600
67	12/6/50	6700	6700	6700
68	12/7/50	6800	6800	6800
69	12/8/50	6900	6900	6900
70	12/9/50	7		

[illegible]

LUMP-SUM WITHDRAWALS (PORTFOLIO) OR INVESTMENT OUTLAYS (CASH FLOW)

DATE	AMOUNT
------	--------

[illegible]

SERIES WITHDRAWALS (PORTFOLIO) OR INVESTMENT OUTLAYS (CASH FLOW)

ST.	DATE	NUMBER	INTERVAL	AMOUNT
1	10/1/50	100	100	100
2	10/1/50	100	100	100
3	10/1/50	100	100	100
4	10/1/50	100	100	100
5	10/1/50	100	100	100
6	10/1/50	100	100	100
7	10/1/50	100	100	100
8	10/1/50	100	100	100
9	10/1/50	100	100	100
10	10/1/50	100	100	100
11	10/1/50	100	100	100
12	10/1/50	100	100	100
13	10/1/50	100	100	100
14	10/1/50	100	100	100
15	10/1/50	100	100	100
16	10/1/50	100	100	100
17	10/1/50	100	100	100
18	10/1/50	100	100	100
19	10/1/50	100	100	100
20	10/1/50	100	100	100
21	10/1/50	100	100	100
22	10/1/50	100	100	100
23	10/1/50	100	100	100
24	10/1/50	100	100	100
25	10/1/50	100	100	100
26	10/1/50	100	100	100
27	10/1/50	100	100	100
28	10/1/50	100	100	100
29	10/1/50	100	100	100
30	10/1/50	100	100	100
31	10/1/50	100	100	100
32	10/1/50	100	100	100
33	10/1/50	100	100	100
34	10/1/50	100	100	100
35	10/1/50	100	100	100
36	10/1/50	100	100	100
37	10/1/50	100	100	100
38	10/1/50	100	100	100
39	10/1/50	100	100	100
40	10/1/50	100	100	100
41	10/1/50	100	100	100
42	10/1/50	100	100	100
43	10/1/50	100	100	100
44	10/1/50	100	100	100
45	10/1/50	100	100	100
46	10/1/50	100	100	100
47	10/1/50	100	100	100
48	10/1/50	100	100	100
49	10/1/50	100	100	100
50	10/1/50	100	100	100
51	10/1/50	100	100	100
52	10/1/50	100	100	100
53	10/1/50	100	100	100
54	10/1/50	100	100	100
55	10/1/50	100	100	100
56	10/1/50	100	100	100
57	10/1/50	100	100	100
58	10/1/50	100	100	100
59	10/1/50	100	100	100
60	10/1/50	100	100	100
61	10/1/50	100	100	100
62	10/1/50	100	100	100
63	10/1/50	100	100	100
64	10/1/50	100	100	100
65	10/1/50	100	100	100
66	10/1/50	100	100	100
67	10/1/50	100	100	100
68	10/1/50	100	100	100
69	10/1/50	100	100	100
70	10/1/50	100	100	100
71	10/1/50	100	100	100
72	10/1/50	100	100	100
73	10/1/50	100	100	100
74	10/1/50	100</		

[illegible]

67 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	g LBL fe	32 25 15	Convert date to -n		X	71	(-N)(I')
	h X \neq Y	35 52	Amount in y; Date in X		h LSTX	35 82	Bring back I
	\uparrow	41	MM.YYYY in X & Y Regs.		+	61	I - NI
	g FRAC	32 83	.YYYY in X Reg.		2	02	(I - NI)/24
	-	51	MM		4	04	= (I' - NI')/2
	h LSTX	35 82	Bring back .YYYY		\div	81	
	EEX	43	YYYY		g GSB fe	32 22 15	Calculate -n'
	4	04			+	61	$\bar{n} = -n' + [(I' - NI')/2]$
	X	71			RCL 6	34 06	Amnt in X; \bar{n} in y Reg.
010	h X \neq Y	35 52	MM. in X; YYYY. in y		GTO 0	22 00	Common lump sum & series
	1	01			g LBL fa	32 25 11	Pass 2 or 3 Initialize
	2	02			0	00	
	\div	81	fraction of year		STO 1	33 01	Initialize
	+	61	= MM/12		STO 2	33 02	TDW & TDP
	RCL 5	34 05	YYYY. fraction		h X \neq Y	35 52	0 in y; mkt value in X
	h X \neq Y	35 52	Eval. Date (0 in Pass 1)		-	51	- mkt. value in X
	-	51	-n = (Eval. Date) - Date		g LBL fb	32 25 12	Pass 2 or 3 lump sum
	h RTN	35 22			0	00	Not series
	f LBL A	31 25 11	Initialize		STO 3	33 03	
020	h F? 0	35 71 00	Test for Pass		+	61	Amnt in X; date in y
	GTO fa	22 31 11	Flag 0 set; Pass 2 or 3		f LBL 2	31 25 02	Common lump sum & series
	f CLREG	31 43	Pass 1. Clear all regs.		g GSB fe	32 22 15	Calc. -n
	STO 1	33 01	and init. TW with		RCL 3	34 03	(I'N - I') or 0
	g GSB fe	32 22 15	Value on Eval. Date		-	51	-n' - (I'N - I') or -n
	CHS	42	Convert Eval. Date		RCL (i)	34 24	$\pm PV = \pm \text{Amount}$
	STO 5	33 05	from MM.YYYY to		h X \neq Y	35 52	$\times (1 + i/100)^{-n}$
	RCL 1	34 01	Yr. fraction & store		h y ^x	35 63	
	h RTN	35 22	Display value on		X	71	
	f LBL B	31 25 12	Eval. Date		f X<0	31 71	PMT or WDL?
030	h F? 0	35 71 00	Lump Sum		GTO 3	22 03	WDL; Go to LBL 3
	GTO fb	22 31 12	Test for Pass		STO + 2	33 61 02	$\Sigma PV_{PMT} = TDP$
	g GSB fe	32 22 15	Flag 0 set. Pass 2 or 3		h RTN	35 22	Display PV _{PMT}
	h X \neq Y	35 52	Pass 1. Cnvt date in		f LBL 3	31 25 03	WDL
	f LBL 0	31 25 00	Y Reg to -n; amount		STO - 1	33 51 01	$\Sigma - (PV_{WDL}) = TDW$
	X	71	in X Reg.		h RTN	35 22	Display - PV _{WDL}
	h LSTX	35 82	Common lump sum & series		g LBL fc	32 25 13	Pass 2 or 3 Series
	f X<0	31 71	(-WDL)(-n) or (PMT)(-n)		STO 4	33 04	Temp. store amount
	GTO 1	22 01	Bring back PMT or WDL		CLX	44	
	STO + 2	33 61 02	PMT or WDL?		1	01	I' = I/12
040	h R \downarrow	35 53	WDL; Go to LBL 1		2	02	I'N
	STO - 4	33 51 04	Σ PMT		\div	81	
	h RTN	35 22	(-n)(PMT) to X Reg		X	71	
	f LBL 1	31 25 01	$\Sigma - (-n)(PMT)$		STO 3	33 03	
	STO - 1	33 51 01	Display - (n)(PMT)		RCL (i)	34 24	(1 + i/100) in X; I'N in y
	h R \downarrow	35 53	WDL		h LSTX	35 82	Bring back I'
	STO + 3	33 61 03	$\Sigma - (-WDL)$		STO - 3	33 51 03	(I'N - I') in Reg. 3
	h RTN	35 22	(-n)(-WDL) to X Reg		h y ^x	35 63	A = $[1 + i/100]^{I'}$ - 1
	f LBL C	31 25 13	$\Sigma (-n)(-WDL)$		1	01	
	h F? 0	35 71 00	Display (n)(WDL)		-	51	
050	GTO fc	22 31 13	Series		h X \neq Y	35 52	A in y; I'N in X
	STO 6	33 06	Test for Pass		RCL (i)	34 24	(1 + i/100) in X; I'N in y
	h R \downarrow	35 53	Flag 0 set. Pass 2 or 3		h X \neq Y	35 52	(1 + i/100) in y; I'N in X
	h X \neq Y	35 52	Pass 1. Temp. store amnt.		h y ^x	35 63	B = $(1 + i/100)^{I'N}$ - 1
	STO X 6	33 71 06	N in X Reg; I in y Reg;		1	01	
	CHS	42	date in Z Reg.		-	51	
	h X \neq Y	35 52	(N)(PMT) or (N)(-WDL)		h X \neq Y	35 52	
			-N				
			I in X; -N in y Reg.				

REGISTERS

0	1 TW or TDW	2 TP or TDP	3 Temp; 1+(i/100)	4 Temp.	5 Eval. Date	6 TW/TP	7 1+(i/100)	8 1+(i/100)	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I	7 or 8			

67 Program Listing II

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
	÷	81	B/A		÷	81	A/B
	RCL 4	34 04	Amount =	170	RCL 7	34 07	
	X	71	Amount x (B/A)		1	01	
	GTO 2	22 02	Common lump sum & series		-	51	
	f LBL D	31 25 14	Calculate Rates		+	61	
	h F? 0	35 71 00	Test for Pass		EEX	43	
	GTO f d	22 31 14	Flag 0 set. Pass 2 or 3		2	02	
120	RCL 2	34 02	Pass 1. Calc. initial rate.		X	71	
	RCL 1	34 01	TP/TW		h RTN	35 22	Display i _c
	÷	81			f LBL E	31 25 15	Set up next pass
	STO 6	33 06	Store TP/TW		h F? 0	35 71 00	Is current pass 1?
	RCL 4	34 04		180	GTO 8	22 08	Current pass is 2 or 3
	RCL 2	34 02	$X_p = [Σ(PNTn)] / TP$		h SF 0	35 51 00	Pass 1. Increase to 2
	÷	81			h CF 1	35 61 01	Clear pass 3 flag
	RCL 3	34 03			7	07	Set I Reg. to 7
	RCL 1	34 01	$X_w = [Σ(WDLn)] / TW$		h STI	35 33	for i ₁
	÷	81			2	02	
130	-	51	$a = X_p - X_w$		h RTN	35 22	Display pass 2
	h 1/x	35 62	$(1 + i/100) = (TP/TW)^{1/a}$		f LBL 8	31 25 08	Current pass is 2 or 3
	h y ^x	35 63			h F? 1	35 71 01	Is current pass 3?
	STO 7	33 07	Store $1 + (i/100)$		GTO 9	22 09	Current pass is 3
	h RTN	35 22	Display $1 + (i/100)$	190	h SF 1	35 51 01	Pass 2. Increase to 3
	g LBL f d	32 25 14	Pass 2 or 3 Rates		8	08	Set I Reg. to 8
	RCL (i)	34 24	$(1 + i/100)$ or $(1 + i_1/100)$		h STI	35 33	for i ₂
	RCL 6	34 06			3	03	
	f LOG	31 53	$A = \log(TW/TP)$		h RTN	35 22	Display Pass 3
	RCL 6	34 06			f LBL 9	31 25 09	Current pass is 3
140	RCL 2	34 02			h CF 0	35 61 00	Reset to 1. Clear
	÷	81	$B = \log \left[\frac{(TW/TP)}{(TDP/TDW)} \right]$		h CF 1	35 61 01	Pass 2 or 3 flag
	RCL 1	34 01			1	01	Clear pass 3 flag
	X	71			h RTN	35 22	Display Pass 1
	f LOG	31 53		200			
	÷	81	$1/b = A/B$				
	h y ^x	35 63	$(1 + i_1/100) = (1 + i/100)^{1/b}$				
	h F? 1	35 71 01	Test for Pass 3				
	GTO 5	22 05	Flag 1 set. Pass 3				
	STO 8	33 08	Pass 2. Store $(1 + i_1/100)$				
150	h RTN	35 22	Display $1 + (i_1/100)$				
	f LBL 5	31 25 05	Pass 3. Calc. final rate				
	STO 3	33 03	Store $(1 + i_2/100)$				
	f -X-	31 84	Display $1 + (i_2/100)$				
	RCL 8	34 08		210			
	RCL 7	34 07					
	-	51	$A = [(i_1/100) - (i/100)]^2$				
	↑	41					
	X	71					
	h LST X	35 82					
160	RCL 3	34 03	$B = (i_1/100) - (i/100)$				
	-	51	$-(i_2/100) + (i_1/100)$				
	RCL 8	34 08					
	+	61					
	f X≠0	31 61	Are i, i ₁ , and i ₂ all equal?	220			
	GTO 6	22 06	No. Proceed				
	CLX	44					
	1	01	Yes. Set B=1				
	f LBL 6	31 25 06					

LABELS					FLAGS		SET STATUS		
A Start	B Lump Sum	C Series	D Calc. Rate	E Next Pass	0 Pass 2 or 3	1 Pass 3	FLAGS	TRIG	DISP
a Pass 2 or 3 Start	b Pass 2 or 3 Lump Sum	c Pass 2 or 3 Series	d Pass 2 or 3 Calc. Rate	e Convert Date to -n			ON OFF		
0 Pass 1 Common	1 Pass 1 WDL	2 Pass 2 or 3 Common	3 Pass 2 or 3 WDL	4			0 <input checked="" type="checkbox"/> <input type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
5 Pass 3 Final Rate	6 used	7	8 Current Pass 2 or 3	9 Current Pass 1			1 <input checked="" type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
							2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
							3 <input type="checkbox"/> <input type="checkbox"/>		n <u>4</u>

Program Description I

Program Title	Convertible Bond Portfolio Premium Evaluation		
Contributor's Name	Ralston W. Barnard		
Address	2811 Ridgecrest Drive S.E.		
City	Albuquerque	State	N.M
		Zip Code	87108

Program Description, Equations, Variables This program calculates the conversion values and premiums over conversion value for a portfolio of up to 14 convertible bonds. The program also calculates the weighted average of the premiums. The weighting factors can range from 1 to 99. The conversion factors and weighting factors are stored in the form XXX.XXYY, where the X's are conversion factors, and the Y's the weighting factors. The conversion value is given by $CV = BP / Cf$, where C.V. is conv. value, BP is bond price, and Cf is conversion factor. BP is entered as a percent of par (100), so Cf is modified accordingly. The premium is given by $[(CV - SP) / SP] * 100$, where SP is stock price. The weighted average of premium is given by $\Sigma Prem * YY / \Sigma YY$, when YY is the weighting factors.

Both the conversion factors and weight factors can be stored on the second side of the program card. If no price is available for a bond issue, the calculations are bypassed and the weighted average does not include that issue.

Operating Limits and Warnings If the portfolio consists of less than 14 bond issues, Steps 91 and 92 can be changed to reflect the actual number of issues: for 14, use 23; for 13, use 22, for 12, use 21, etc.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

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Sketch(es)

Sample Problem(s) Assume a portfolio consisting of the following numbers of bonds:

Conv. Fac	# of Bonds	Bond Price	Stock Price
19.74	5	88	20
50.00	15	80	10
28.56	1	70	20
109.59	25	88	6

Calculate the conversion value and premium for each. Calculate the weighted average premium, and write the data for future use.

Solution(s) Prepare: 19.7405 [ST0] [0], 50.0015 [ST0] [1], 28.5601 [ST0] [2], 109.5925 [ST0] [3]. [f] [A] (initializes) -----> 0.00

88 [A] ----->44.58 (conv. val), 20 [B] ----->123 (prem).

80 [A] ----->16.00 , 10 [B] -----> 60.0

70 [A] ----->24.51 , 20 [B] -----> 22.5

88 [A] -----> 8.03 , 6 [B] -----> 33.8

[C] ----->51.8

[E] ----->Crd ----->0.00

Reference(s)

User Instructions

1
2
 CONVERTIBLE BOND PORTFOLIO PREMIUM EVALUATION
 (Initialize)
 REVIEW
WRITE
 Bond PR. Stock PR. → AVG. PREM CONV. FACS CONV. FACS

[illegible]

97 Program Listing I

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS		
001	*LBLα	21 16 11		057	0	00			
002	RCLD	36 14		058	X≠Y?	16-35			
003	RCLC	36 13		059	DSP0	-63 00			
004	RCLB	36 12		060	X≠Y	-41			
005	RCLA	36 11		061	ENT↑	-21			
006	P≠S	16-51		062	ENT↑	-21			
007	CLRG	16-53		063	ROLE	36 15			
008	P≠S	16-51		064	ENT↑	-21			
009	STOA	35 11		065	R↓	-31			
010	R↓	-31		066	x	-35			
011	STOB	35 12		067	R↑	16-31			
012	R↓	-31		068	Σ+	56			
013	STOC	35 13		069	CF3	16 22 03			
014	R↓	-31		070	R↓	-31			
015	STOD	35 14		071	R↓	-31			
016	CF3	16 22 03		072	RTN	24			
017	RTN	24		073	*LBLC	21 13			
018	*LBLA	21 11		074	RCLΣ	36 56			
019	DSP2	-63 02		075	=	-24			
020	RCLi	36 45		076	DSP1	-63 01			
021	F3?	16 23 03		077	RTN	24			
022	GT03	22 03		078	*LBLD	21 14			
023	GT02	22 02		079	DSP4	-63 04			
024	*LBL3	21 03		080	0	00			
025	EEX	-23		081	STOI	35 46			
026	2	02		082	*LBL4	21 04			
027	x	-35		083	RCLi	36 45			
028	ENT↑	-21		084	PSE	16 51			
029	FRC	16 44		085	ISZI	16 26 46			
030	STOE	35 15		086	1	01			
031	-	-45		087	0	00			
032	EEX	-23		088	RCLi	36 46			
033	3	03		089	X=Y?	16-33			
034	÷	-24		090	GSB7	23 07			
035	÷	-24		091	2	02			
036	*LBL2	21 02		092	3	03			
037	ISZI	16 26 46		093	RCLi	36 46			
038	1	01		094	X>Y?	16-34			
039	0	00		095	RTN	24			
040	RCLi	36 46		096	GT04	22 04			
041	X=Y?	16-33		097	*LBL E	21 15			
042	GSB7	23 07		098	GSBα	23 16 11			
043	R↓	-31		099	WDTA	16-61			
044	R↓	-31		100	RTN	24			
045	RTN	24		101	R/S	51			
046	*LBL7	21 07							
047	ENT↑	-21							
048	+	-55							
049	STOI	35 46							
050	RTN	24							
051	*LBLB	21 12							
052	X≠Y	-41							
053	%CH	16 55							
054	DSP1	-63 01							
055	1	01							
056	0	00							
REGISTERS									
0 C.F.1	1 C.F.2	2 C.F.3	3 C.F.4	4 C.F.5	5 C.F.6	6 C.F.7	7 C.F.8	8 C.F.9	9 C.F.10
S0	S1	S2	S3	S4 Σ bonds	S5 Σ (bonds) ²	S6 Σ (bond×pre)	S7 Σ () ²	S8 Σ ()	S9 n
A C.F. 11	B C.F. 12	C C.F. 13	D C.F. 14	E # of bonds	I control				

SET STATUS

FLAGS

TRIG

DISP

ON	OFF
0 <input type="checkbox"/>	<input checked="" type="checkbox"/>
1 <input type="checkbox"/>	<input checked="" type="checkbox"/>
2 <input type="checkbox"/>	<input checked="" type="checkbox"/>
3 <input type="checkbox"/>	<input checked="" type="checkbox"/>

DEG <input checked="" type="checkbox"/>
GRAD <input type="checkbox"/>
RAD <input type="checkbox"/>

FIX <input checked="" type="checkbox"/>
SCI <input type="checkbox"/>
ENG <input type="checkbox"/>
n <u>2</u>

110

Program Description I

Program Title	Yield on Call Option Sales		
Contributor's Name	Hewlett-Packard		
Address	1000 NE Circle Boulevard		
City	Corvallis	State	OR Zip Code 97330

Program Description, Equations, Variables This program calculates various yields (actual and annualized) useful in evaluating call option sales (writing): yield if exercised, yield if unexercised⁴, and breakeven point³. Calculations consider whether the stock is purchased on a cash basis (full price) or on a margin basis².

$$\text{exercised} = \frac{\text{Net Prem} - \text{Net Pur} + \text{Net Sale} + \text{Div} - [\text{Im}]_2}{[.5]_2 \text{ Net Pur} - \text{Net Prem}}$$

$$\text{unexercised} = \frac{\text{Net Prem} + \text{Div} - [2 \times C_{sp}]_1 - [\text{Im}]_2}{[.5]_2 \text{ Net Pur} - \text{Net Prem}}$$

$$\text{breakeven} = \frac{\text{Net Pur} - \text{Net Prem} - \text{Div} + [\text{Im}]_2}{N}$$

$$\text{Net Pur} = (\# \text{ Shares} \times \text{Stock price}) + \text{Stock Commission}$$

$$\text{Net Prem} = (\# \text{ Shares} \times \text{Option premium}) - \text{Option Commission}$$

$$\text{Net Sale} = (\# \text{ Shares} \times \text{Exercise price}) - \text{Commission}$$

$$\text{Im} = \text{Interest rate} \times 1/2 \text{ Net Pur} \times T/365$$

Operating Limits and Warnings

- ¹ Stock is purchased for one option period and then sold.
- ² Applicable for 50% margin requirement.
- ³ Stock price below which the writer has a loss (the loss point on the downside).
- ⁴ Unexercised yield does not include commissions unless the commission flag is set. With the flag set two commissions (buy and sell: By & S1) are included in the yield calculation.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

33

Sketch(es)

Sample Problem(s)

A. You wish to write 3 calls vs 300 shares of XYZ stock, which you intend to buy at \$20. The calls trade at $1 \frac{3}{16}$ and 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. Margin interest rate is 7.2%.

- 1) Calculate: the yield if called, the yield if not called (assuming you own the stock), and the breakeven 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 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).

Solution(s)

A.			
1)	300 [f] [A]	300.00	# shares
	20 [↑] .5 [A]	6000.00	gross purchase
	1.2 [%] 44.5 [+]	116.50	purchase commission
	[R/S]	6116.50	net purchase cost (cash)
	25 [↑] 100 [B]	7500.00	gross exercise
	1.2 [%] 44.5 [+]	134.50	exercise commission
	[R/S]	7365.50	net exercise proceeds
Reference(s)	1 [↑] 3 [↑] 16 [÷] [+]	1.19	convert $1 \frac{3}{16}$ to fraction
	[C]	356.25	gross option proceeds

continued on next page

Program Description II

Sketch(es)

Sample Problem(s)

1.43 [%]	33 [+]	. . . . .	38.09	option commission
	[R/S].	. . . . .	318.16	net option proceeds
	[D]	. . . . .	29.61	exercised yield
	[R/S].	. . . . .	108.09	annualized yield
	[E]	. . . . .	8.07	unexercised yield
	[R/S].	. . . . .	29.47	annualized yield
	f [D]	. . . . .	18.83	breakeven point

2)	[f] [B]	. . . . .	1.00	(sets for margin acct)
	7.2 [f] [C]	. . . . .	7.2	(enters margin rate)
	[D]	. . . . .	64.87	yield if called
	[f] [E]	. . . . .	6.38	yield (un called) including buy & sell (double) commission

Solution(s)

[R/S].	23.29	annualized yield
--------	-----------	-------	------------------

3) There is no need to re-enter the # of shares (f [A]) or purchase price and dividends ([A]) since they remain the same from the previous calculation. The margin flag is also similarly set (1) from the last calculation.

30 [↑]	190 [B].	. . . . .	9000.00	gross exercise
1.2 [%]	44.5 + [R/S]	. . . . .	8847.50	net exercise
2 [↑]	1 [↑]	8 [÷] [+]	[C]	. . . . . 637.50 gross option proceeds

1.43 [%]	33 [+]	[R/S]	595.38	net option proceeds
	[E].	. . . . .	25.61	actual yield (margin basis)
	f [B]	. . . . .	0	reset for cash purchase
	[E]	. . . . .	13.50	actual yield (cash basis)

User Instructions

35

1

sh
Margin?
Margin Rate
→Brkevn
By&S1

Sp↑D;C
Ex↑T;C
Prem;C
→Exer
→ Unexer

2

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1	Enter number of shares of stock on which calls are written (# sh)		<input type="button" value="f"/>	<input type="button" value="A"/>	
			<input type="button" value=""/>	<input type="button" value=""/>	
			<input type="button" value=""/>	<input type="button" value=""/>	
2	Margin (1), cash (0) ₂		<input type="button" value="f"/>	<input type="button" value="B"/>	0 or 1
			<input type="button" value=""/>	<input type="button" value=""/>	
3°	a) Stock price (sp)	\$	<input type="button" value=""/>	<input type="button" value="↑"/>	
	b) Dividend per share received before option expiration (d)	\$	<input type="button" value=""/>	<input type="button" value="A"/>	gross purchase
	c) Compute & input stock commission ₁ (C)		<input type="button" value=""/>	<input type="button" value="R/S"/>	net cost
			<input type="button" value=""/>	<input type="button" value=""/>	
4°	a) Option exercise price (Ex)	\$	<input type="button" value=""/>	<input type="button" value="↑"/>	
	b) Time to exercise (T)	days	<input type="button" value=""/>	<input type="button" value="B"/>	gross exercise
	c) Exercise commission (C)	\$	<input type="button" value=""/>	<input type="button" value="R/S"/>	proceeds if called
			<input type="button" value=""/>	<input type="button" value=""/>	
			<input type="button" value=""/>	<input type="button" value=""/>	
5°	a) Option premium (Pm)	\$	<input type="button" value=""/>	<input type="button" value="C"/>	gross premium
	b) Option commission (C)	\$	<input type="button" value=""/>	<input type="button" value="R/S"/>	net premium
			<input type="button" value=""/>	<input type="button" value=""/>	
6*	Yield if option is exercised		<input type="button" value=""/>	<input type="button" value="D"/>	actual yield(%)
			<input type="button" value=""/>	<input type="button" value="R/S"/>	annual yield(%)
			<input type="button" value=""/>	<input type="button" value=""/>	
7*	Yield assuming stock price remains constant and option expires unexercised (no dividends included)		<input type="button" value=""/>	<input type="button" value="E"/>	actual yield(%)
			<input type="button" value=""/>	<input type="button" value="R/S"/>	annual yield
			<input type="button" value=""/>	<input type="button" value=""/>	
8*	Same as 7 but with buy and sell (double) commissions included		<input type="button" value="f"/>	<input type="button" value="E"/>	annual yield
			<input type="button" value=""/>	<input type="button" value="R/S"/>	annual yield
			<input type="button" value=""/>	<input type="button" value=""/>	
9*	Breakeven point (loss point on downside)		<input type="button" value="f"/>	<input type="button" value="D"/>	\$
			<input type="button" value=""/>	<input type="button" value=""/>	
°	3,4 & 5 may be used in any order		<input type="button" value=""/>	<input type="button" value=""/>	
*	6,7, 8 & 9 may be used in any order		<input type="button" value=""/>	<input type="button" value=""/>	
			<input type="button" value=""/>	<input type="button" value=""/>	
1	Commissions may be computed as if calculator were in ordinary manual mode (see example)		<input type="button" value=""/>	<input type="button" value=""/>	
			<input type="button" value=""/>	<input type="button" value=""/>	
2	Alternate presses of [f] [B] set and unset margin status		<input type="button" value=""/>	<input type="button" value=""/>	
			<input type="button" value=""/>	<input type="button" value=""/>	
			<input type="button" value=""/>	<input type="button" value=""/>	

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBL	21 16 11	Store # Shares	056	R/S	51	Compute, store & display net prem
002	ST01	35 01		057	RCL5	36 05	
003	RTN	24		058	XZY	-41	
004	*LBL	21 16 12	Alternately set and unset margin flag f 0	059	-	-45	Exercise numerator less Im
005	F0?	16 23 00		060	ST05	35 05	
006	GT04	22 04		061	R/S	51	
007	SF0	16 21 00	Store margin rate	062	*LBLD	21 14	Margin calculations
008	1	01		063	RCL6	36 06	
009	RTN	24		064	RCL5	36 05	
010	*LBL4	21 04	Compute store, & display gross purchase	065	+	-55	Divide and normalize
011	CF0	16 22 00		066	RCL4	36 04	
012	0	00		067	+	-55	
013	RTN	24	Cancel dividends if purchase commission is 0	068	RCL2	36 02	Annualize using day factor
014	*LBL	21 16 13		069	-	-45	
015	ST08	35 08		070	GSB4	23 04	
016	R/S	51	Compute, display & store net purchase	071	÷	-24	Unexercised numerator less double dividend and Im
017	*LBLA	21 11		072	EEX	-23	
018	RCL1	36 01		073	2	02	Double dividend
019	ST04	35 04	Initialize R6 with # shares	074	x	-35	
020	ST02	35 02		075	RTN	24	
021	R↓	-31		076	RCL7	36 07	Annualize
022	STx4	35-35 04	Compute and store day factor T/365	077	1/X	52	
023	XZY	-41		078	x	-35	
024	STx2	35-35 02		079	RTN	24	By & S1, double dividends
025	RCL2	36 02	Compute, store, & display gross exer	080	*LBL	21 15	
026	R/S	51		081	RCL4	36 04	
027	ST03	35 03		082	RCL5	36 05	Compute double dividends
028	X=0?	16-43	Compute, store & display net exer	083	+	-55	
029	ST04	35 04		084	F1?	16 23 01	
030	RCL2	36 02		085	GSB2	23 02	Create error message if By & S1 used in conjunction with 0 commission
031	+	-55	Compute, store & display gross prem	086	GSB4	23 04	
032	ST02	35 02		087	÷	-24	
033	R/S	51		088	EEX	-23	
034	*LBLB	21 12	Compute, store & display gross exer	089	2	02	
035	RCL1	36 01		090	x	-35	
036	ST06	35 06		091	CF1	16 22 01	
037	R↓	-31	Compute, store & display gross exer	092	RTN	24	
038	3	03		093	RCL7	36 07	
039	6	06		094	1/X	52	
040	5	05	Compute, store & display gross exer	095	x	-35	
041	÷	-24		096	RTN	24	
042	ST07	35 07		097	*LBL	21 16 15	
043	R↓	-31	Compute, store & display gross exer	098	SF1	16 21 01	
044	STx6	35-35 06		099	GT0E	22 15	
045	RCL6	36 06		100	RTN	24	
046	R/S	51		101	*LBL2	21 02	
047	RCL6	36 06		102	RCL3	36 03	
048	XZY	-41	Compute, store & display gross exer	103	2	02	
049	-	-45		104	x	-35	
050	ST06	35 06		105	X=0?	16-43	
051	R/S	51	Compute, store & display gross exer	106	GT03	22 03	
052	*LBLC	21 13		107	-	-45	
053	RCL1	36 01		108	RTN	24	
054	x	-35	Compute, store & display gross exer	109	*LBL3	21 03	
055	ST05	35 05		110	÷	-24	
				111	RTN	24	

REGISTERS

0	1 # sh	2 Net Pur	3 Pur Comm	4 Dividends	5 Net Prem	6 Net Exer	7 Day Factor	8 Margin Rate	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

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[illegible]

Program Description I

Program Title **BOND PRICE AND YIELD**

Contributor's Name HEWLETT-PACKARD COMPANY

Address Corvallis Division
1000 N.E. Circle Boulevard

City Corvallis, OR 97330

State

Zip Code

Program Description

This program calculates the "flat" price (i.e., not including accrued interest) or annual yield of a semiannual coupon bond. Data required for input are the number of coupon periods (PER) between settlement date and redemption date (maturity date, call date, etc.), the annual coupon rate expressed as a percent (CR), the redemption value (RV) if other than 100, and either the annual yield expressed as a percent (YLD) or the bond price (PRICE).

All prices are expressed as a percent of the face value. (e.g., since most bonds have a face value of \$1,000, a call price of 107 implies an actual redemption value of \$1,070 if the bond is "called".)

The amount of the accrued interest for the expired portion of the current coupon period is available in register 8 and may be recalled (**RCL** **8**).

Each time the coupon rate is entered by pressing **B**, the redemption value is automatically set to 100. This is the proper value for a price-to-maturity calculation, and no value must be keyed in for redemption value (RV). If however, the price-to-call is desired and the call price is other than 100, the call price has to be entered for RV *after* the coupon rate has been keyed in.

All input data are retained so that when alternative calculations are to be performed, only changed data must be keyed in. This permits, for instance, calculating the price for each of several different yields. In addition, the settlement date is retained throughout the bond calculations, and need not be reentered when returning to the calendar program for another bond calendar calculation.

The number of remaining coupon periods between settlement date and redemption date may be calculated and entered in two ways. If the calendar program is used to calculate the number of days between the settlement date and redemption date, the number of remaining semiannual coupon periods is automatically calculated and stored in register 0 for use by the bond program. In this case the instruction to enter the number of remaining coupon periods in step 3 below may be ignored. If however, the number of remaining coupon periods is already known, or the method used to calculate this value by the calendar program is deemed inappropriate, it may be entered in step 3. Choosing between an actual or 30/360 calendar calculation depends on trade custom for the particular security. Corporate bonds are traditionally traded on a 30/360 basis, while many government securities use an "actual" calendar.

Operating Limits and

This program may be used for after-tax as well as before-tax yield calculations. The procedure is to reduce the coupon and redemption values to their after-tax net values prior to entering them in the program. This can be important when

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Program Description I

Program Title _____

Contributor's Name _____

Address _____

City _____

State _____

Zip Code _____

Program Description, Equations, Variables

comparing a bond with taxable coupons to one whose coupons are tax-free.

The program may also be used to calculate a yield when a bond is purchased, and then sold prior to redemption by the issuer. The procedure is simple to treat the exit date and price as the redemption date and redemption value respectively. The yield calculated is the precise yield if the exit date is also a coupon date, and is an approximate yield for other exit dates.

Operating Limits and Warnings

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Program Description II

Sketch(es)

Sample Problem(s)

15. Bond Price and Yield
for $PER > 1$

$$PRICE = RV \left(1 + \frac{YLD}{2} \right)^{-PER} + 100 \frac{CR}{YLD} \left[\left(1 + \frac{YLD}{2} \right)^J - \left(1 + \frac{YLD}{2} \right)^{-PER} \right] - 100 \left(\frac{CR}{2} \right)^J$$

where

$$J = 1 - \text{FRAC}(PER)$$

$\text{FRAC}(PER)$ = fractional portion of the number
of remaining coupon periods

i.e., if $PER = 12.6$, $\text{FRAC}(PER) = .6$, and $J = 1 - .6 = .4$
for $PER < 1$

Solution(s)

$$PRICE = \frac{RV + \frac{CR}{2}}{1 + \frac{YLD}{2} \cdot PER} - \left(\frac{CR}{2} \right)^J$$

Reference(s)

Program Description II

Sketch(es)

Example 1:

What is the price of a semiannual 3% bond to yield 10% with settlement date of January 1, 1972? The bond matures March 6, 1978, and a 30/360 calendar is used.

Keystrokes:

Enter program BD-14

1.011972 **A** 3.061978 **B D** →

Outputs:

2225.00 (days settlement
to maturity, 30/360
basis)

Now enter program BD-15

3 **B** 10 **C E** →

68.29 (price-to-maturity)

Example 2:

Having performed the above calculation, determine the price of the same bond using the "actual" number of days. Remember, the settlement date has been retained and need not be reentered.

Keystrokes:

Enter program BD-14

3.061978 **B C** →

Outputs:

2256.00 (actual days settle-
ment to maturity)

Enter program BD-15

3 **B** 10 **C E** →

68.31 (price-to-maturity)

Example 3:

A U.S. Treasury Note with a 5.75% coupon and 88 days from settlement to maturity is purchased at 100 18/32. If there are assumed to be 183 days in a coupon period, what is the yield-to-maturity?

Keystrokes:

5.75 **B** 88 **ENTER** 183 **÷** **A** →

Outputs:

0.48 (fraction of a coupon
period remaining)

18 **ENTER** 32 **÷** 100 **+** **E C** →

3.34 (% annual yield-to-
maturity)

Example 4:

Assuming that the previous problem has just been performed as shown, calculate the yield if there are assumed to be 182 days in a coupon period instead of 183.

Keystrokes:

88 **ENTER** 182 **÷** **A C** →

Outputs:

3.35 (% annual yield-
to-maturity)

Example 5:

An annual coupon bond with a 5% coupon is settled on March 1, 1974. If the yield is 5.5%, and the bond matures on February 1, 1984 what is the price-to-maturity on a 30/360 basis?

Keystrokes:

Enter program BD-14

3.011974 **A** 2.011984 **B D** →

Outputs:

3570.00 (days settlement
to maturity, 30/360
basis)

Sample Problem(s)

Solution(s)

Reference(s)

Program Description II

Sketch(es)

Determine the number of **annual coupon periods** remaining by dividing by the number of days in a coupon period.

360 \div \longrightarrow 9.92 (number of annual coupon periods)

Enter program BD-15

A \longrightarrow 9.92 (the correct value for PER is entered)

The coupon rate and yield rate must be multiplied by a factor prior to input. This factor is determined by dividing the number of coupon periods per year into 2. For annual coupon bonds the factor is therefore 2 (for quarterly coupons the factor is 0.5 etc.).

5 **ENTER** 2 \times **B** 5.5 **ENTER**

2 \times **C** **E** \longrightarrow 96.24 (price-to-maturity)

Sample Problem(s)

Example 6:

A semiannual coupon bond with a 5% coupon rate maturing February 6, 1993 was purchased November 15, 1973 for a price of 99. The bond is callable on February 6, 1980 at a call price of 101. What is the yield-to-call and yield-to-maturity if the 30/360 calendar is used?

Keystrokes:

Outputs:

Enter program BD-14

11.151973 **A** 2.061980 **B** **D** \longrightarrow 2241.00 (days settlement to call)

Enter Program BD-15

5 **B** 101 **D** 99 **E** **C** \longrightarrow 5.33 (% yield-to-call)

Enter program BD-14

2.061993 **B** **D** \longrightarrow 6921.00 (days settlement to maturity)

Enter program BD-15

5 **B** 99 **E** **C** \longrightarrow 5.08 (% yield-to-maturity)

Solution(s)

Example 7:

Having just completed the before tax yield-to-maturity calculation in the previous example, the bond purchaser wishes to perform an after tax yield-to-maturity calculation. He is in a 40% income tax bracket and a 25% tax is to be applied to capital gains.

Keystrokes:

Outputs:

First, calculate and enter the after tax value of the coupon.

5 **ENTER** **ENTER** .4 \times $-$ **B** \longrightarrow 3.00 (net after tax coupon)

Now calculate and enter the net after tax proceeds when the bond is redeemed for 100 at maturity.

100 **ENTER** **ENTER** 99 $-$ \longrightarrow 1.00 (capital gain)

.25 \times \longrightarrow 0.25 (capital gains tax)


$-$ **D** \longrightarrow 99.75 (net proceeds from bond redemption)

(The price and remaining coupon periods have been retained from the previous calculation.)

C \longrightarrow 3.06 (% after tax yield)

Reference(s)

User Instructions

BOND PRICE AND YIELD						
1	PER	CR	<>YLD	RV	<>PRICE	2
						

[illegible]

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	÷	-24	
002	CF3	16 22 03		058	-	-45	
003	CHS	-22		059	ST-6	35-45 06	
004	ST00	35 00	-PER→R ₀	060	ABS	16 31	Has limit been reached?
005	CHS	-22		061	EEX	-23	
006	RTN	24		062	CHS	-22	
007	*LBLB	21 12		063	6	06	
008	EEX	-23		064	X<Y?	16-35	
009	2	02		065	GT01	22 01	
010	ST03	35 03	100→R ₃	066	F2?	16 23 02	
011	R↓	-31		067	GT02	22 02	
012	ST01	35 01	CR→R ₁	068	RCL6	36 06	
013	RTN	24		069	GT03	22 03	
014	*LBLD	21 14		070	*LBL2	21 02	
015	CF3	16 22 03	RV→R ₃	071	RCL5	36 05	
016	ST03	35 03		072	1	01	Modify price for next set of iterations.
017	RTN	24		073	RCL0	36 00	
018	*LBLC	21 13		074	FRC	16 44	
019	F3?	16 23 03	YLD→R ₂	075	+	-55	
020	GT05	22 05		076	LSTX	16-63	
021	RCL0	36 00		077	x	-35	
022	ABS	16 31		078	4	04	
023	1	01		079	÷	-24	
024	X>Y?	16-34	1>PER?	080	RCL1	36 01	
025	GT00	22 00		081	x	-35	
026	SF2	16 21 02		082	RCL6	36 06	
027	RCL1	36 01	Calculate initial guess	083	x	-35	
028	2	02		084	-	-45	
029	÷	-24		085	ST05	35 05	
030	RCL4	36 04		086	GT01	22 01	
031	ST05	35 05		087	*LBL0	21 00	
032	÷	-24		088	RCL3	36 03	Calculate yield if less than 1 coupon period remaining
033	ST06	35 06		089	RCL1	36 01	
034	*LBL1	21 01	Calculate f(y)	090	2	02	
035	1	01		091	÷	-24	
036	RCL3	36 03		092	+	-55	
037	RCL5	36 05		093	LSTX	16-63	
038	÷	-24		094	RCL0	36 00	
039	1	01		095	1	01	
040	RCL6	36 06		096	+	-55	
041	+	-55		097	x	-35	
042	RCL0	36 00		098	RCL4	36 04	
043	Y*	31		099	+	-55	
044	ST08	35 08		100	÷	-24	
045	x	-35		101	1	01	
046	-	-45		102	-	-45	
047	RCL6	36 06		103	RCL0	36 00	
048	x	-35		104	CHS	-22	
049	1	01		105	÷	-24	
050	RCL8	36 08		106	*LBL3	21 03	
051	-	-45		107	2	02	
052	÷	-24		108	0	00	
053	RCL1	36 01		109	0	00	
054	2	02		110	x	-35	
055	÷	-24		111	ST02	35 02	
056	RCL5	36 05		112	RTN	24	Display answer if second time through

0	1	2	3	4	5	6	7	8	9
-PER	CR	YLD	RV	PRICE	Used	Used	DT ₁	Acc. Int.	
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

97 Program Listing II

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	*LBL5	21 05		169	+	-55	
114	ST02	35 02		170	RCL5	36 05	
115	RTN	24		171	1	01	
116	*LBL5	21 15		172	-	-45	
117	F3?	16 23 03	Price→R ₄ ,R ₅	173	RCL0	36 00	
118	GT06	22 06		174	x	-35	
119	RCL2	36 02		175	CHS	-22	
120	2	02		176	1	01	
121	0	00	Calculate J	177	+	-55	
122	0	00		178	÷	-24	
123	÷	-24		179	RCL1	36 01	
124	1	01		180	2	02	
125	+	-55		181	÷	-24	
126	ST05	35 05		182	RCL6	36 06	
127	1	01		183	x	-35	
128	RCL0	36 00		184	ST08	35 08	
129	FRC	16 44		185	-	-45	
130	+	-55		186	RTN	24	
131	ST06	35 06		187	*LBL6	21 06	
132	RCL0	36 00		188	ST04	35 04	
133	CHS	-22		189	ST05	35 05	
134	1	01	Is PER<1?	190	RTN	24	
135	X>Y?	16-34					
136	GT04	22 04					
137	RCL5	36 05					
138	RCL6	36 06					
139	Y*	31					
140	RCL5	36 05	Calculate price for				
141	RCL0	36 00	long term bonds.				
142	Y*	31					
143	ST05	35 05					
144	-	-45		200			
145	RCL1	36 01					
146	x	-35					
147	RCL2	36 02					
148	÷	-24					
149	EEX	-23					
150	2	02					
151	x	-35					
152	RCL6	36 06					
153	2	02		210			
154	÷	-24					
155	RCL1	36 01					
156	x	-35					
157	ST08	35 08					
158	-	-45					
159	RCL5	36 05					
160	RCL3	36 03					
161	x	-35					
162	+	-55					
163	RTN	24		220			
164	*LBL4	21 04					
165	RCL1	36 01	Calculate price for				
166	2	02	short term bonds.				
167	÷	-24					
168	RCL3	36 03					

LABELS					FLAGS	SET STATUS		
A PER	B CR	C YLD	D RV	E Price	0	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF		
0 Used	1 Used	2 Used	3 Used	4 Used	2 Used	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
5 Used	6 Used	7	8	9	3 Digit?	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>

Program Description I

Program Title **DAYS BETWEEN DATES**

Contributor's Name **HEWLETT-PACKARD COMPANY**

Address **Corvallis Division**
 1000 N.E. Circle Boulevard

City **Corvallis, OR 97330**

State

Zip Code

Program Description, Equations, Variables

This program calculates the number of days between two dates on an actual or 30/360 basis (30 day month, 360 day year). When the actual number of days is desired, the two dates must occur between January 1, 1901 and December 31, 2099. There is no limitation for the 30/360 basis.

The earlier date is keyed in for DT 1 (**A**), the later date is keyed in for DT 2 (**B**). The calculation is performed by pressing **C** for the actual number of days or by pressing **D** for the number of days on a 30/360 basis. Both input dates are retained, so that only a changed date must be keyed in for a new calculation.

The date format for input is MM.DDYYYY (March 3, 1976 is keyed in as 3.031976). The program does not check input data. Thus, if an improper format or an invalid date (i.e., February 30) is keyed in, erroneous answers will result.

An important feature of this program is that it is designed to be used in conjunction with BOND PRICE AND YIELD (BD-15). When the settlement date is entered for DT 1 and the redemption date (maturity date, call date, etc.) is entered for DT 2, pressing **C** or **D** also causes the number of remaining semiannual coupon periods to be stored for use by the bond program. The number of semiannual coupon periods on an actual day basis is determined by subtracting the number of leap days (February 29 of a leap year) from the actual number of days (the displayed value) and dividing this by 182.5 (days per semiannual period). On a 30/360 basis the number of semiannual coupon periods is found by dividing the number of days (displayed value) by 180 days per semiannual period).

In addition, the settlement date is retained throughout the bond calculations. Therefore, on return to this program, it is only necessary to key in a new DT 1 if the settlement date is different.

Operating Limits and Warnings

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Program Description II

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Sketch(es)**Sample Problem(s)**

14. Days Between Dates

Actual

$$\text{DAYS} = f(\text{DT2}) - f(\text{DT1})$$

where

$$f(\text{DT}) = 365(\text{yyyy}) + 31(\text{mm} - 1) + \text{dd} + \text{Int}(z/4) - x$$

and

for $\text{mm} \leq 2$

$$x = 0$$

$$z = (\text{yyyy}) - 1$$

for $\text{mm} > 2$

$$x = \text{Int}(.4 \text{ mm} + 2.3)$$

$$z = (\text{yyyy})$$

Int = Integer portion

Solution(s)

30/360 Basis

$$\text{DAYS} = f(\text{DT2}) - f(\text{DT1})$$

$$f(\text{DT}) = 360(\text{yyyy}) + 30 \text{ mm} + z$$

for $f(\text{DT1})$ if $\text{dd}_1 = 31$ then $z = 30$ if $\text{dd}_1 \neq 31$ then $z = \text{dd}_1$ for $f(\text{DT2})$ if $\text{dd}_2 = 31$ and $\text{dd}_1 = 30$ or 31 then $z = 30$ if $\text{dd}_2 = 31$ and $\text{dd}_1 < 30$ then $z = \text{dd}_2$ if $\text{dd}_2 < 31$ then $z = \text{dd}_2$ **Reference(s)**

Program Description II

Sketch(es)

Sample Problem(s)

Example 1:

Calculate the actual number of days between June 24, 1974 and December 5, 1985.

Keystrokes:

6.241974 **A** 12.051985 **B C** →

Outputs:

4182.00 (actual)

Example 2:

Having just performed the above calculation, now calculate the actual number of days between June 24, 1974 and March 21, 1990.

Keystrokes:

3.211990 **B C** →

Outputs:

5749.00 (actual)

Example 3:

Calculate the number of days, on both an actual and 30/360 basis, between May 1, 1975 and November 1, 1980.

Keystrokes:

5.011975 **A** 11.011980 **B C** →
D →

Outputs:

2011.00 (actual)
 1980.00 (30/360)

Solution(s)

Reference(s)

User Instructions

[illegible]

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS			
001	*LBLA	21 11	DT ₁ →R ₇	057	CLX	-51	Compute days since 0 AD neglecting 400s and 100s.			
002	ST07	35 07		058	RCL5	36 05				
003	RTN	24		059	+	-55				
004	*LBLB	21 12	DT ₂ →R ₁	060	RCL3	36 03		Control & storage.		
005	ST01	35 01		061	1	01				
006	RTN	24		062	-	-45				
007	*LBLC	21 13	Control & storage.	063	3	03			Control & storage.	
008	RCL7	36 07		064	1	01				
009	GSBE	23 15		065	x	-35				
010	ST02	35 02		066	+	-55				
011	LSTX	16-63		067	RCL6	36 06				
012	ST00	35 00		068	4	04				
013	RCL1	36 01		069	÷	-24				
014	GSBE	23 15		070	INT	16 34				
015	LSTX	16-63		071	XZY	-41				
016	ST-0	35-45 00		072	+	-55				
017	CLX	-51		073	RTN	24				
018	RCL2	36 02		074	*LBLD	21 14				
019	-	-45		075	3	03				
020	RCL4	36 04	076	0	00					
021	2	02	077	ST02	35 02	Sum years & months.				
022	÷	-24	078	RCL7	36 07					
023	ST=0	35-24 00	079	GSBe	23 16 15					
024	XZY	-41	080	ST00	35 00					
025	RTN	24	081	RCL1	36 01					
026	*LBL E	21 15	082	GSBe	23 16 15					
027	GSB4	23 04	083	RCL0	36 00					
028	ST06	35 06	084	-	-45					
029	3	03	085	ST00	35 00					
030	6	06	086	RCL4	36 04					
031	5	05	087	CHS	-22					
032	ST04	35 04	088	2	02					
033	x	-35	089	÷	-24					
034	2	02	090	ST=0	35-24 00	Are days equal to 31?				
035	RCL3	36 03	091	R↓	-31					
036	XZY?	16-34	092	RTN	24					
037	GT00	22 00	093	*LBL E	21 16 15					
038	x	-35	094	GSB4	23 04					
039	CLX	-51	095	3	03					
040	RCL6	36 06	096	6	06					
041	1	01	097	0	00					
042	-	-45	098	ST04	35 04					
043	ST06	35 06	099	x	-35					
044	GT01	22 01	100	RCL3	36 03					
045	*LBL0	21 00	101	3	03					
046	.	-62	102	0	00					
047	4	04	103	x	-35					
048	x	-35	104	+	-55					
049	.	-62	105	RCL5	36 05					
050	3	03	106	3	03					
051	+	-55	107	1	01					
052	+	-55	108	X=YZ?	16-33					
053	INT	16 34	109	GT02	22 02					
054	-	-45	110	R↓	-31					
055	RCL6	36 06	111	ST02	35 02					
056	*LBL1	21 01	112	+	-55	No, add & return.				
REGISERS										
0	PER	1 DT ₂	2 Used	3 M	4 365/360	5 D	6 y,z	7 DT ₁	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9	
A	B	C	D	E	I					

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[illegible]

Program Description I

Program Title	Bond Yield to Maturity		
Contributor's Name	Ralston W. Barnard		
Address	2811 Ridgecrest Drive S.E.		
City	Albuquerque	State	New Mexico
		Zip Code	87108

Program Description, Equations, Variables This program calculates yield to maturity, current yield, and accrued interest for semiannual coupon bonds using the 360 day calendar. Inputs are settlement date, maturity date, annual coupon, and price. All time periods, from less than 6 months to 99+ years, are valid.

Dates are entered in the format MM.DDYY, bond coupons in percent, and bond prices as percents of par (100), i.e., a bond selling for \$950.00 is entered as 95. Accrued interest is in dollars, cents and tenths to ensure accurate determinations for multiple bond transactions.

Equations used are: for a bond with more than 6 mos. to maturity,

$$\text{price} = \left\{ 100/(1+i)^N + (C/2i)[(1+i)^i - (1+i)^{-N}] - (C/2i) \right\}$$
, where i = interest rate,
 C = Coupon, N = Number of semiannual periods from settlement date to maturity date, $i = 1 - \text{frac}(N)$

The secant method is used to solve for i . The yield to maturity, expressed as an annual percent, is given by $Y-200i$.

For a bond with less than 6 months to maturity, $i = \left\{ (100+C/2)/(\text{price}-c/2j)-1 \right\} \frac{1}{N}$.

Current yield = $C/\text{price} \times 100$. Accrued interest = $c/2j \times 10$.

Operating Limits and Warnings Program will not correctly determine time periods for maturity dates more than 100 years away. If greater accuracy is desired, change step 97 from DSP 3 to DSP 4. This will increase the time to calculate YTM, however.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

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Sketch(es)

Sample Problem(s) 1. For a settlement date of February 10, 1977, which of the following bonds provides a greater yield to maturity?

5's, due 6/1/1987 priced at 80 or

8.75's, due 5/15/1989 priced at 108.

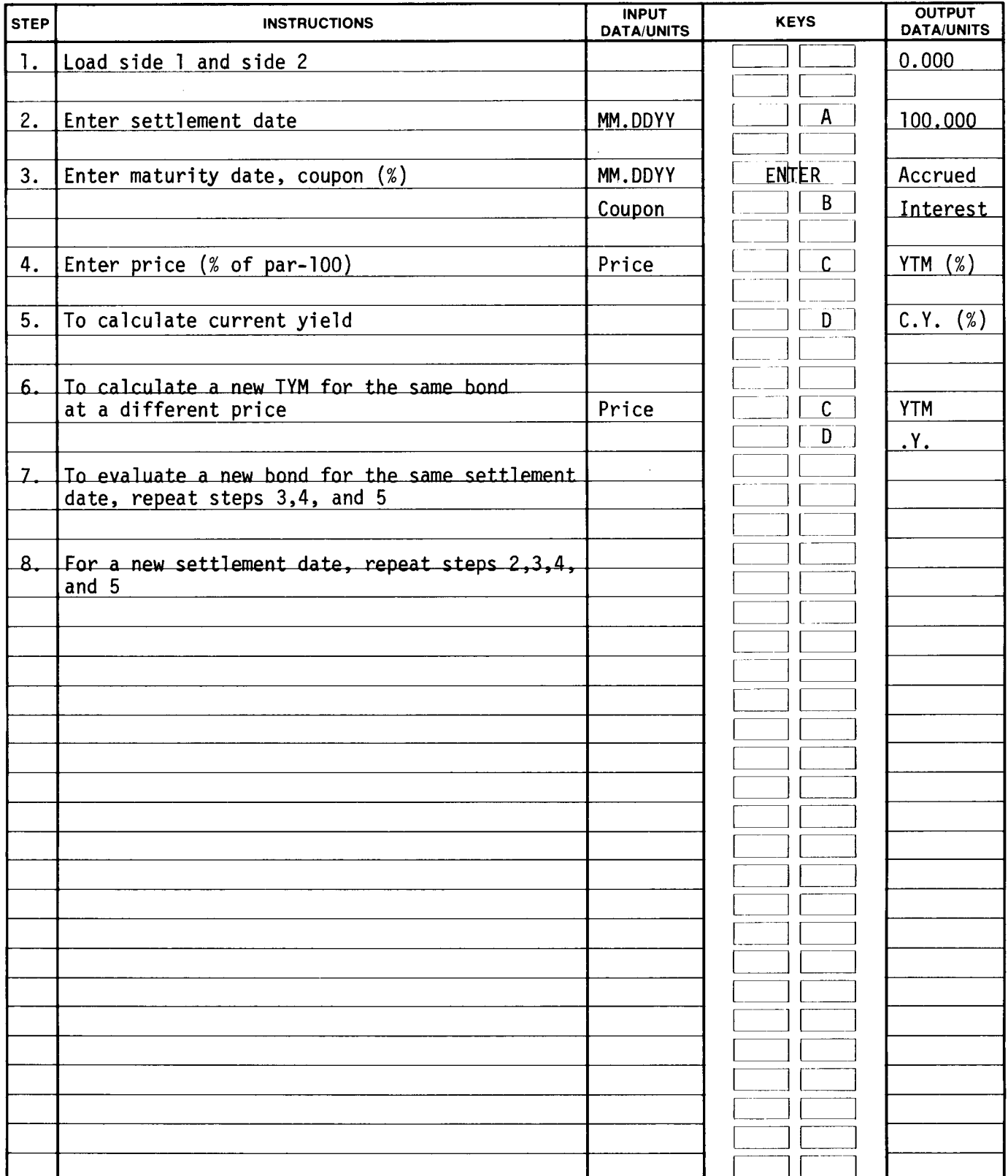
What are the accrued interest values for each?

2. For a settlement date of May 6, 1977, what are the YTM's and CY's for the first bond listed above, if its prices are 75, 82, 87.024?

Solution(s)

1) Keystrokes	2.1077 [A]	----->	100.000
	6.0187 [ENT] 5[B]	----->	9.583 (Accrued Int)
	80 [C]	----->	7.866 (Yield to Maturity)*
	[D]	----->	6.250 (Current Yield)
	5.1589 [ENT] 8.75 [B]	-->	20.660 (Accrued Int.)
	108 [C]	----->	7.726 (Yield to Mat.)
	[D]	----->	8.102 (Current Yield)
2)	3.0677 [A]	---->	100.000, 6.0187 [ENT] 5[B]
		---->	13.194, 75 [C]
		----->	8.744,
	[D]	---->	6.667, 82 [C]
		---->	7.555, [D]
		---->	6.098, 87.024 [C]
		---->	6.777, [D]
		---->	5.746

Reference(s) Homer, Sidney, and Martin Lebowitz, "Inside the Yield Book", Appendix A, Prentice-Hall, 1972.



97 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS		
113	÷	-24	Initial guess for i	169	Y*	31			
114	GSB8	23 08		170	X*Y	-41			
115	RCLC	36 13		171	STO4	35 04			
116	GT07	22 07		172	-	-45			
117	*LBL6	21 06		173	RCL6	36 06			
118	RCL3	36 03		174	2	02			
119	GSB9	23 09		175	÷	-24			
120	STOC	35 13		176	RCL3	36 03			
121	*LBL7	21 07		177	÷	-24			
122	RCL9	36 09		178	X	-35			
123	RCL3	36 03	Iteration (secant method of root finding)	179	RCL5	36 15			
124	STO9	35 09		180	-	-45			
125	-	-45		181	RCLD	36 14			
126	RCLA	36 11		182	RCL4	36 04			
127	RCLC	36 13		183	X	-35			
128	STOA	35 11		184	+	-55			
129	-	-45		185	RCL7	36 07			
130	÷	-24		186	X*Y	-41			
131	X	-35		187	-	-45			
132	ST-3	35-45 03		188	RTN	24		Calculates YTM from i	
133	RCL3	36 03	189	*LBL5	21 05				
134	÷	-24	190	RCLD	36 14				
135	RND	16 24	191	X	-35				
136	X#0?	16-42	192	2	02				
137	GT06	22 06	193	X	-35	Calculates i for M ≤ 6 mos			
138	RCL3	36 03	194	RTN	24				
139	GT05	22 05	195	*LBL4	21 04				
140	*LBL8	21 08	196	RCL6	36 06				
141	RCLD	36 14	197	2	02				
142	1/X	52	198	÷	-24		Calculates current yield		
143	2	55	199	+	-55				
144	STOB	35 12	200	X*Y	-41				
145	2	02	201	RCL5	36 15				
146	÷	-24	202	+	-55				
147	-	-45	203	÷	-24				
148	STO9	35 09	204	1	01				
149	STO3	35 03	205	-	-45				
150	GSB9	23 09	206	RCL5	36 05				
151	STOA	35 11	207	÷	-24	Evaluates Price -			
152	RCL9	36 09	208	GT05	22 05				
153	RCLB	36 12	209	*LBLD	21 14				
154	+	-55	210	RCL6	36 06				
155	STO3	35 03	211	RCL7	36 07				
156	GSB9	23 09	212	÷	-24				
157	STOC	35 13	213	RCLD	36 14				
158	RTN	24	214	X	-35				
159	*LBL9	21 09	215	DSP2	-63 02				
160	STO3	35 03	216	RTN	24				
161	1	01	217	R/S	51				
162	+	-55							
163	STO4	35 04							
164	RCL5	36 05	220						
165	Y*	31							
166	1/X	52							
167	RCL4	36 04							
168	RCL8	36 08							
LABELS				FLAGS		SET STATUS			
A	Sett. date	B Mat.,Dt.,Cou	C Price	D → Curr.Yld	E	N ≤ 6 mos	FLAGS	TRIG	DISP
a	b	c	d	e		1	ON OFF	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
0	Stores dates	1 N Cal	2 N Cal	3 N Cal	4 i, N<6Mo	2	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5	i → YTM	6 Iterate	7 Secant	8 Δ i Cal	9 f(i) Cal	3	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
							2 <input type="checkbox"/> <input checked="" type="checkbox"/>		n
							3 <input type="checkbox"/> <input checked="" type="checkbox"/>		

Program Description I

Program Title INTEREST AT MATURITY/DISCOUNTED SECURITIES

Contributor's Name HEWLETT-PACKARD COMPANY

Address Corvallis Division
1000 N.E. Circle Boulevard

City Corvallis, OR 97330

State

Zip Code

Program Description, Equations, Variables

The first part of this program calculates the price or yield of interest at maturity securities. The necessary inputs are the days from issue to maturity (DIM), the days from settlement to maturity (DSM), the calendar basis (360 or 365), the coupon rate (CR), and either the price (to calculate yield) or the yield (to calculate price).

The second part of the program calculates the price or yield of discounted securities such as U.S. Treasury Bills. The required inputs are the number of days from settlement to maturity and one of the following: discount rate (to calculate price and/or yield), yield (to calculate price) or price (to calculate yield).

Operating Limits and Warnings

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Program Description II

Sketch(es)

Sample Problem(s)

16. Interest at Maturity/Discounted Securities

Price (given yield) =

$$\frac{\left(\frac{\text{DIM}}{B} \times \frac{\text{CR}}{100} + 1 \right)}{\left(\frac{\text{DSM}}{B} \times \frac{\text{YLD}}{100} + 1 \right)} - \left(\frac{\text{DIM} - \text{DSM}}{B} \times \frac{\text{CR}}{100} \right)$$

Yield (given price) =

$$\left[\frac{\left(\frac{\text{DIM}}{B} \times \text{CR} + 100 \right)}{\frac{\text{DIM} - \text{DSM}}{B} \times \text{CR} + \text{PRICE}} - 1 \right] \left(\frac{B}{\text{DSM}} \right) (100)$$

$$\text{Price (given yield)} = \frac{100}{1 + \frac{\text{YLD}}{100} \times \frac{\text{DSM}}{360}}$$

Solution(s)

$$\text{YLD (given price)} = \left(\frac{100 - \text{PRICE}}{\text{PRICE}} \times \frac{360}{\text{DSM}} \right) \times 100$$

$$\text{Price (given discount rate)} = 100 - \left(\frac{\text{DR} \times \text{DSM}}{360} \right)$$

Reference(s)

Program Description II

Sketch(es)

Sample Problem(s)

Example 1:

Find the yield of the following interest at maturity security:

DIM = 220
DSM = 117
Basis = 360
CR = 5%
Price = 99.531250

Keystrokes:

220 **ENTER** 117 **A**
360 **B** 5 **C**
99.531250 **E** **D** →

Outputs:

6.38 (% yield)

Example 2:

Having just performed the above calculation, what is the price of this interest at maturity security to give a yield of 7%?

Keystrokes:

7 **D** **E** →

Output:

99.33 (price)

Solution(s)

Example 3:

Given the number of days from settlement to maturity and the discount rate of the following security, find the price and yield.

DSM = 81
DR = 5.60

Keystrokes:

81 **f** **A** 5.6 **f** **B**
f **E** →
f **D** →

Outputs:

98.74 (price)
5.67 (% yield)

Example 4:

Find the yield of the following discounted security:

DSM = 307
Price = 96.27

Keystrokes:

307 **f** **A** 96.27 **f** **E**
f **D** →

Outputs:

4.54 (% yield)

Reference(s)

[illegible]

97 Program Listing I

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	RCLB	36 08	
002	STOA	35 11	DSM→R _A	058	÷	-24	
003	XZY	-41		059	1	01	
004	STO9	35 09	DIM→R ₉	060	+	-55	
005	XZY	-41		061	RCLA	36 11	
006	RTN	24	-----	062	RCLB	36 12	
007	*LBLB	21 12	Basis→R _B	063	÷	-24	
008	STOB	35 12		064	RCLD	36 14	
009	EEX	-23	100→R ₈	065	x	-35	
010	2	02		066	RCLB	36 08	
011	STOB	35 08		067	÷	-24	
012	XZY	-41		068	1	01	
013	RTN	24	-----	069	+	-55	
014	*LBLC	21 13	CR→R _C	070	÷	-24	
015	STOC	35 13		071	RCL9	36 09	
016	RTN	24	-----	072	RCLA	36 11	
017	*LBLD	21 14		073	-	-45	
018	STOD	35 14	YLD→R _D	074	RCLB	36 12	
019	F3? 16 23 03			075	÷	-24	
020	RTN	24	-----	076	RCLC	36 13	
021	RCL9	36 09	Calc. Yield	077	x	-35	
022	RCLB	36 12		078	RCLB	36 08	
023	÷	-24		079	÷	-24	
024	RCLC	36 13		080	-	-45	
025	x	-35		081	EEX	-23	
026	RCLB	36 08		082	2	02	Store price in R _E .
027	+	-55		083	x	-35	
028	RCL9	36 09		084	STOE	35 15	
029	RCLA	36 11		085	RTN	24	
030	-	-45		086	*LBLA 21 16 11		DSM→R _A
031	RCLB	36 12		087	STOA	35 11	
032	÷	-24		088	CF1 16 22 01		
033	RCLC	36 13		089	RTN	24	
034	x	-35		090	*LBLB 21 16 12		
035	RCLC	36 15		091	SF1 16 21 01		
036	+	-55		092	STOI	35 46	
037	÷	-24		093	RCLA	36 11	Calc. price given
038	1	01		094	x	-35	DR
039	-	-45		095	3	03	
040	RCLB	36 12		096	6	06	
041	x	-35		097	0	00	
042	RCLA	36 11		098	÷	-24	
043	÷	-24		099	EEX	-23	
044	RCLB	36 08		100	2	02	
045	x	-35		101	XZY	-41	
046	STOD	35 14	Store yield in R _D .	102	-	-45	
047	RTN	24	-----	103	STO7	35 07	
048	*LBLC	21 15		104	GSCC 23 16 13		
049	STOE	35 15		105	RCLI	36 46	
050	F3? 16 23 03		Price→R _E	106	RTN	24	
051	RTN	24	-----	107	*LBLC 21 16 13		Calc. yield given
052	RCL9	36 09		108	EEX	-23	price
053	RCLB	36 12		109	2	02	
054	÷	-24		110	XZY	-41	
055	RCLC	36 13		111	-	-45	
056	x	-35		112	LSTX	16-63	

REGISTERS

REGISTERS										
0	1	2	3	4	5	6	7 Used	8 100	9 DIM	
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9	
A DSM		B 360/365		C CR(%)		D YLD		E PRICE		I DISC RATE

[illegible]

Program Description I

Program Title U.S. Treasury Bill Valuation
Contributor's Name Howard B. Kutner, CPA
Address 370 Lexington Avenue - Rm 909
City New York **State** New York **Zip Code** 10017

Program Description, Equations, Variables

Calculates price per \$100 and dollar value of U.S. Treasury Bills using as input

- a) Face Amount b) Quote date c) Maturity date
 d) Quotation - as a percentage yield - bid and ask

As a subroutine the program also calculates actual days between and/or day of the year for any date.

Program determines value based on mean between bid and ask quotes. To find value based on either bid or ask enter that quotation for both bid and ask

$$\text{Price per \$100} = 100 - \left(\frac{\text{bid task}}{2} \right) \left(\frac{\text{days to maturity}}{360} \right)$$

$$\text{Day of Year} = 31 (\text{mo}-1) + (\text{day of mo}) - \text{INT} [0.4(\text{mo.}) + 2.3]$$

For Jan + Feb last term is ignored

Operating Limits and Warnings No provision is made for leap years. To compensate it is only necessary to advance maturity date by one day before entering it when the time span includes Feb 29.

Although the year is not entered as part of the date the program recognizes when a time period spans Jan 1 and determines actual period.

Program limits days to maturity to a maximum of 360 in accordance with standard practice.

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[illegible]

Sample Problem(s)					
	<u>Face Amt</u>	<u>Due</u>	<u>Bid</u>	<u>Ask</u>	<u>Quotation Date</u>
a)	100,000	5/15	5.75	5.5	2/10
b)	50,000	3/20	5.5	5.25	11/15
c)	70,000	1/15	5.25	5.0	12/10

<u>Solution(s)</u>	<u>Day of the Year</u>		<u>Days Between Dates</u>	<u>Price per</u>	<u>Total</u>
	<u>Quote Date</u>	<u>Due Date</u>		<u>\$100</u>	<u>Value</u>
a)	41	135	94	98.53	\$98,531.25
b)	319	79	125	98.13	\$49,066.84
c)	344	15	36	99.49	\$69,641.25

Reference(s) _____

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[illegible]

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	-	-45	
002	GSBe	23 16 15	Quote date	058	3	03	
003	ST01	35 01	day of year	059	1	01	
004	RTN	24		060	x	-35	
005	*LBLB	21 12	Maturity date	061	+	-55	
006	GSBe	23 16 15	day of year	062	RTN	24	
007	RCL1	36 01	days between dates	063	*LBLC	21 13	enter quotes and
008	-	-45		064	R/S	51	determine mean
009	0	00		065	*LBLC	21 13	
010	ST01	35 01		066	+	-55	
011	X≤Y?	16-35	if days between dates	067	2	02	
012	GT03	22 03	is negative, life	068	=	-24	
013	CLX	-51	spans year-end	069	x	-35	
014	3	03	clear zero and	070	3	03	Determine
015	6	06	add 365 To get	071	6	06	equivalent
016	5	05	Five days between dates	072	0	00	price
017	+	-55		073	=	-24	
018	ENT↑	-21		074	EEX	-23	
019	*LBL3	21 03		075	2	02	
020	CLX	-51		076	-	-45	
021	3	03		077	CHS	-22	
022	6	06		078	RTN	24	
023	0	00	if days between dates	079	*LBLD	21 14	recover 100
024	X>Y?	16-34	is less than 360	080	LSTX	16-63	convert to decimal
025	R↓	-31	display days - else	081	=	-24	obtain Value
026	RTN	24	display 360	082	x	-35	
027	*LBLc	21 16 15		083	RTN	24	
028	ENT↑	-21					
029	INT	16 34	store month				
030	ST02	35 02					
031	-	-45					
032	EEX	-23					
033	2	02					
034	x	-35	store days of month				
035	ST03	35 03					
036	2	02					
037	RCL2	36 02	if month is later than Feb				
038	X>Y?	16-34	go to adjust routine				
039	GT01	22 01					
040	0	00	clear and lift register				
041	GT02	22 02					
042	*LBL1	21 01					
043	.	-62	Adjust routine				
044	4	04	for months later				
045	x	-35	than Feb				
046	.	-62					
047	3	03					
048	+	-55					
049	+	-55					
050	INT	16 34					
051	CHS	-22					
052	*LBL2	21 02	Determine				
053	RCL3	36 03	Day of year				
054	+	-55					
055	RCL2	36 02					
056	1	01					

SET STATUS			
FLAGS	TRIG	DISP	
ON OFF		DEG	FIX
0 <input type="checkbox"/> <input checked="" type="checkbox"/>		GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
1 <input type="checkbox"/> <input checked="" type="checkbox"/>		RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
2 <input type="checkbox"/> <input checked="" type="checkbox"/>			n <input checked="" type="checkbox"/>
3 <input type="checkbox"/> <input checked="" type="checkbox"/>			

REGISTERS									
0	Quote day of year	2 MONTH	3 Day	4	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

Program Description I

Program Title Convertible Security Analysis

Contributor's Name Hewlett-Packard

Address 1000 Circle Blvd.

City Corvallis

State Oregon

Zip Code 97330

Program Description, Equations, Variables

Given a convertible security (bond or preferred stock) Price (Pb), coupon or dividend rate (i) and the underlying common stock's price (Pc), annual dividend (D) and shares per convertible (C), computes:

$$\text{Indicated Convertible Price} = (C) (Pc)$$

$$\text{Anticipated Stock Price} = Pb/C$$

$$\text{Conversion Parity Price (Bonds only)} = 1000/C$$

$$\text{Conversion Premium Percentage} = \frac{Pb - ((C) (Pc))}{Pb}$$

$$\text{Current Convertible Yield} = i/Pb$$

$$\text{Incremental Payout Return} = \frac{(C) (D) - (i) (Pb)}{Pb - ((C) (Pc))}$$

Operating Limits and Warnings Convertible must pay interest or dividend.

Program assumes all bonds are \$1000 units.

This program has been verified only with respect to the numerical example given in *Program Description II*. User accepts and uses this program material AT HIS OWN RISK, in reliance solely upon his own inspection of the program material and without reliance upon any representation or description concerning the program material.

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Program Description II

Sketch(es)

N O N E

Sample Problem(s)

I. Bond Price = 50; Coupon Rate = 4.5%

Stock Price = 20; Annual Dividend = \$1.00

Shares per Bond = 20

II. Preferred Stock Price - 60 $\frac{3}{8}$; Dividend = \$5.25

Common Stock = 28 $\frac{1}{2}$; Annual Dividend = \$0.00

Shares Per Bond = 2.03

Solution(s) I. E 50 A 4.5 R/S 20 B 1 R/S 20 C 40.00 Ind. Conv. Price
 R/S 25.00 R/S 50.00 R/S 20.00 R/S 9.00 R/S 25
 Antic. Stk.P. Conv. Pr. Conv. Prem. Curr. Yld. Incr. Payout
 R/S 0.00
 Ready for next case, hit E if another bond.

II.

60.375 A 5.25 R/S 28.5 B 0 R/S 2.03 C 57.86 Antic. Conv. Price
 R/S 29.74 R/S 4.17 R/S 8.70 R/S 208.33 R/S 0.00
 Antic. Com.Pr. Cnv. Prem. Curr. Yld. Incr. Payout Ready for next

Reference(s) This program is a one for one translation of the 65 user contributed program #1399 written by Morris A. Nunes.

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[illegible]

LABELS					FLAGS	SET STATUS							
A	Pb,i	B	Pc,D	C	D	Subroute	E	Bond	0	FLAGS		TRIG	DISP
a		b		c	d		e		1	Bond	ON OFF		
0		1		2	3	Skip par	4		2		0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
											1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
											2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
5		6		7	8		9		3		3 <input type="checkbox"/> <input type="checkbox"/>		n_____

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS		
001	*LBLA	21 11	Enter Pb	056	RCL4	36 04	Calculate incremental payout return and display as a percentage		
002	ENT↑	-21		057	RCL5	36 05			
003	ENT↑	-21	If bond, mult.by 10 to reflect \$ value	058	X	-35			
004	F1? 16 23 01			059	-	-45			
005	G8B6	23 06	Display Ph Enter i	060	RCL1	36 01			
006	ST01	35 01		061	RCL6	36 06			
007	R↓	-31	If bond, mult. by 10 to reflect \$ value	062	-	-45			
008	R/S	51		063	÷	-24			
009	ENT↑	-21	Display i	064	1	01			
010	ENT↑	-21		065	0	00			
011	F1? 16 23 01		Enter Pc	066	0	00	Set program for preferred stock clear stack to show ready for next case		
012	G8B6	23 06		067	X	-35			
013	ST02	35 02	Enter D	068	R/S	51			
014	R↓	-31		069	CF1 16 22 01				
015	RTN	24	Enter shs/convert	070	CLX	-51			
016	*LBLB	21 12		071	ENT↑	-21			
017	ST03	35 03	Calculate indicate convertible price & save	072	ENT↑	-21			
018	R/S	51		073	ENT↑	-21			
019	ST04	35 04	If bond, 10% for Market price	074	RTN	24			
020	RTN	24		075	*LBLE	21 15	Set program for analysis of a bond case		
021	*LBLC	21 13	Display/go	076	SF1 16 21 01				
022	ST05	35 05		077	RTN	24			
023	RCL3	36 03	Calculate anticipate common stock price	078	*LBL6	21 06			
024	X	-35		079	1	01			
025	ST06	35 06	Test for Pfd. Stk. If so skip	080	0	00			
026	F1? 16 23 01			081	X	-35			
027	G8B7	23 07	Calculate conversion premium percentage and display as a percentage	082	RTN	24			
028	R/S	51		083	*LBL7	21 07			
029	RCL1	36 01		084	1	01			
030	RCL5	36 05		085	0	00			
031	÷	-24		086	÷	-24			
032	R/S	51		087	RTN	24			
033	F1? 16 23 01			088	*LBL8	21 08			
034	G8B8	23 08		089	1	01			
035	R/S	51		090	EEX	-23	Produce \$1000 par value and calculate conversion parity principle		
036	*LBL3	21 03	Calculate current convertible yield and display as a percentage	091	3	03			
037	RCL1	36 01		092	RCL5	36 05			
038	RCL6	36 06		093	÷	-24			
039	-	-45		094	RTN	24			
040	RCL1	36 01		095	R/S	51			
041	÷	-24							
042	1	01							
043	0	00		100					
044	0	00							
045	X	-35							
046	R/S	51							
047	RCL2	36 02							
048	RCL1	36 01							
049	÷	-24							
050	1	01							
051	0	00							
052	0	00							
053	X	-35							
054	R/S	51	110						
055	RCL2	36 02							
REGISTERS									
0	1 Pb	2 i	3 Pc	4 D	5 C	6 Indic. conv Price	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

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