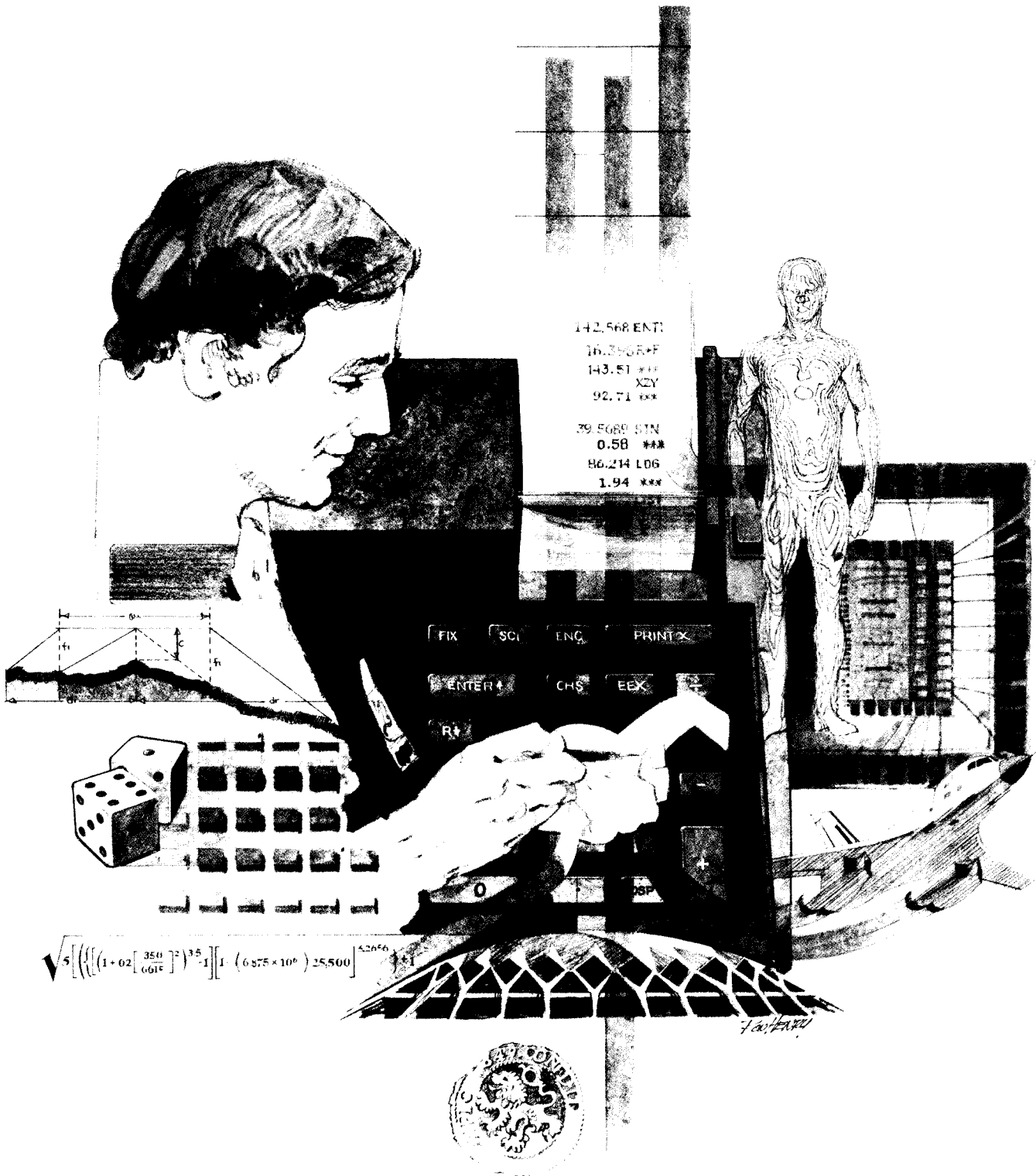


HEWLETT-PACKARD

HP-67/HP-97

Users' Library Solutions
Home Management



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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Estimates the required calories/day for an individual to maintain, gain, or lose weight based on activity levels and estimated basal metabolism.	

Program Description I

1

Program Title Income Tax Planning - I

Contributor's Name Richard D. Rutter

Address Arthur Young & Co. 780 N. Water St.

City Milwaukee **State** Wi **Zip Code** 53202

Program Description, Equations, Variables

This program calculates regular, alternative, and average income taxes for individuals using IRS forms 1040, schedule D, and schedule G. Although the program was originally written prior to the Tax Reduction and Simplification Act of 1977 (which effects 1977 returns) the changes in the law have only had a minor effect on the program results. The tax amount computed for ordinary income differs slightly from that arrived at through the use of Table A through D (adjusted incomes less than \$20,000 (\$40,000 for joint returns)) but the differences are well within the tolerances required for tax planning. For filing purposes, the new tables (A through D) should be used for calculating ordinary income wherever specified by the IRS. If schedule x, y, and z are specified for tax computation, however, the program answers are exact.

The following mnemonics are in the accompanying documentation

OTI = Form 1040 Line 34

- (exemptions x 750)

- 3200 Joint

or

1600 Separate

or

2200 Single

-(.5 x C G)

C G = Capital Gains (Schedule D, line 13)

4 yr TI = Total Taxable income for preceding 4 years (see next page)

Computed tax amounts do not include the income tax credit. For the exact net tax amount, use the program Tax Computation Schedule and the tax on ordinary income generated by this program.

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

Contributor's Name

Address

City

State

Zip Code

Program Description, Equations, Variables

4 Yr TI - The increase in personal exemption for the current year (1977) has resulted in an increase in the 4 year base period total as implemented in the new income averaging schedule G. The effect is an increase in the averaged tax of approximately .5%. For planning purposes this is not a significant amount. However, if the exact income averaged tax is desired, add the following amounts to the 4 year taxable income.

+ \$2133 Joint

or

+ \$1067 Separate

or

+ \$1467 Single

Operating Limits and Warnings

Tax calculations cannot be performed for values less than \$1,000 (if attempted, error code '9' will flash in the display). All input data must conform with the following limits:

OTI \geq \$1,000

CG $>$ 0

4 yr TI $>$ 0

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

3

Sketch(es)

Sample Problem(s)

Mr. and Mrs. Smith will file a joint return claiming 2 exemptions for tax year 1977. The following data are applicable.

1040 Line 34	100,000
Capital Gains (CG)	10,000
4 Year TI	160,000

2.00	GSEA
100000.00	ENT1
750.00	ENT1
2.00	X
1500.00	***

line 34

net exemption

98500.00	***
3200.00	-
95300.00	***

standard deduction

capital gains

10000.00	STOC
2.00	-

-1/2 C G

90300.00	***
	STOB

OTI

160000.00	STOD
	GSEB

4 yr TI

3.00	T
42360.00	Z
41860.00	Y
40529.00	X

regular

alternative
averaged

Reference(s)

User Instructions

INCOME TAX PLANNING - I (Form 1040)
↓ STORE (Sched. D,G)
START OTI C G 4 YR TI RUN

[illegible]

User Instructions

5

TAX TABLE CARD 1 (or 2)

Married-Joint \$1,000-39,999 (or \$40,000 +)

Married-Separate \$1,000-19,999 (or \$20,000 +)

Individual \$1,000-19,999 (or \$20,000 +)

2

STEP	INSTRUCTIONS				INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1.	Record the following data on pairs of data cards for use with Income Tax Planning I and II programs. Record only the Tax Table(s) that you will use.							
	REG	MARRIED- JOINT	MARRIED- SEPARATE	INDIVIDUAL				
		CARD 1						
	R0	1.0401	1.0201	1.0201		STO	0	
	R1	1.0001415	0.	0.		STO	1	
	R2	2.0002916	0.	0.		STO	2	
	R3	3.0004517	1.0001416	1.0001416		STO	3	
	R4	4.0006219	2.0003119	2.0003119		STO	4	
	R5	8.0013822	4.0006922	4.0006921		STO	5	
	R6	12.0022625	6.0011325	6.0011124		STO	6	
	R7	16.0032628	8.0016328	8.0015925		STO	7	
	R8	20.0043832	10.0021932	10.0020927		STO	8	
	R9	24.0056636	12.0028336	12.0026329		STO	9	
						P S		
	R 0	28.0071039	14.0035539	14.0032131		STO	0	
	R 1	32.0086642	16.0043342	16.0038334		STO	1	
	R 2	36.0103445	18.0051745	18.0045136		STO	2	
	R 3	52000.	26000.	38000.		STO	3	
		CARD 2				P S	W/DATA	
	R0	2.0402	2.0202	2.0202		STO	0	
	R1	40.0121448	20.0060748	20.0052338		STO	1	
	R2	44.0140650	22.0070350	22.0059940		STO	2	
	R3	52.0180653	26.0090353	26.0075945		STO	3	
	R4	64.0244255	32.0122155	32.0102950		STO	4	
	R5	76.0310258	38.0155158	38.0132955		STO	5	
	R6	88.0379860	44.0189960	44.0165960		STO	6	
	R7	100.0451862	50.0225962	50.0201962		STO	7	
	R8	120.0575864	60.0287964	60.0263964		STO	8	
	R9	140.0703866	70.0351966	70.0327966		STO	9	
						P S		
	R 0	160.0835868	80.0417968	80.0393968		STO	1	
	R 1	180.0971869	90.0485969	90.0461969		STO	2	
	R 2	200.1109870	100.0554970	100.0530970		STO	3	
	R 3	52000.	26000.	38000.		P S	W/DATA	

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBL0	21 00	Tax Calculation Subroutine	057	LSTX	16-63	Exit for initial Tax Table Load
002	EEY	-23		058	ST00	35 00	
003	3	03		059	R4	-31	
004	+	-24		060	INT	16 34	
005	ST0E	35 15		061	X=Y?	16-33	
006	1	01		062	GT09	22 09	
007	X&Y?	16-35		063	R4	-31	
008	GT0E	22 06		064	GT03	22 03	
009	9	09		065	*LBL9	21 09	
010	R4E	51		066	F2?	16 23 02	
011	*LBL6	21 06	Determine which half of tax table is required by comparing argument to 'Table Split' value stored in R1 (Frac).	067	RTH	24	Tax Table Search Routine
012	RCL1	36 46		068	*LBL5	21 05	
013	FRC	16 44		069	RCL1	36 46	
014	EEY	-23		070	FRC	16 44	
015	3	03		071	1	01	
016	X	-35		072	2	02	
017	ENT1	-21		073	+	-55	
018	INT	16 34		074	ST01	35 46	
019	RCL1	36 15		075	*LBL7	21 07	
020	X&Y	-41		076	RCL1	36 15	
021	X&Y?	16-34	Request the other half of the Tax Table ('1' or '2') if necessary, and branch to Tax Table load routine Else, branch to Tax Table Search routine	077	RCL1	36 45	Perform indirect read loop through Tax Table (Descending) until correct entry is found. Then branch to tax calculation routine.
022	GT01	22 01		078	INT	16 34	
023	2	02		079	X&Y?	16-35	
024	GT0E	22 12		080	GT0E	22 08	
025	*LBL1	21 01		081	DSZ1	16 25 46	
026	1	01		082	GT07	22 07	
027	*LBLB	21 12		083	*LBL8	21 08	
028	R4	16-31		084	RCL1	36 45	
029	FRC	16 44		085	FRC	16 44	
030	EEY	-23		086	EEY	-23	
031	1	01	Entry for initial Tax Table load	087	5	05	Tax Calculation Routine
032	X	-35		088	X	-35	
033	INT	16 34		089	ENT1	-21	
034	X=Y?	16-33		090	INT	16 34	
035	GT05	22 05		091	EEY	-23	
036	R4	-31		092	1	01	
037	GT03	22 03		093	X	-35	
038	*LBLA	21 11		094	X&Y	-41	
039	SF2	16 21 02		095	FRC	16 44	
040	*LBL3	21 03		096	RCL1	36 15	
041	RCL0	36 00	Tax Table Load Routine	097	RCL1	36 45	Mainline Calculate Alternative Tax Compute Tax on OTI Store in R0.
042	AB0	16 31		098	INT	16 34	
043	R4	-31		099	-	-45	
044	1	01		100	EEY	-23	
045	3	03		101	3	03	
046	ST01	35 46		102	X	-35	
047	X&Y	-41		103	X	-35	
048	*LBL2	21 02		104	+	-55	
049	MR0	16-62		105	RTH	24	
050	PSE	16 51		106	*LBL1	21 15	
051	F3?	16 23 03	Store 'Table Split' value in R1 (Frac)	107	RCLB	36 12	
052	GT04	22 04		108	GSB0	23 00	
053	GT02	22 02		109	ST00	35 00	
054	*LBL4	21 04		110	5	05	
055	RCL0	36 00		111	EEY	-23	
056	ST01	35 46		112	4	04	

REGISTERS

0 Accum. Tax Amt	1 Tax Table	2	3	4	5	6	7	8	9
S0 Tax Table	S1	S2	S3 Constant 38/26/52000	S4 Ave Tax	S5	S6	S7	S8	S9 Work
A Alt. Tax	B OTI	C C G	D 4 YR TI	E Work	F	G	H	I Loop Control(Int) Table Split(Frac)	J

97 Program Listing II

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	RCLD	36 13		169	RCLD	36 14	Compute tax on 4YR TI
114	X=0?	16-43	If CG = 0	170	GSB0	23 00	Leave in R _x
115	SF2	16 21 02	Set Flag 2	171	RCL0	36 00	Compute 4 (R ₀ -R _x)
116	X<Y?	16-35	If CG < 50000	172	X<Y	-41	Add to R ₀
117	GT0a	22 16 13	Branch to LBL c	173	-	-45	
118	X<Y	-41	If C G 50000	174	4	04	
119	4	04	Add 12500 To R ₀	175	x	-35	
120	÷	-24		176	ST+0	35-55 00	
121	ST+0	35-55 00		177	GT0a	22 16 11	Leave 0 in R ₀
122	2	02	Compute Tax on	178	*LBLb	21 16 12	
123	x	-35	(OTI + 25000)	179	0	00	
124	RCLB	36 12	Subtract from R ₀	180	ST00	35 00	
125	+	-55		181	*LBLa	21 16 11	Store
126	GSB0	23 00		182	RCL0	36 00	Averaged Tax
127	ST-0	35-45 00		183	P2S	16-51	in R ₅₄
128	RCLB	36 12	Compute Tax on	184	ST04	35 04	
129	RCLC	36 13	(OTI + $\frac{CG}{2}$)	185	P2S	16-51	
130	2	02	Branch to LBL d	186	RCLD	36 14	Restore 4 YR TI
131	÷	-24		187	.	-62	in R ₀
132	+	-55		188	3	03	
133	GSB0	23 00		189	÷	-24	
134	GT0a	22 16 14		190	ST00	35 14	
135	*LBLc	21 16 13	If CG 50000	191	RCLB	36 12	Calculate
136	4	04	Compute $\frac{CG}{4}$	192	RCLC	36 13	Regular Tax
137	÷	-24	Add (Tax on OTI + $\frac{CG}{2}$)	193	2	02	Compute Tax on
138	*LBLd	21 16 14	or ($\frac{CG}{4}$) to R ₀	194	÷	-24	(OTI + $\frac{CG}{2}$)
139	ST+0	35-55 00	If CG=0, Alt. Tax=0	195	+	-55	Leave in R _x
140	RCL0	36 00	Store Alt. Tax in R _A	196	GSB0	23 00	Display
141	F2?	16 23 02	Calculate income	197	3	03	
142	0	00	averaged tax	198	X<Y	-41	'3.00'
143	ST0A	35 11	Calculate OTI + $\frac{CG}{2}$	199	RCLA	36 11	'Regular Tax'
144	RCLB	36 12		200	P2S	16-51	'Alternative Tax'
145	RCLC	36 13		201	RCL4	36 04	'Averaged Tax'
146	2	02		202	P2S	16-51	
147	÷	-24		203	PRST	16-14	
148	+	-55		204	RTN	24	
149	RCLD	36 14	If 4 Yr TI=0	205	R/S	51	
150	X=0?	16-43	Branch to LBL b				
151	GT0b	22 16 12	Compute .3(4Yr TI)				
152	.	-62	Store in R _A				
153	3	03	If (OTI + $\frac{CG}{2}$) -				
154	x	-35	.3(4YR TI)				
155	ST0D	35 14	< 3000				
156	-	-45	Branch to LBL b				
157	3	03					
158	EEX	-23					
159	3	03					
160	X<Y	-41					
161	X<Y?	16-35					
162	GT0a	22 16 12	Compute Tax on				
163	5	05	$[(OTI + \frac{CG}{2} - .3(4YRTI))$				
164	÷	-24	$\frac{5}{220}$				
165	RCLD	36 14					
166	+	-55					
167	GSB0	23 00	+ 4 YR TI]				
168	ST00	35 00	Store in R ₀				

LABELS					FLAGS	SET STATUS		
A	B	C	D	E		FLAGS	TRIG	DISP
038	027			102	0	ON OFF		
a	177	b	174	c	131	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
		d	134	e		1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
0	001	1	025	2	045	2 <input type="checkbox"/> <input checked="" type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
5	064	6	011	7	071	3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>2</u>
		8	079	9	058			

Program Description I

Program Title True Cost of Insurance Policy

Contributor's Name Hewlett-Packard Company

Address 1000 N. E. Circle Boulevard

City Corvallis

State Oregon

Zip Code 97330

Program Description, Equations, Variables The price per \$1,000 of insurance protection for a given policy year may be calculated by the following formula:

$$YPT_t = \frac{(P_t + V_{t-1})(1+i) - V_t - D_t}{(F_t - V_t)(.001)} \quad (1)$$

The rate of return on the savings element in a given policy year may be calculated by the following formula:

$$i = \frac{V_t + D_t + (YPT_t)(F_t - V_t)(.001)}{P_t + V_{t-1}} - 1 \quad (2)$$

where

YPT_t = price per \$1,000 of protection in policy year t

P_t = annual premium for policy year t

V_t = cash value for policy year t

D_t = dividend for policy year t

F_t = face amount for policy year t

i = rate of return on savings element, expressed as a decimal (after-tax)

[note that in using the program i is expressed in percent]

Operating Limits and Warnings You must assume a value for YPT_t (e.g., a low-cost term policy of the one-year renewable type) to calculate i ; visa versa, you must assume a value for i (e.g., the interest rate you could earn on a one-year savings certificate, after tax) to calculate YPT_t .

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

9

Sketch(es)

Sample Problem(s) Consider an average \$50,000 face amount cash-value policy. The annual premium of \$1,010 is due at the beginning of the year, and a dividend of \$165 is received at the end of the policy year. Cash value of \$3,302 at the beginning of the year grows to \$4,104. Using formula (1) and assuming a 6% savings rate available elsewhere, the cost per \$1,000 of insurance protection could be purchased for \$3.00 per \$1,000, the rate of return on your savings is 2.20%.

Note: even complex policies like minimum-deposit plans can be analyzed with this program. Use policy surrender values for cash-values, and the actual (after-tax) amounts for payments (premiums) and dividends.

Solution(s) Input: [f] [A]

50000 [A]

165 [Enter] 1010 [B]

3302 [Enter] 4104 [C]

For true cost per \$1,000, input 6 [D] = 6.57

For savings rate, input 3 [E] = 2.20

Reference(s) Joseph M. Belth, Life Insurance - a consumer's handbook, Indiana University Press, 1973, p. 234.

This program is a translation of the HP-65 Users' Library Program #00332A submitted by Nicholas Kaiser.

User Instructions

Init
1
2

TRUE COST OF INSURANCE POLICY

Face Amount	Dividend Premiums	C.V.Beg. C.V.End	Int. Rate Cost/Thou.	Cost/Thou. Int. Rate
----------------	----------------------	---------------------	-------------------------	-------------------------

[illegible]

97 Program Listing I

11

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBL	21 16 11	Initialize	057	RCL3	36 03	
002	CLRG	16-53		058	+	-55	
003	0	00		059	RCL1	36 01	
004	RTN	24		060	RCL2	36 02	
005	*LBLA	21 11	Policy face amount	061	+	-55	
006	ST05	35 05	Store in R5	062	÷	-24	
007	RTN	24		063	1	01	
008	*LBLB	21 12	Premium/Dividend	064	-	-45	
009	ST01	35 01	Store annual	065	1	01	
010	R↓	-31	Premium in R1	066	0	00	
011	ST04	35 04	Store dividend R4	067	0	00	
012	RTN	24		068	x	-35	
013	*LBLC	21 13	Cash Value	069	RTN	24	
014	ST03	35 03	Store cash value	070	R/S	51	
015	R↓	-31	(year end)				
016	ST02	35 02	Store cash value				
017	RTN	24	(year beginning)				
018	*LBLD	21 14	Calculates actual				
019	ENT↑	-21	cost per thousand				
020	1	01	of insurance				
021	0	00	assuming the rate				
022	0	00	of return on				
023	÷	-24	savings entered				
024	1	01	in X-reg	080			
025	+	-55					
026	RCL1	36 01					
027	RCL2	36 02					
028	+	-55					
029	x	-35					
030	RCL3	36 03					
031	-	-45					
032	RCL4	36 04					
033	-	-45					
034	RCL5	36 05		090			
035	RCL3	36 03					
036	-	-45					
037	.	-62					
038	0	00					
039	0	00					
040	1	01					
041	x	-35					
042	÷	-24					
043	RTN	24					
044	*LBL E	21 15	Calculates actual	100			
045	ENT↑	-21	rate of return on				
046	RCL5	36 05	savings assuming				
047	RCL3	36 03	the cost per				
048	-	-45	thousand of				
049	x	-35	insurance entered				
050	.	-62	in X-reg				
051	0	00					
052	0	00					
053	1	01					
054	x	-35		110			
055	RCL4	36 04					
056	+	-55					

SET STATUS		
FLAGS	TRIG	DISP
ON OFF		
0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
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 2

REGISTERS									
0	1 Annual Premium	2 Cash Val Beg. Yr.	3 Cash Val Yr. End	4 Annual Dividend	5 Policy Face Amt	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A		B		C		D		E	

Program Description I

Program Title AUTOMOBILE COST / TIRE COST COMPARISON

Contributor's Name Hewlett-Packard

Address 1000 N. E. Circle Boulevard

City Corvallis

State Oregon

Zip Code 97330

Program Description, Equations, Variables Given initial price (P_i) and fuel economy

(H = MPG, Highway; C = MPG, City) and use data:

Annual Mileage

Percent Highway Miles $\hat{=}$ $K = \frac{\text{Highway Miles}}{\text{Total Miles}} \times 100$

Other inputs are length of ownership (years and tenths of years) and cost data:

Annual Interest Rate

i ,

Cost of Fuel

\$, ϕ per gallon

Equation: 1) Sinking fund $FV = PMT \left[\frac{(1+i)^n - 1}{i} \right]$

2) Depreciation $P(N) = P(0) [.75]^n$

where

n = # periods

i = Annual interest rate

FV = Final value

PMT = Payment/Period

$P(0)$ = Initial price

$P(N)$ = Price at N years

The program accepts price, excise tax, and estimated life (mileage) for up to 3 different tires and computes the best buy based on the number of miles expected for dollar spent. Best buy is indicated by displaying entered tire price for identification and miles per dollar as a single split display. Single tire price, miles per dollar, and four tire set price can also be recalled for each case.

Equations solved are:

1) $4 \times (\text{Excise Tax \& Tire Price}) = 4 \text{ Tire Set Price}$

2) $\frac{\text{Estimated Life in Miles}}{4 \text{ Tire Set Price}} = \text{Miles/Dollar}$

3) Best Buy = Greatest Miles/Dollar Ratio

OPERATING LIMITS AND WARNINGS

Percentages for highway mileage and interest rate are entered as whole numbers between 0 and 100.

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) 1. Compute the net cost difference at the end of 3 years of ownership of two candidate autos:

1) The "Wombat 1" with $P_1 = \$4,000$
HWY = 25 city = 15

2) The "Lightfoot 2" with $P_2 = \$3,000$
HWY = 30 city = 20

Assume use data as follow - annual mileage 12,000 miles/year, and 50% use is HWY type. Cost data is taken as : Interest rate 6%
Fuel at \$0.60/ gal

2. Find the best buy of the 3 tires below:

#1 Price \$54.22; Excise Tax \$2.52; Estimated Life 36,000 Miles

#2 Price \$36.57; Excise Tax \$1.96; Estimated Life 25,000 Miles

#3 Price \$29.88; Excise Tax \$1.22; Estimated Life 17,000 Miles

SOLUTION(S):

1.	4000	[↑]	25	[↑]	15	[A]	→	4000
	3000	[↑]	30	[↑]	20	[B]	→	3000
	12000	[↑]	50	[C]			→	10
	3	[D]					→	421.88
	6	[↑]	0.60	[E]			→	1010.82
2.	Enter	2.52		[ENT↑]				2.52
	"	54.22		[ENT↑]				54.22
	"	36000		[f]	[A]			226.96 (4 Tire Cost)
	"	1.96		[ENT↑]				1.96
		36.57		[ENT↑]				36.57
		25000		[f]	[B]			154.12 (4 Tire Cost)
		1.22		[ENT↑]				1.22
		29.88		[ENT↑]				29.88
		17000		[f]	[C]			124.40 (4 Tire Cost)

(Continued on following page)

Reference(s) This program is a modification of the Users' Library Program #04638A submitted by Robert S. Siebert.

This program is a modification of the Users' Library Program #03428A submitted by Robert A. Plack.

Program Description II

Sketch(es)

Sample Problem(s)

Solution(s)

Compute and Display Best Buy	[f] [D]	36,5700162	[Tire 2 best buy] 162 Mi./\$
Display	[f] [E]	54,2200159	
		226.96	Tire 1
		36.5700162	
		154.12	Tire 2
		29,8800137	
		124.40	Tire 3

Reference(s)

User Instructions

15

1

Auto 1 Auto 2 Use Years Cost

Tire 1 Tire 2 Tire 3 Best Buy Display

AUTOMOBILE COST/TIRE COST

2

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1	Load side 1 and side 2		<input type="text"/>	<input type="text"/>	
2	For automobile cost comparison, go to step 3		<input type="text"/>	<input type="text"/>	
	For tire cost comparison, go to step 9		<input type="text"/>	<input type="text"/>	
3	For automobile #1:		<input type="text"/>	<input type="text"/>	
	Enter price:	\$P1	ENT↑	<input type="text"/>	
	highway mpg:	MPG	ENT↑	<input type="text"/>	
	city mpg:	MPG	A	<input type="text"/>	P ₁
4	For automobile # 2:		<input type="text"/>	<input type="text"/>	
	Enter price:	\$P2	ENT↑	<input type="text"/>	
	highway mpg:	MPG	ENT↑	<input type="text"/>	
	city mpg:	MPG	B	<input type="text"/>	P ₂
5	Enter use data:		<input type="text"/>	<input type="text"/>	
	annual mileage	MILES	ENT↑	<input type="text"/>	
	percent highway	%	C	<input type="text"/>	Δ Gal/Mo.
	(0 < K ≤ 100)		<input type="text"/>	<input type="text"/>	
6	Years of service	Years	D	<input type="text"/>	Future Val.
7	Enter costs:		<input type="text"/>	<input type="text"/>	of P ₁ -P ₂
	Interest rate	i	ENT↑	<input type="text"/>	
	Fuel Cost	\$/Gal.	E	<input type="text"/>	Net Cost
8	To re-run, change desired step and reenter all higher numbered steps.		<input type="text"/>	<input type="text"/>	
9	For tire #1:		<input type="text"/>	<input type="text"/>	
	Enter tire excise tax	\$	ENT↑	<input type="text"/>	
	single tire price	\$	ENT↑	<input type="text"/>	
	tire estimated life	MILES	f A	<input type="text"/>	4 Tire Pr.
10	For tire #2:		<input type="text"/>	<input type="text"/>	
	Enter tire excise tax	\$	ENT↑	<input type="text"/>	
	single tire price	\$	ENT↑	<input type="text"/>	
	tire estimated life	MILES	f B	<input type="text"/>	4 Tire Pr.
11	(Optional: For tire #3)		<input type="text"/>	<input type="text"/>	
	Enter tire excise tax	\$	ENT↑	<input type="text"/>	
	single tire price	\$	ENT↑	<input type="text"/>	
	tire estimated life	MILES	f C	<input type="text"/>	4 Tire Pr.
12	Compute best buy based on miles/dollar.		f D	<input type="text"/>	\$-Miles/\$
	(Read split display as follows:		<input type="text"/>	<input type="text"/>	
	<div style="border-top: 1px dashed black; width: 100px; margin: 5px 0;"></div>		<input type="text"/>	<input type="text"/>	
	single tire miles/\$		<input type="text"/>	<input type="text"/>	
	price		<input type="text"/>	<input type="text"/>	
	(Continued following page)		<input type="text"/>	<input type="text"/>	

User Instructions

1	Tire 1	Tire 2	Tire 3	Best Buy	Display	2
	AUTOMOBILE COST/TIRE COST					
Auto 1	Auto 2	Use	Years	Cost		

[illegible]

97 Program Listing I

17

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	1	01	
002	ST01	35 01		058	2	02	
003	-	-45		059	0	00	
004	ST02	35 02		060	0	00	
005	R↓	-31		061	=	-24	
006	RTN	24	Price 1	062	ST08	35 08	
007	*LBLB	21 12		063	1	01	
008	ST03	35 03		064	+	-55	
009	-	-45		065	RCL7	36 07	
010	ST04	35 04		066	Y*	31	
011	R↓	-31		067	ST×5	35-35 05	
012	-	-45		068	ST02	35 02	
013	ST05	35 05		069	1	01	
014	-	-45		070	-	-45	
015	RTN	24	Price 2	071	RCL8	36 08	
016	*LBLC	21 13		072	÷	-24	
017	1	01		073	x	-35	
018	0	00		074	RCL5	36 05	
019	0	00		075	+	-55	
020	÷	-24		076	RCL9	36 09	
021	ST×4	35-35 04		077	-	-45	
022	RCL2	36 02		078	RCL5	36 05	
023	x	-35		079	RCL2	36 02	
024	RCL1	36 01		080	÷	-24	
025	+	-55		081	ST05	35 05	
026	1/X	52		082	XZY	-41	
027	RCL4	36 04		083	RTN	24	
028	RCL3	36 03		084	*LBLA	21 16 11	
029	+	-55		085	DSP2	-63 02	
030	1/X	52		086	CF1	16 22 01	
031	-	-45		087	SF2	16 21 02	
032	x	-35		088	CLRG	16-53	
033	1	01		089	ST07	35 07	
034	2	02		090	R↓	-31	
035	÷	-24		091	ST01	35 01	
036	ST06	35 06	Gallons/Mo.Diff	092	ST04	35 04	
037	RTN	24		093	ST06	35 06	
038	*LBLD	21 14		094	+	-55	
039	ST09	35 09		095	4	04	
040	1	01		096	x	-35	
041	2	02		097	ST02	35 02	
042	x	-35		098	RTN	24	
043	ST07	35 07		099	*LBLB	21 16 12	
044	.	-62		100	ST08	35 08	
045	7	07		101	R↓	-31	
046	5	05		102	ST03	35 03	
047	RCL9	36 09		103	+	-55	
048	Y*	31		104	4	04	
049	RCL5	36 05		105	x	-35	
050	x	-35		106	ST04	35 04	
051	ST09	35 09	Remaining Value of	107	RTN	24	
052	RTN	24	Cost Difference	108	*LBLC	21 16 13	
053	*LBLE	21 15		109	CF2	16 22 02	
054	RCL6	36 06		110	ST09	35 09	
055	x	-35		111	R↓	-31	
056	XZY	-41		112	ST05	35 05	

Restores 5.

Net Cost Difference

Initialize

#1 Tire Life
#1 Tire Price
Fill to Prevent
Division by Zero
if only 2 cases en.
Compute #1 Tire
4 Tire Price

#2 Tire Life
#2 Tire Price
Compute #2 Tire
4 Tire Price

#3 Tire Life
#3 Tire Price

REGISTERS

0	1 Used Tire C1	2 Used Tire T1	3 Used TC2	4 Used TT2	5 P1 - P2 TC3	6 ΔMPG TT3	7 # Mo. TL1	8 L. TL2	9 Final Pr TL3
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

97 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	+	-55	Compute #3 Tire 4 Tire Price	169	SPC	16-11	#3 Price - Miles/\$
114	4	04		170	F2?	16 23 02	
115	x	-35		171	RTN	24	
116	ST06	35 06		172	DSP7	-63 07	
117	RTN	24		173	RCL5	36 05	
118	*LBLd	21 16 14		174	PRTX	-14	
119	RCL7	36 07		175	DSP2	-63 02	
120	RCL2	36 02		176	RCL6	36 06	
121	GSB0	23 00		177	PRTX	-14	
122	ST07	35 07		178	RTN	24	
123	ST+1	35-55 01	Compute Miles Per Dollar	179	*LBL0	21 00	Miles/Dollar Sub Routine
124	RCL8	36 08		180	÷	-24	
125	RCL4	36 04		181	EEX	-23	
126	GSB0	23 00		182	7	07	
127	ST08	35 08		183	÷	-24	
128	ST+3	35-55 03		184	RTN	24	
129	RCL9	36 09		185	R/S	51	
130	RCL6	36 06					
131	GSB0	23 00					
132	ST09	35 09					
133	ST+5	35-55 05					
134	DSP7	-63 07					
135	RCL9	36 09					
136	RCL8	36 08					
137	X>Y?	16-34					
138	GT01	22 01					
139	X*Y	-41					
140	SF1	16 21 01					
141	*LBL1	21 01					
142	RCL7	36 07					
143	X>Y?	16-34	Display Best Buy				
144	GT02	22 02					
145	F1?	16 23 01					
146	GT03	22 03					
147	RCL3	36 03					
148	RTN	24					
149	*LBL2	21 02					
150	RCL1	36 01					
151	RTN	24					
152	*LBL3	21 03					
153	RCL5	36 05	Display Mode				
154	RTN	24					
155	*LBL4	21 16 15					
156	DSP7	-63 07					
157	RCL1	36 01					
158	PRTX	-14					
159	DSP2	-63 02					
160	RCL2	36 02					
161	PRTX	-14					
162	SPC	16-11					
163	RCL3	36 03	#1 Price - Miles/\$				
164	DSP7	-63 07					
165	PRTX	-14					
166	RCL4	36 04					
167	DSP2	-63 02					
168	PRTX	-14					
			#1 4 Tire Price				
			#2 Price - Miles/\$				
			#2 4 Tire Price				

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0	FLAGS	TRIG	DISP
Auto 1	Auto 2	Use	# Years	Costs	1 Used	ON OFF		
Tire 1	Tire 2	Tire 3	Best	Display	2 Used	0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
Used	Used	Used	Used			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 _____

Program Description I

Program Title COMPARISON SHOPPING

Contributor's Name Hewlett-Packard Company

Address 1000 N. E. Circle Boulevard

City Corvallis

State Oregon

Zip Code 97330

Program Description, Equations, Variables Competing manufacturers often package their products in various weights or volumes, so that in stores that lack some form of "unit pricing", consumers have a difficult time deciding which brand is actually cheapest. This program overcomes that difficulty. The price and amount of each item is entered successively. The program converts to cost/amount, which is compared to that of the item which was cheapest up to that point. In case erroneous input is entered, the second least expensive item is retained along with the least. This can be recalled if the output data cannot be associated with any product. Output data identifies the least expensive product by its cost, amount, and gives the cost/amount. A counter lists the number of items input so far with each new entry.

Operating Limits and Warnings None

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Program Description II

Sketch(es)

Sample Problem(s) Find the lowest price among the following products:

<u>Item</u>	<u>Price</u>	<u>Weight</u>
Ketchup 1	\$.85	16.5 oz.
Ketchup 2	.69	14.75 oz.
Catsup	.78	16.0 oz.

Solution(s)

[A]

.85 [Enter] 16.5 [B]

.69 [Enter] 14.75 [B]

.78 [Enter] 16.0 [B]

[C] 14.75 weight

[R/S] 0.69 price

[R/S] 0.468 price/weight

Reference(s)

This program is a translation of the HP-65 Users' Library Program

01258A submitted by Randal Lee O'Toole.

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[illegible]

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLB	21 12	Entry of data				
002	F1?	16 23 01	First entry is				
003	GT00	22 00	treated seperately				
004	ST01	35 01	Amount	060			
005	ST05	35 05					
006	=	-24					
007	ST02	35 02	Cost/Amount				
008	ST04	35 04					
009	SF1	16 21 01	Flag to show further				
010	GT01	22 01	ent. aren't first				
011	*LBL0	21 00	Second and further				
012	ST03	35 03	entries treated				
013	=	-24	here				
014	ST06	35 06		070			
015	RCL2	36 02					
016	X4Y?	16-35	Comparison cost/amt				
017	GT01	22 01					
018	ST04	35 04					
019	RCL1	36 01					
020	ST05	35 05					
021	RCL6	36 06					
022	ST02	35 02					
023	RCL3	36 03					
024	ST01	35 01		080			
025	*LBL1	21 01					
026	DSZ1	16 25 46	Counter of entries				
027	RCL1	36 46					
028	CHS	-22					
029	DSP0	-63 00					
030	RTN	24					
031	*LBLC	21 13	Identification of				
032	DSP2	-63 02	least expen. item				
033	RCL1	36 01	Amount				
034	RTN	24		090			
035	RCL1	36 01	Cost				
036	RCL2	36 02					
037	X	-35					
038	R/S	51					
039	RCL2	36 02	Cost/Amount				
040	DSP4	-63 04					
041	R/S	51					
042	*LBLA	21 11	Signal new products				
043	CF1	16 22 01	being compared				
044	CLRG	16-53		100			
045	CLX	-51					
046	RTN	24					
047	*LBLD	21 14	Recalls second				
048	RCL4	36 04	least expensive				
049	ST02	35 02	data				
050	RCL5	36 05					
051	ST01	35 01					
052	RTN	24					
053	R/S	51		110			

SET STATUS

FLAGS	TRIG	DISP
ON OFF		
0 <input type="checkbox"/> <input checked="" type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
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 type="checkbox"/>		n2

REGISTERS

0	1Cheapest	2Cheapest	3Competing	4Second	5Second	6Competing	7	8	9
	Amount	Cost/Amt	Amount	Ch. CT/Amt	cheap amt	Cost/Amt.			
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

Program Description I

Program Title TIME & CHARGES RUNNING TOTAL

Contributor's Name THOMAS M. COX JR.

Address 7544 MAPLE LEAF LANE

City SACRAMENTO State CALIF Zip Code 95828

Program Description, Equations, Variables PROGRAM USES A TEN SECOND LOOP TO TIME A TELEPHONE CALL. THE LOOP PAUSES FIRST TO DISPLAY TENS OF SECONDS, THEN FIVE PAUSES DISPLAY MINUTE ONE IS INTO LEFT OF DECIMAL POINT AND CHARGE IN CENTS TO THE RIGHT, THEN 30 "+" INSTRUCTIONS ARE USED FOR CALIBRATION PURPOSES (figure 50 MS. PER ADD PERFORMED).

PROGRAM NEED NOT BE MORE ACCURATE THAN THE MINUTE PLUS FIFTY SECONDS - IT NEEDS ONLY TO TELL WHAT MINUTE ONE IS INTO FOR BILLING PURPOSES. A TIMING GAIN OF ONE SECOND IN FIVE MINUTES IS EASILY ACHIEVED AND DEEMED MORE THAN ADEQUATE FOR LONG DISTANCE CALLS LASTING LESS THAN TWO HOURS. (FIVE HOURS BEFORE DISPLAY WOULD BE WRONG IF CALLING ON A WEEKEND WITHIN 48 STATES.) PROGRAM EASILY MODIFIED TO HANDLE CALLS COSTING OVER \$100 IF DESIRED (ADD 0 STEP 72, DSP5 STEP 5).

Operating Limits and Warnings (SEE ABOVE)

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Program Description II

Sketch(es)							
		1.0054	2.0092	3.0130		MIN. TOTAL
ENTER CHG1 54 A	ENTER CHG2 38 B	PARTY ANSWERS C	1ST MIN END	2ND MIN END	3RD MIN END	NTH MIN END	CALL END R/S

Sample Problem(s) CHARGES DURING NORMAL BUSINESS HOURS FOR A PHONE CALL FROM SACRAMENTO TO NEW YORK CITY IS 54¢ FOR FIRST MINUTE AND 38¢ FOR EACH SUCCEEDING MINUTE. CAUSE THE CALCULATOR TO DISPLAY TIME AND CHARGES AFTER PARTY ANSWERS, UPDATED AT ONE MINUTE INTERVALS.

Solution(s)

Key strokes:

54

A

→

1.0054

38

B

→

1.0038 PAUSE, 1.0054 HALT.

PARTY ANSWERS

C

→

1.0054, 2.0092, 3.0130, etc.

Reference(s)

25

[illegible]

[illegible]

Program Description I

Program Title Reconcile Checking Account

Contributor's Name Geoffrey Kidd

Address 1514 Oxford Street Apt #301

City Berkeley, State CA Zip Code 94709

Program Description, Equations, Variables This program serves as an aid in reconciling personal checkbook tallies to bank statements. Inputs are outstanding(uncancelled) checks, outstanding deposits(deposits after the statement closing date), and bank statement balance. Outputs are: final balance, which should agree with the personal checkbook tally, sum and total number of outstanding checks, and sum and number of deposits.

$$\text{Formula: } FB = SB + \sum_{i=1}^{m_D} D_i - \sum_{i=1}^{n_C} C_i$$

where FB=final balance, SB=bank statement balance, D_i =Outstanding deposit number i, C_i =Outstanding check number i, m_D =Number of outstanding deposits, n_C =Number of outstanding checks.

The checkbook balance,, then, is equal to the bank statement balance plus deposits made after the statement closing date minus checks not received at the bank before the closing date.

Operating Limits and Warnings All statement service charges should be subtracted from the checkbook tally before reconciling. Also, insure that all checks which have been cancelled are accounted for in the checkbook tally and are not still listed as outstanding.

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Program Description II

Sketch(es)

Sample Problem(s)

As an example, suppose the bank statement balance was \$432.96. You had outstanding checks of \$47.82, \$5.63, \$25.00, \$36.47, and \$96.02. The outstanding deposits are \$100.00 and \$256.03. Compute the current checkbook balance, total of outstanding checks, and total of outstanding deposits.

Solution(s)

[D] 432.96[A]

47.82[B] 5.63[B] 25[B] 36.47[B] 96.02[B]

100[C] 256.03[C]

[A] -----> 578.05 Current checkbook balance

[B] -----> 210.94 Total outstanding checks

[C] -----> 356.03 Total outstanding deposits

Reference(s)

29

[illegible]

67 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS		
001	/LBL D	31 25 14	(Initialize)		/-X-	31 84			
	/CL REG	31 43	Clear reg + stack		R XZ4	35 52			
	CLX	44			/-X-	31 84			
	E↑	41		060	R XZ4	35 52			
	E↑	41			R RTN	35 22			
	E↑	41			R/S	84			
	R RTN	35 22							
	/LBL A	31 25 11	(Balance)						
	R F?3	35 71 03	If new entry,						
010	GTO 0	22 00	branch						
	RCL 0	34 00	Calculate FB						
	RCL 1	34 01							
	-	51							
	RCL 2	34 02							
	+	61		070					
	R RTN	35 22							
	/LBL 0	31 25 00							
	STO 0	33 00	STO SB						
	R RTN	35 22							
020	/LBL R	31 25 12	(Sum chks)						
	R F?3	35 71 03	If new entry,						
	GTO 1	22 01	branch						
	RCL 3	34 03	else,						
	RCL 1	34 01	Set up for display	080					
	GTO 3	22 03							
	/LBL 1	31 25 01	ΣC, #checks						
	STO +1	33 61 01	Augment ΣC,						
	E↑	41							
	1	01							
030	STO +3	33 61 03	#checks						
	R RV	35 53							
	R RTN	35 22							
	/LBL C	31 25 13	(Sum Dep)						
	R F?3	35 71 03	If new entry,	090					
	GTO 2	22 02	branch						
	RCL 4	34 04	else display						
	RCL 2	34 02							
	GTO 3	22 03							
	/LBL 2	31 25 02	ΣD, #deposits						
040	STO +2	33 61 02	Augment ΣD,						
	E↑	41							
	1	01							
	STO +4	33 61 04	#deposits						
	R RV	35 53		100					
	R RTN	35 22							
	/LBL 6	31 25 12	(Clear out chk)						
	CLX	44	Clear ΣC,						
	STO 1	33 01							
	STO 3	33 03							
050	R RTN	35 22	#checks						
	/LBL C	31 25 13	(Clear out dep)						
	CLX	44	Clear ΣD,						
	STO 2	33 02							
	STO 4	33 04			110				
	R RTN	35 22	#checks						
	/LBL 3	31 25 03	(Routine for display)						
REGISTERS									
0 SB	1 ΣC	2 ΣD	3 #chks	4 #dep	5	6	7	8	9
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

Labels used:
A, B, C, D
b, c
0, 1, 2, 3

Set status
all flags off
DEG mode
FIX display
n = 2

Labels used:

A, B, C, D

b, c

0, 1, 2, 3

Set status

all flags off

DEG mode

FIX display

N = 2

Program Description I

Program Title SAVINGS ACCOUNT COMPOUNDED DAILY

Contributor's Name Hewlett-Packard Users' Library

Address 1000 N.E. Circle Blvd.

City Corvallis

State OR

Zip Code 97330

Program Description, Equations, Variables This program uses the formula

$$B_{\text{new}} = B_{\text{old}} (1 + i/36525)^N$$

where B_{new} = new balance

B_{old} = old balance

i = interest (in %)

N = Number of days elapsed

N is computed using the following calendar formula:

$D(m,d,y)$ = number of days since a certain fixed date in antiquity

$$= d + [30.6 f(m)] + [365.25 g(y,m)],$$

where $f(m) = \begin{cases} m + 13 & \text{if } m = 1 \text{ or } 2 \\ m + 1 & \text{if } m > 2 \end{cases}$

$g(y,m) = \begin{cases} y - 1 & \text{if } m = 1, 2 \\ y & \text{if } m > 2 \end{cases}$ [] = f INT

N = new D - previous D .

Dates are coded mm.dd.

Operating Limits and Warnings

1. The calendar routine is valid from March 1, 1900 through February 28, 2100; however, the error for dates outside of this range is minute.
2. Interest rates are based on a 365 1/4-day year, which may differ slightly from what banks use. It should even out in the long run, however.
3. Error messages are not given for illegal date entries.

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)

Compute interest on this account:

Starting year 1976, interest 5.25%

1. July 1 deposit \$1500.00
2. September 22 deposit \$154.50
3. September 27 withdraw \$148.00
4. October 15 deposit \$133.33
5. October 16 withdraw \$15.87
6. November 5 withdraw \$180.00
7. February 12 deposit \$40.00
8. July 7 withdraw \$300.00
9. November 22 withdraw \$50.00
10. May 5 deposit \$173.21
11. October 22 withdraw \$400.00

Find the balance at the end of each transaction and the total interest at the end.

Solution(s)	1. 1500.00	7. 1533.19
	2. 1672.50	8. 1265.48
	3. 1525.70	9. 1240.83
	4. 1662.99	10. 1443.64
	5. 1647.35	11. 1079.34
	6. 1472.10	Total interest = 172.17

Reference(s)

33

[illegible]

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	001 *LBLA	21 11	Year → R ₃		057 XZY	-41	m
	002 ST03	35 03			058	3	03
	003	0			059	0	00
	004 ST04	35 04	Clear date	060	060	.	-62
	005 RTN	24			061	6	06
	006 *LBLB	21 12			062	X	-35
	007	3			063 INT	16 34	[30.6 m]
	008	6			064 +	-55	D = d + [30.6m]
	009	5			065 RCL2	36 02	+ [365.25y]
010	010	2			066 XZY	-41	
	011	5			067 ST02	35 02	
	012 ST06	35 06			068	-	-45
	013	÷	-24		069 CHS	-22	N = difference
	014	1	01		070 RCL5	36 05	LN (1 + i/36525)
	015 +	-55			071	X	(1 + i/36525) ^N
	016 LN	32	LN (1 + i/36525)		072 e ^x	33	
	017 ST05	35 05	→ R ₅		073	1	01
	018	0			074	-	-45
	019 RTN	24			075 RCL1	36 01	Old balance
020	020 *LBLC	21 13			076	X	-35
	021 RCL4	36 04			077 ST+0	35-55 00	New interest
	022 XZY	-41			078 CHS	-22	Total interest
	023 ST04	35 04			079 *LBLD	21 15	Negate following
	024	-	-45		080 CHS	-22	CHS
	025	0			081 *LBLD	21 14	Withdraw
	026 XZY	16-35	Compare date with previous date. If new date is smaller, add 1 to year.		082 ST+1	35-55 01	Deposit
	027	1			083 RCL1	36 01	New balance
	028 RCL3	36 03			084 RTN	24	
	029 +	-55			085 *LBLG	21 00	
030	030 ST03	35 03			086 R1	16-31	
	031	3			087 GT09	22 09	
	032 RCL4	36 04			088 R/S	51	
	033	1					
	034 +	-55					
	035 INT	16 34					
	036 XZY	16-34	If month is Jan. or Feb., add 12 to m and subtract 1 from y.				
	037 ST00	22 00					
	038	9					
	039 +	-55					
040	040 +	-55					
	041 XZY	-41					
	042	1					
	043	-					
	044 *LBLB	21 09					
	045 RCL6	36 06					
	046	X	-35				
	047 EEK	-23					
	048	2					
	049	÷	-24				
050	050 INT	16 34	[365.25y]				
	051 RCL4	36 04					
	052 FRC	16 44					
	053 EEK	-23					
	054	2					
	055	X	-35				
	056	÷	-55				
			J				

090

100

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

LABELS				
A	B	C	D	E
Year	i (%)	Date	Deposit	Withdraw
a	b	c	d	e
0 USED	1	2	3	4
5	6	7	8	9
				Jan.-Feb.

REGISTERS									
0	1	2	3	4	5	6	7	8	9
Tot. int.	Bal.	N = days	Year	Date	USED	36525			
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

Program Description I

Program Title ACCUMULATED INTEREST/REMAINING BALANCE

Contributor's Name HEWLETT-PACKARD COMPANY

Address Corvallis Division
1000 N.E. Circle Boulevard

City Corvallis, OR 97330

State

Zip Code

Program Description

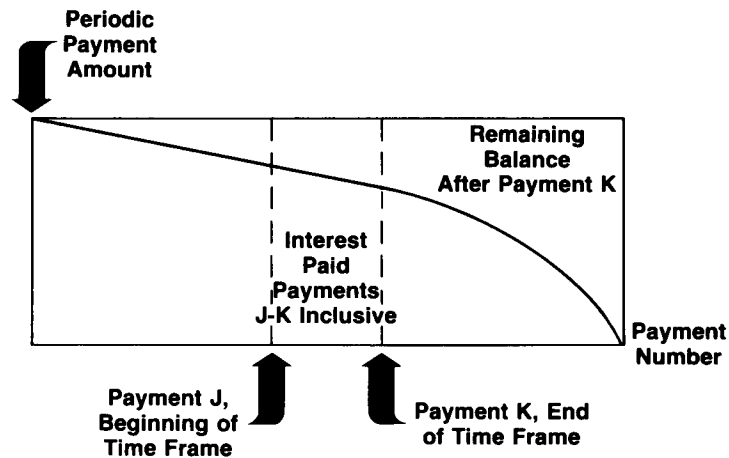


Figure 4

This program finds both the total interest paid over a specified number of payment periods and the remaining balance at the end of the last specified period, given the periodic interest rate, periodic payment amount, loan amount, and the beginning and ending payment numbers for the time span being considered. The payments associated with both the beginning (J) and the ending (K) payment period are included in the calculation.

The program can be used for loans with a balloon payment as well as loans arranged to be fully amortized provided two cautions are observed. First, the balloon payment of the loan must be at the same time as, and in addition to the last payment. Second, care should be taken not to enter a value for K that is after the last payment since the program has no way of knowing the term of the loan.

Operating Limits

An option is available to output the amortization schedule between payments J and K (**F A**).

Pressing **F E** sets and clears the print flag. Successive use of **F E** will alternately display 1.00 and 0.00, indicating that the print/pause mode is on or off respectively.

The data generated is valid for loans that have a balloon payment, as well as those that are arranged to be fully amortized. For loans with a balloon payment, the remaining balance of the last payment period is the balloon payment due in addition to the last periodic payment.

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Program Description I

Program Title _____

Contributor's Name _____

Address _____

City _____

State _____

Zip Code _____

Program Description, Equations, Variables

For loans scheduled to be fully amortized, the remaining balance after the last payment period may be slightly more or less than zero. This is because the program assumes that **all** payments are equal to the value entered for PMT. In fact for most loans, the last payment is slightly more or less than the rest.

The calculator performs all internal calculations to ten digits. If the user wishes to round the schedule to dollars and cents, the following sequence may be used:

1. Press **GTO** .113
2. Switch to PRGM mode.
3. Press **RND**
4. Switch back to RUN mode.

Operating Limits and Warnings

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Program Description II

Sketch(es)

Sample Problem(s)

5. Accumulated Interest/Remaining Balance

$$BAL_K = \frac{1}{(1+i)^{-K}} \left[PMT \frac{(1+i)^K - 1}{i} + PV \right]$$

$$Int_{J-K} = BAL_K - BAL_{J-1} + (K - J + 1) \cdot PMT$$

where:

$$k^{th} \text{ payment to principal} = BAL_{K-1} - BAL_K$$

$$k^{th} \text{ payment to interest} = PMT - (BAL_{K-1} - BAL_K)$$

$$\text{Total payment to interest} = (K) \times (PMT) - (PV - BAL_K)$$

Solution(s)

Reference(s)

Program Description II

Sketch(es)

Example 1:

A mortgage is arranged such that the first payment is made at the end of October, 1975 (i.e., October is payment period 1). It is a \$20,000 loan at 9%, with monthly payments of \$167.84. What is the accumulated interest for 1975 (periods 1-3) and 1976 (periods 4-15) and what would the remaining balance be at the end of each year?

Sample Problem(s)

Keystrokes:

1 **A** 3 **A** 9 **ENTER** 12 **=** **B**
167.84 **C** 20000 **D** **E** →

R/S →

4 **A** 15 **A** **E** →

R/S →

Outputs:

449.60 (interest paid
in 1975)
19946.08 (remaining balance at
the end of 1975)
1785.89 (interest paid
in 1976)
19717.88 (remaining balance at
the end of 1976)

Example 2:

Generate an amortization schedule for the first two payments of a \$30,000, 7% mortgage having monthly payments of \$200. Then jump ahead and generate the data for the 36th payment.

Keystrokes:

1 **A** 2 **A** 7 **ENTER** 12 **=** **B**
200 **C** 30000 **D** **f** **A** →

R/S →

R/S →

R/S →

R/S →

R/S →

R/S →

R/S →

R/S →

R/S →

Outputs:

1.00 (starting 1st period)
175.00 (payment to interest)
25.00 (payment to principal)
29975.00 (remaining balance)
175.00 (total interest to
date)
2.00 (starting 2nd period)
174.85 (payment to interest)
25.15 (payment to principal)
29949.85 (remaining balance)
349.85 (total interest to
date)

Solution(s)

Keystrokes:

Now let's skip ahead to the 36th payment period.

36 **A** **A** **f** **A** →

R/S →

R/S →

R/S →

R/S →

Outputs:

36.00 (starting 36th period)
169.36 (payment to interest)
30.64 (payment to principal)
29001.75 (remaining balance)
6201.75 (total interest to
date)

Reference(s)

User Instructions

39

1
2

ACCUMULATED INT/REMAINING BAL

→ SCHED
J, K

i

PMT

PV

P?
→ INT; RB

STEP	STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS	UT UNITS	KEYS	OUTPUT DATA/UNITS
	1	Load side 1 and side 2.						
	2	Optional: Select print/pause mode for amortization schedule.		1 E	1.00 or 0.00			
	3	Key in						
		• Starting period number	J	A	J			
		• Ending period number	K	A	K			
		• Periodic interest rate	i (%)	B	i (%)			
		• Periodic payment amount	PMT	C	PMT			
		• Initial loan amount	PV	D	PV			
	4	Compute the total interest paid between periods J and K inclusive, and the remaining balance at the end of period K.		E	INT			
				RS	BAL			
		OR						
	5	Generate the amortization schedule between payments J and K inclusive. If the print/pause mode is on (1.00), the results are printed automatically.		1 A	J			
	6	Calculate amount paid to interest for period J.		RS	PMT to INT			
	7	Calculate amount paid to principal for period J.		RS	PMT to PRIN			
	8	Calculate remaining balance at the end of period J.		RS	BAL			
	9	Calculate total interest paid between periods J thru K inclusive.		RS	TOT INT			
	10	Increment J for next period. If $J \leq K$, go to step 6 for next period's values. Otherwise, stop.		RS	J + 1			
	11	For a new case, go to step 2 and change appropriate input values.						

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11		057	*LBLA	21 16 11	
002	RCL0	36 00		058	RCL7	36 07	
003	ST07	35 07	$J \rightarrow R_7$	059	F07	16 23 00	
004	XZY	-41	$K \rightarrow R_0$	060	SPC	16-11	
005	ST00	35 00		061	GSB9	23 09	
006	RTN	24		062	1	01	
007	*LBLB	21 12		063	RCL1	36 01	
008	EEX	-23		064	+	-55	
009	2	02		065	ST08	35 08	
010	=	-24	$i/100 \rightarrow R_1$	066	RCL7	36 07	
011	ST01	35 01		067	GSB1	23 01	
012	LSTM	16-63		068	ST04	35 04	
013	X	-35		069	RCL8	36 08	
014	RTN	24		070	RCL7	36 07	
015	*LBLC	21 13		071	1	01	
016	ST02	35 02		072	-	-45	
017	RTN	24	$PMT \rightarrow R_2$	073	GSB1	23 01	
018	*LBLD	21 14		074	RCL4	36 04	
019	ST03	35 03		075	-	-45	
020	RTN	24	$PV \rightarrow R_3$	076	ST06	35 06	
021	*LBLE	21 15		077	RCL2	36 02	
022	RCL0	36 00		078	XZY	-41	
023	RCL7	36 07		079	-	-45	INT _J
024	XZY?	16-35		080	GSB9	23 09	
025	ST00	22 00		081	RCL6	36 06	
026	ST00	35 00		082	GSB9	23 09	PRINC _J
027	R4	-31		083	RCL4	36 04	
028	ST07	35 07		084	GSB9	23 09	RBAL _J
029	*LBL0	21 00		085	RCL7	36 07	
030	1	01		086	RCL2	36 02	
031	RCL1	36 01		087	X	-35	
032	+	-55	$(1 + i/100) \rightarrow R_8$	088	RCL3	36 03	
033	ST08	35 08		089	RCL4	36 04	
034	RCL0	36 00		090	-	-45	
035	GSB1	23 01		091	-	-45	
036	ST04	35 04	$BAL_K \rightarrow R_4$	092	GSB9	23 09	TOT INT
037	RCL8	36 08		093	1	01	
038	RCL7	36 07		094	ST+7	35-55 07	
039	1	01		095	RCL0	36 00	
040	-	-45		096	RCL7	36 07	
041	GSB1	23 01	$-BAL_{J-1}$	097	XZY?	16-35	$J \leq K?$
042	CHS	-22		098	ST00	22 16 11	
043	RCL4	36 04		099	RTN	24	
044	+	-55	$BAL_K - BAL_{J-1} \rightarrow R_6$	100	*LBL1	21 01	
045	ST06	35 06		101	CHS	-22	
046	RCL0	36 00		102	YX	31	
047	RCL7	36 07		103	ST05	35 05	
048	-	-45		104	1	01	
049	1	01		105	-	-45	
050	+	-55		106	RCL1	36 01	
051	RCL2	36 02		107	=	-24	
052	X	-35	INT _{J-K}	108	RCL2	36 02	
053	+	-55	BAL _K	109	X	-35	
054	RTN	24		110	RCL3	36 03	
055	RCL4	36 04		111	+	-55	
056	R/S	51		112	RCL5	36 05	

REGISTERS 11E

0	K	1	i/100	2	PMT	3	PV	4	Used	5	Used	6	Used	7	J	8	1+i/100	9	
S0		S1		S2		S3		S4		S5		S6		S7		S8		S9	
A		B		C		D		E		F		G		H		I		J	

41

[illegible]

Program Description I

Program Title Stock Portfolio Valuation

Contributor's Name Hewlett-Packard

Address _____

City _____

State _____

Zip Code _____

Program Description, Equations, Variables Data cards created with a separate data program provide initial purchase price of a stock and the number of shares for a portfolio of any size. Valuation 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(s)	Input	Output	Input
Prompt	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

◀ 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"/>	

User Instructions

1 (Price ↑ Dividends R/S) 2

Initial Totals Print

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"/>	
			<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"/>	
			<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
			<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"/>	
			<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
			<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

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	Set I to 0 for	057	*LBLc	21 16 13	
002	DSP2	-63 02	portfolio register	058	MRG	16-62	
003	1	01	run	059	PSE	16 51	
004	STOI	35 46		060	F3?	16 23 03	
005	*LBL1	21 01	Recall ith	061	GT0A	22 11	
006	RCLi	36 45	historical stock	062	GT0c	22 16 13	Continue prompting
007	X=0?	16-43	data & check for a	063	*LBLB	21 12	with i+18 & loading
008	GT0?	22 07	deleted stock	064	RCLA	36 11	Original portfolio
009	INT	16 34		065	GSB5	23 05	value
010	STOE	35 15		066	RCLB	36 12	New portfolio value
011	LSTX	16-63	Unpack data store	067	GSB5	23 05	
012	FRC	16 44	# of shares in E,	068	%CH	16 55	
013	EEX	-23	calculate and	069	GSB5	23 05	Change in value
014	3	03	store original	070	DSP2	-63 02	
015	x	-35	stock value in D,	071	RCLC	36 13	Total yearly
016	x	-35	and accumulate	072	GSB5	23 05	dividend
017	STOD	35 14	original portfolio	073	LSTX	16-63	
018	RCLA	36 11	value in A	074	=	-24	Total dividend
019	+	-55		075	1	01	
020	STOA	35 11		076	0	00	yield as a % of
021	RCLi	36 46		077	0	00	current value
022	RCL0	36 00	Prompt for current	078	x	-35	
023	+	-55	input	079	GSB5	23 05	
024	F0?	16 23 00		080	P2S	16-51	
025	PRTX	-14		081	RCL9	36 09	Date portfolio
026	R/S	51		082	P2S	16-51	Created
027	RCLC	36 15	Accumulate total	083	DSP6	-63 06	
028	x	-35	dividend in C	084	GSB5	23 05	
029	RCLC	36 13		085	DSP2	-63 02	
030	+	-55		086	R/S	51	
031	STOC	35 13		087	*LBLE	21 15	
032	R4	-31	Normalize price	088	F0?	16 23 00	Print/no print
033	GSBc	23 16 11		089	GT04	22 04	flag set
034	RCLC	36 15		090	SF0	16 21 00	
035	x	-35		091	1	01	
036	RCLB	36 12	Accumulate current	092	RTN	24	
037	X2Y	-41	value in B	093	*LBL4	21 04	
038	+	-55		094	0	00	
039	STOB	35 12		095	CF0	16 22 00	
040	LSTX	16-63	Calculate and	096	RTN	24	
041	RCLD	36 14	display % change	097	*LBL5	21 05	
042	X2Y	-41	in ith stocks value	098	F0?	16 23 00	Print or no
043	%CH	16 55		099	GT06	22 06	print decision
044	GSB5	23 05	print option	100	R/S	51	
045	*LBL2	21 02		101	RTN	24	
046	ISZI	16 26 46	Check for end of	102	*LBL6	21 06	
047	1	01	registers. If	103	PRTX	-14	
048	8	08	less than 18	104	SPC	16-11	Print
049	RCLi	36 46	continue else:	105	RTN	24	
050	X2Y?	16-35		106	R/S	51	
051	GT01	22 01		107	*LBL7	21 07	
052	CF3	16 22 03		108	RCLi	36 46	
053	X2Y	-41		109	RCL0	36 00	Display contents
054	STOI	35 46	Data card merge	110	+	-55	of a 0 register
055	RCL0	36 00	and prompt	111	PSE	16 51	
056	+	-55					

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	I				
Old Port Total	New Port Total	Total Div	Old Stock Val.	# of Shrs.	Used				

97 Program Listing II

47

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
112	X*Y	-41	Return to sequential review				
113	R/S	51		170			
114	GT02	22 02					
115	*LBLa	21 16 11					
116	ENT↑	-21					
117	FRC	16 44					
118	X=0?	16-43					
119	GT0b	22 16 12					
120	EEX	-23					
121	1	01	Convert CC.DN into CC + D/N checking to avoid division by 0.				
122	x	-35		180			
123	INT	16 34					
124	LSTX	16-63					
125	FRC	16 44					
126	=	-24					
127	EEX	-23					
128	1	01					
129	=	-24					
130	X*Y	-41					
131	INT	16 34					
132	*LBLb	21 16 12		190			
133	+	-55					
134	RTN	24					
135	R/S	51					
140							
				200			
150							
				210			
160							
				220			

LABELS					FLAGS	SET STATUS		
A Initil	B Summary	C	D	E Print?	0 Print?	FLAGS	TRIG	DISP
a Fract Dec	b	c	d	e	1	ON OFF		
0	1 Unpack	2 End Check	3 Crd Prmpt	4 Print	2	0 <input checked="" type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input checked="" type="checkbox"/>
5 Print	6 Print	7	8	9	3 Merge	1 <input checked="" type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
						2 <input checked="" type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input checked="" type="checkbox"/> <input type="checkbox"/>		n 2

Program Description I

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 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 of 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

1

NEW

PORTFOLIO

ADD

STOCK

DELETE

STOCK#?

DATE

ASSEMBLED

CORRECT

ENTRY#?

2

(# Shares E↑ Price R/S)

fE

Print/No Print

[illegible]

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	Initialize Sequential data entry	056	XZY	-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	XZY	-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	GSB6	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	Initialize sequential register search for first zero register	066	+	-55	Check for end of registers
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	Recall register to be deleted and display	071	STOI	35 45	Output data
017	GT02	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	Delete (store 0) designed register	076	RCLi	36 46	Clear registers and begin loading data for subsequent card
022	DSP6	-63 06		077	XZY?	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	Store date in register 19	081	0	00	Normalize Price CCC.ND becomes CCC + $\frac{N}{D}$ (Avoids ND = 0)
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	Set I register to store change	086	CLRG	16-53	
032	*LBLD	21 14		087	P2S	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	P2S	16-51	Prompt user with register #	091	RTN	24	
037	STO9	35 09		092	*LBL6	21 16 12	
038	P2S	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	Set I register to store change	096	GT0c	22 16 13	
042	RTN	24		097	EEX	-23	
043	*LBLE	21 15		098	1	01	
044	DSP6	-63 06		099	x	-35	
045	RCL0	36 00		100	INT	16 34	
046	-	-45	Prompt user with register #	101	LSTX	16-63	
047	STOI	35 46		102	FRC	16 44	
048	GSB6	23 16 11		103	÷	-24	
049	DSP2	-63 02		104	EEX	-23	
050	R/S	51		105	1	01	
051	*LBLc	21 16 11	Prompt user with register #	106	÷	-24	
052	RCLi	36 46		107	XZY	-41	
053	RCL0	36 00		108	INT	16 34	
054	+	-55		109	*LBLc	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	TRUE ANNUAL GROWTH RATE (DCF) OF INVESTMENT PORTFOLIO		
Contributor's Name	Ken L. Singer		
Address	2323 Augusta Drive		
City	Houston	State	Texas
		Zip Code	77057

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

55

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

Contributor's Name

Address

City

State

Zip Code

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

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

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

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

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

State

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

User Instructions

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STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
8	To calculate initial rate, press		D	1+1/100
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+1 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+1 ₂ /100***
				1 ₂ (%)
	(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			

67Program Listing I

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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≠Y	35 52	Amount in y; Date in X		h LSTX	35 82	Bring back I
	↑	41	MM.YYYY in X & Y Regs.		+	61	I - NI
	g FRAC	32 83	.YYYY in X Reg.	060	2	02	(I - NI)/24
	-	51	MM		4	04	= (I' - NI')/2
	h LST X	35 82	Bring back .YYYY		÷	81	
	EEX	43			g GSB fe	32 22 15	Calculate -n'
	4	04	YYYY		+	61	$\bar{n} = -n' + [(I' - NI')/2]$
	X	71			RCL 6	34 06	Amnt in X; \bar{n} in y Reg.
010	h X≠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	fraction of year		0	00	
	÷	81	= MM/12		STO 1	33 01	Initialize
	+	61	YYYY. fraction		STO 2	33 02	TDW & TDP
	RCL 5	34 05	Eval. Date (0 in Pass 1)	070	h X≠Y	35 52	0 in y; mkt value in X
	h X≠Y	35 52			-	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	
	f LBL A	31 25 11	Initialize		STO 3	33 03	Not series
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	080	-	51	-n' - (I'N - I') or -n
	CHS	42	Convert Eval. Date		RCL (i)	34 24	
	STO 5	33 05	from MM.YYYY to		h X≠Y	35 52	±PV = ±Amount
	RCL 1	34 01	Yr. fraction & store		h y ^x	35 63	$x(1 + i/100)^{-n}$
	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	Σ 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≠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	090	STO - 1	33 51 01	Σ - (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	
040	h Rb	35 53	WDL; Go to LBL 1		2	02	I' = I/12
	STO - 4	33 51 04	Σ PMT		÷	81	
	h RTN	35 22	(-n)(PMT) to X Reg		X	71	I'N
	f LBL 1	31 25 01	Σ - (-n)(PMT)		STO 3	33 03	
	STO - 1	33 51 01	Display - (n)(PMT)	100	RCL (i)	34 24	(1 + i/100) in X; I'N in y
	h Rb	35 53	WDL		h LSTX	35 82	Bring back I'
	STO + 3	33 61 03	Σ - (-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	
	f LBL C	31 25 13	Σ (-n)(-WDL)		1	01	A = [1 + i/100] ^{I'} - 1
	h F? 0	35 71 00	Display (n)(WDL)		-	51	
050	GTO fc	22 31 13	Series		h X≠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 Rb	35 53	Flag 0 set. Pass 2 or 3		h X≠Y	35 52	(1 + i/100) in y; I'N in X
	h X≠Y	35 52	Pass 1. Temp. store amnt.		h y ^x	35 63	
	STO x 6	33 71 06	N in X Reg; I in y Reg;	110	1	01	B = (1 + i/100) ^{I'N} - 1
	CHS	42	date in Z Reg.		-	51	
	h X≠Y	35 52	(N)(PMT) or (N)(-WDL)		h X≠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			

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 × (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	$X_p = [Σ(PMT \times n)] / TP$		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 for i_1
	RCL 1	34 01	$X_w = [Σ(WDL \times n)] / TW$		h STI	35 33	
	÷	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 for i_2
	RCL (i)	34 24	$(1 + i/100)$ or $(1 + i_1/100)$		h STI	35 33	
	RCL 6	34 06	$A = \log(TW/TP)$		3	03	
	f LOG	31 53			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 pass 2 or 3 flag
	÷	81	$B = \log \left[\frac{(TW/TP)}{(TDP/TDW)} \right]$		h CF 1	35 61 01	Clear pass 3 flag
	RCL 1	34 01			1	01	
	X	71		200	h RTN	35 22	Display Pass 1
	f LOG	31 53					
	÷	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					
	RCL 7	34 07		210			
	-	51	$A = [(i_1/100) - (i/100)]^2$				
	↑	41					
	X	71					
	h LSTX	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	Yes. Set B=1				
	1	01					
	f LBL 6	31 25 06					

LABELS

A Start	B Lump Sum	C Series	D Calc. Rate	E Next Pass
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
0 Pass 1 Common	1 Pass 1 WDL	2 Pass 2 or 3 Common	3 Pass 2 or 3 WDL	4
5 Pass 3 Final Rate	6 used	7	8 Current Pass 2 or 3	9 Current Pass 1

FLAGS

0 Pass 2 or 3	1 Pass 3	2	3
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SET STATUS

Program Description I

Program Title DIET PLANNING

Contributor's Name Hewlett-Packard Company

Address 1000 N.E. Circle Boulevard

City Corvallis

State Oregon

Zip Code 97330

Program Description, Equations, Variables Most diet plans emphasize energy input, or counting calories in the food to be eaten, without enough regard for the individual's energy output, or the calories/day required. Since calculation of caloric needs is tedious, it is usually ignored, with reliance on some fixed-calorie diet instead. However, weight gain or loss is determined by the relationship between energy input and energy output.

This program estimates an individual's basal metabolism (energy requirement necessary to keep the body alive, at rest, with no weight change, at 20°C.) based upon height, weight, age, and sex. Next the required calories/day to maintain the current weight are estimated from the basal metabolism and the hours/day spent at each of five activity levels. Finally the required calories/day to lose (or gain) weight at the desired rate are estimated from the caloric content of body fat. Inputs may be in either English or metric units, and are automatically converted, if necessary. Knowledge of one's daily calorie requirement allows for more rational diet planning.

Fad diets may result in weight loss, but do not establish good eating habits which will allow maintenance of the desired weight. Good diets maintain a balance of food types, so that nutritional requirements are met. A balanced diet would contain at least 12 to 14% protein and not over 35% fat, with the rest being carbohydrate. (Note that protein and carbohydrate have 4 calories/gram, while fat has 9 calories/gram. Therefore 35% of a diet's calories may be given by about 19% by weight of fat). For best health, the carbohydrates should be primarily natural carbohydrates rather than the highly refined sugars and white flour.

The actual diet to use is left to the user. Many diet manuals have lists of the calorie content of various foods; so long as your calorie input is less than your calorie requirement, you will lose weight (and vice versa). While these calorie requirement estimates are not exact, they should help the dieter to modify diet and/or activities so as to move towards and maintain the desired weight.

Operating Limits and Warnings Individual differences may cause the estimates of basal metabolism and calorie needs to vary by $\pm 10\%$ from their absolute values; however, once the deviation is established, it should remain consistent.

Age must be from 5 to 80 years, inclusive.

In this program, the term "calories" actually means "kilocalories", as is commonly the case when referring to the energy content of foods.

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 DIET PLANNING

(Cont.)

Contributor's Name _____

Address _____

City _____

State _____

Zip Code _____

Program Description, Equations, Variables

Programming

This program first calculates body surface area in sq. meters, using the equation:

$$SA = W^{.425} \times H^{.725} \times 0.007184$$

Weight and height values are converted to metric units before calculation, if necessary. The program then refers to tables of basal metabolism rate (BMR)/sq. meter/hour vs. age (one table for each sex). These tables (in R6) cover ages from 5 years to 80 years. Flag 1 determines whether the male or the female table is selected from R6. Since both tables start at "49" for 5 years, it was possible to store only the differences between the ages of 5, 10, 20, 40, and 80 years. These ages were chosen to match changes in the slope of the curve of BMR/m²/hr. vs. age. The program determines in which interval the entered age lies, then performs a linear interpolation of the BMR for the exact age. Thus a table look-up with interpolation fits data that are not reducible to a simple equation.

The product of the interpolated tabular value and the surface area gives the BMR/hr., and multiplying by 24 gives the basal metabolism in calories/day.

Next, to find the total required calories/day, the number of hours at each of five levels of activity is multiplied by its estimated calorie requirement and accumulated. Total hours must equal 24, or no answer is given. Calories/hour are assumed to be at the BMR for sleeping, and at 80, 160, 240, 320 calories/hr./70 kg. body weight for the other four levels of activity. While very strenuous exercise may require over 320 calories/hour, such exercise is normally not sustained for one hour.

Finally, if a weight change is desired, the Δ weight and the time (in weeks) to make the change are combined to calculate a new total required calories/day to give the desired rate of weight change. Body fat is assumed to contain 3,500 calories/pound (instead of the 4,100 calories/pound for pure fat) because of its water content. Kilograms are converted to pounds, if necessary.

OPERATING LIMITS AND WARNINGS

In the original reference article, note that the surface area equation has the exponents reversed in the text, but has the correct equation in line No. 305 of the BASIC language program. Also note that in the program DATA listing, the last number in line No. 359 should be "37.9" instead of "39.7".

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) Calculate Diet Planning data in English units for a man, 70 inches height, 170 lbs. weight, 35 years old, who sleeps 8 hrs., sits 4 hrs., stands 8 hrs., walks 3 hrs., exercises 1 hr., and wants to lose 10 lbs. in 8 weeks.

Solution:

Operation

Enter Program, Part 1	--	--	--
Initialize	E	0.00	--
Set for Male	[f] [A]	0.00	--
Set for English units	[f] [A]	0.00	--
Ht. - 70 in., Wt. - 170 lb.,	70, [ENTER], 170,		
Age - 35 yr.	[ENTER], 35, [A]	1708.	Basal Metabolism, Cal./day
Set for Total Req. Cal./day	[C]	0.	Activity # for Hrs. to Enter
Enter 8 hrs. Sleep	8, [R/S]	1.	" " " " " "
Enter 4 hrs. Sitting	4, [R/S]	2.	" " " " " "
Enter 8 hrs. Standing	8, [R/S]	3.	" " " " " "
Enter 3 hrs. Walking	3, [R/S]	4.	" " " " " "
Enter 1 hr. Exercise	1, [R/S]	3484.	Cal./day to Maintain Weight
Diet 8 wk. for 10 lb. loss	8, [ENTER], 10,		
	[CHS], [D]	2859.	Cal.day to Lose Weight at
			Rate of 10 lb. in 8 wk.

Reference(s) Martin Cl. Beattie, M.D. "BASIC Diet Planning" Interface Age
Vol. 1, No. 11 October, 1976 pp. 26-42

This program is a translation of the HP-65 Users' Library Program #05351A
submitted by Delmer D. Hinrichs.

User Instructions

1

Male
Female
Metric
English

DIET PLANNING

2

1

Basal Met
Cal/Day
Diet
Init

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1	Load side 1 and side 2		<input type="text"/>	<input type="text"/>	
2	Initialize		E	<input type="text"/>	0.00
3	Set for Male or Female: Male:		f	A	
	or Female		f	B	
4	Set for Metric or English unit: Metric:		f	C	
	or English:		f	D	
5	Enter Personal Data and Calc. Basal Metabolism		<input type="text"/>	<input type="text"/>	
	a) Height (centimeters or inches):	Height	ENT	<input type="text"/>	Height
	b) Weight (kilograms or pounds):	Weight	ENT	<input type="text"/>	Weight
	c) Age (5 to 80 years):	Age	A	<input type="text"/>	BM, Cal/day
6	Set for Required Cal./Day for Current Weight		C	<input type="text"/>	0.
7	Enter Hours for Activity No. Displayed:		<input type="text"/>	<input type="text"/>	
	0) Sleeping or Resting, hours/day:	Sleep	R/S	<input type="text"/>	1.
	1) Sitting, hours/day:	Sitting	R/S	<input type="text"/>	2.
	2) Standing or Light Activity, hours/day:	Standing	R/S	<input type="text"/>	3.
	3) Walking or Moderate Activity, hrs./day:	Walking	R/S	<input type="text"/>	4.
	4) Exercising or Heavy Work, hours/day:	Exercise	R/S	<input type="text"/>	Req. Cal/day
	(If total hours do not equal 24, program will return to Step 6 and display "0.". If this occurs, reenter activity hours correctly.)		<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
8	Enter Diet Data, to Calculate Required Cal./day for desired rate of weight loss (or gain):		<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
	a) Length of Diet Plan, weeks:	Length	ENT	<input type="text"/>	Length
	b) Desired Weight Change (kilo. or pound):	Δ Weight	D	<input type="text"/>	Reg. Cal/day
	(Δ Weight must be negative for loss, positive for gain.)		<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
9	For a New Problem, go to Step 3.		<input type="text"/>	<input type="text"/>	
			<input type="text"/>	<input type="text"/>	
	<u>Notes:</u>		<input type="text"/>	<input type="text"/>	
	1. As required calories/day will change with weight change, results should be recalculated each week for new weight.		<input type="text"/>	<input type="text"/>	
	2. Steps (5), (6&7), and (8) may be recalculated as desired to see the effect of changing parameters.		<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

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLE	21 15	Initialize:	057	GSBB	23 12	
002	.	-62		058	Z	02	Total Activity Hrs.
003	7	07		059	4	04	Total Hrs. = 24?
004	2	02		060	RCL9	36 09	
005	5	05		061	X*Y?	16-32	
006	ST01	35 01	Height Exponent	062	GT00	22 13	No, Ret. and Try Aga.
007	.	-62		063	R↓	-31	Yes, Recall Cal/Day
008	4	04		064	R↓	-31	
009	2	02		065	ST09	35 09	
010	5	05		066	PRTX	-14	
011	ST02	35 02	Weight Exponent	067	RTN	24	Display Req. Cal/Day
012	7	07		068	*LBLD	21 14	Calc. Req Cal/Day
013	1	01		069	F0?	16 23 00	Metric?
014	8	08		070	GSB4	23 04	Yes, Convert to lb.
015	4	04		071	X*Y	-41	No, Continue
016	EEA	-23		072	+	-24	Δ Pounds/Week
017	6	06		073	5	05	
018	CHS	-22		074	EEA	-23	
019	ST03	35 03	Surface Area Const	075	Z	02	
020	2	02		076	X	-35	Δ Calories/Day
021	.	-62		077	RCL9	36 09	Cal/Day for Cur.Wt.
022	5	05		078	+	-55	Display Diet Cal/Day
023	4	04		079	PRTX	-14	
024	ST04	35 04	Centimeters/Inch	080	RTN	24	
025	2	02		081	*LBL4	21 04	
026	.	-62		082	RCL5	36 05	
027	2	02		083	X	-35	
028	ST05	35 05	Pounds/Kilogram	084	RTN	24	
029	.	-62		085	*LBLB	21 12	Subroutine to Incre.
030	0	00		086	R/S	51	hours & Calories
031	5	05		087	ST+9	35-55 09	Display Activity No.
032	6	06		088	X*Y	-41	Increment Hours
033	2	02		089	8	08	
034	3	03		090	0	00	
035	0	00		091	X	-35	Activity No. X 80
036	7	07		092	RCL6	36 06	Weight Factor
037	7	07		093	X	-35	
038	0	00		094	X	-35	
039	4	04		095	+	-55	Increment Calories
040	CHS	-22	Condensed BMR/m ² .	096	RTN	24	
041	ST06	35 06	Table for Mal&Fem	097	*LBLA	21 11	Calc. Basal Metab:
042	*LBLC	21 13	Calculate Req.	098	ST09	35 09	Store Age
043	RCL7	36 07	Cal./Day for	099	R↓	-31	
044	0	00	Current Weight	100	F0?	16 23 00	Metric?
045	R/S	51	Stop & Display "0."	101	ST01	22 01	Yes, Continue
046	ST09	35 09	Hours of Sleep	102	RCL5	36 05	No, Convert to
047	X*Y	-41		103	+	-24	Kilograms
048	R↓	-31		104	*LBL1	21 01	
049	X	-35	Increment Hrs. &	105	ST08	35 08	
050	1	01	Cal. for each	106	RCL2	36 02	Weight (.425)
051	GSBB	23 12	Activity	107	Y*	31	
052	2	02		108	X*Y	-41	Metric?
053	GSBB	23 12		109	F0?	16 23 00	Yes, Continue
054	3	03		110	GT02	22 02	No, Convert to
055	GSBB	23 12		111	RCL4	36 04	Centimeters
056	4	04		112	X	-35	

REGISTERS

0	1	2	3	4	5	6	7	8	9
	Ht. Exp.	Wt. Exp.	SA Factor	CM/Inch	Lb./Kg.	BMR/m ² Table	BMR Cal./Hr.	Wt. Fac.	Used
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
A	B	C	D	E	I				

97 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	*LBL2	21 02		169	R↓	-31	Display Basal Metab
114	RCL1	36 01		170	*LBL6	21 06	Subroutine
115	Y*	31	Height (.425)	171	2	02	
116	RCL3	36 03		172	X	-35	
117	X	-35		173	EE*	-23	
118	X	-35		174	1	01	
119	ST07	35 07	Surface Area, Sq. m	175	R↑	16-31	
120	1	01	BMR/m ² Tables, M&F	176	X	-35	
121	RCL6	36 06		177	INT	16 34	
122	F1?	16 23 01	Male?	178	RTN	24	
123	GT03	22 03		179	*LBLa	21 16 11	Male
124	EE*	-23	No, Enter 10 ⁵	180	SF1	16 21 01	
125	5	05		181	RTN	24	
126	*LBL3	21 03	Multiply by 1 or	182	*LBLb	21 16 12	Female
127	X	-35	10 ⁵	183	CF1	16 22 01	
128	FRC	16 44		184	RTN	24	
129	4	04	49, First Tabular	185	*LBLc	21 16 13	Metric
130	9	09	BMR/m ²	186	SF0	16 21 00	
131	ENT1	-21		187	RTN	24	
132	5	05	5, First Tabular	188	*LBLd	21 16 14	English
133	ENT↑	-21	Age	189	CF0	16 22 00	
134	*LBL0	21 00	Loop to Find Portio	190	RTN	24	
135	CLX	-51	of Table to Use	191	R/S	51	
136	GSB5	23 05					
137	R↑	16-31					
138	LSTX	16-63					
139	FRC	16 44					
140	R↓	-31					
141	+	-55					
142	X↑Y	-41					
143	RCL9	36 09					
144	X↑Y?	16-34	Corect Part of Tab.	200			
145	GT00	22 00	No, Ret. & Try Agn.				
146	X↑Y	-41					
147	-	-45					
148	LSTX	16-63					
149	÷	-24	Interpolate				
150	GSB6	23 06					
151	X	-35					
152	LSTX	16-63					
153	+	-55		210			
154	+	-55					
155	RCL7	36 07	Surface Area				
156	X	-35					
157	ST07	35 07	BMR, Calories/Hour				
158	7	07					
159	0	00					
160	ST÷8	35-24 08	Weight Fac. (Kg./70)				
161	CLX	-51					
162	2	02					
163	4	04					
164	X	-35	BM, Calories/Day	220			
165	DSP0	-63 00					
166	PRTX	-14					
167	RTN	24					
168	*LBL5	21 05					

LABELS					FLAGS		SET STATUS		
A Basal	B	C Cal/Day	D Diet	E Init.	0 Units	1 Sex	FLAGS	TRIG	DISP
a Male	b Female	c Metric	d English	e			ON OFF		
0 Used	1 Used	2 Used	3 Used	4 Used	2		0 <input type="checkbox"/> <input type="checkbox"/>	DEG <input type="checkbox"/>	FIX <input type="checkbox"/>
5 Used	6 Used	7	8	9	3		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"/>
							3 <input type="checkbox"/> <input type="checkbox"/>		n _____

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