HEWLETT-PACKARD

HP-67/HP-97

Users' Library Solutions

Real Estate Investment

INTRODUCTION

In an effort to provide continued value to it's 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.

TABLE OF CONTENTS

Program Description I

Program Title Mortgage Yield

Contributor's Name Jack B. Buster

Address P. O. Box 8062

City Anchorage **State** Alaska **Zip Code** 99508

Program Description, Equations, Variables By injecting the periodic (monthly) interest rate of a mortgage (STO B), the monthly payment amount (STO C), the amount owing on the mortgage (STO D) and the purchase price of the note (STO 0), the following calculations are possible:

Total amortization period (Press A)

Full term yield (Press B)

Yield at a specified point in time (Enter months to prepayment, press C)

Yield at a specified prepaying balloon (Enter balloon and press D) - Then C

Successive yields at different prepayment points (After C then enter months and R/S)

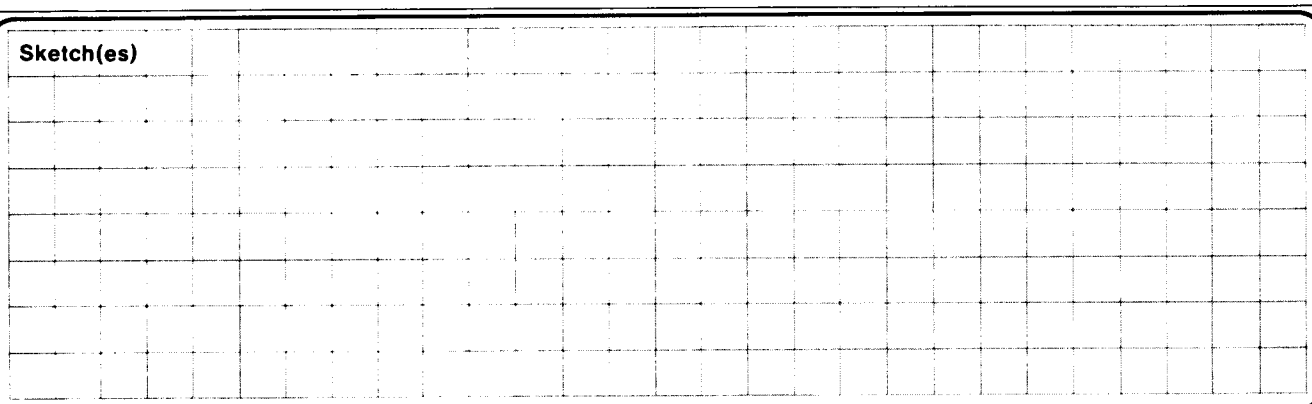
Total amount of prepaying Balloon, total amount of accumulated monthly payments and total amount of cash paid on the mortgage. (Press E)

This program provides the basic tool for analysis of mortgage performance and creation of desired data to be specified by the user. The field and the application of the calculations possible with this program are too widespread to be encompassed completely herein and are therefore left to the development of the user.

Operating Limits and Warnings Label C is not totally interactive with Labels A, B,D and E. Information desired from Labels A, B and D must be obtained before going to C. After C is pressed, only the routine contained in Label E and another loop through C is possible(by pressing R/S) . An attempted A, B or D calculation after a C routine is run will give meaningless information.

Program Description II

Sketch(es)



Sample Problem(s) *Given a $11,125 mortgage payable at $140 per month including 8.5% interest purchased for $7,200 cash. Analyze the mortgage with the use of this program finding total amortization period, full term yield, yield if prepaid when remaining balance is $5,000 and construct a chart of performance at 24 month intervals.*

SOLUTION:

Initialize f a

Load data: 8.5 ÷ 12 = .71 STO B 140 STO C 11125 STO D 7200 STO 0

Amortization period - - - Press A - - - - = 117.24 months

Full Term Yield - - - - - Press B - - - - = 19.96% (Pressing A before B is not necessary)

Yield if prepaid when balance is $5,000 - - - key in 5000 - - - Press D - - = 75.92 months

Press C - - = 20.98%

Total cash paid at this point - - Press E - - 5000.00 (Balloon) - 10,628.00 (Amount received in monthly payments to this point - 15,628.00 (Total cash paid on mortgage)

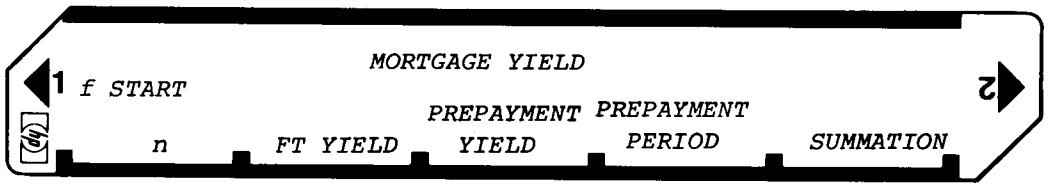
Solution(s) *Construct a chart of performance at 24 month intervals:*

Initialize and reload data as above.

Mos from purchase to prepayment	Yield	Balloon Amount	Payments Received	Cash Received
Enter 24 [C]	34.76% Press [E]	9530.16	3360.00	12890.16
Enter 48 [R/S]	24.25% Press [E]	7640.91	6720.00	14360.91
Enter 72 [R/S]	21.24% Press [E]	5402.92	10080.00	15482.92
Enter 96 [R/S]	20.18% Press [E]	2751.81	13440.00	16191.81
Enter 117.24 [R/S]	19.96% Press [E]	.13	16413.60	16413.73

Reference(s) *This program was developed from the HP-67 standard pac program L05-03, Annuities and Compound Amounts, and the HP-80 reference book, Real Estate Applications.*

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1	Load side 1 and side 2				
2	Initialize		f	A	0.00
3	Enter data as follows:				
	Monthly interest rate		STO	B	i
	Monthly payment	Dollars	STO	C	PMT
	Amount of mortgage	Dollars	STO	D	PV
	Purchase price of mortgage	Dollars	STO	0	PP
4	CALCULATE:				
	a. Total amortization period			A	Months
	b. Full term yield			B	Per-cent
	c. Months to specified balance	Dollars		D	Months
	d. Yield at specified point	Months		C	Per-cent
	e. Cash totals: (i) Balloon Payment			E	Dollars
	(ii) Accumulated Payments				Dollars
	(iii) Total Cash Received				Dollars
	f. Yields at successive points:				
	Key in point at which yield desired	Months		C	Per-cent
	Key in next point	Months		R/S	Per-cent

67 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS
001 *	f LBL A	31 25 11	
	0	00	
	STO A	33 11	
	GSB 0	31 22 00	
	RCL E	34 15	
	LST X	35 82	
	-	51	Figure
	RCL D	34 14	
	LST X	35 82	Amortization
010	-	51	
	÷	81	Period
	f LN	31 52	
	RCL 7	34 07	
	f LN	31 52	
	÷	81	
	STO A	33 11	
	h RTN	35 22	
*	f LBL 4	31 25 04	
	1	01	Figure
020	STO D	33 14	Balloon Amount
	f GSB 0	31 22 00	
	STO D	33 14	
	h RTN	35 22	
*	f LBL 0	31 25 00	
	1	01	
	STO 5	33 05	Calculation
	RCL B	34 12	
	f %	31 82	Routine
	STO 9	33 09	
030	+	61	
	STO 7	33 07	
	RCL A	34 11	
	CHS	42	
	y^x	35 63	
	STO 8	33 08	
	RCL E	34 15	
	X	71	
	1	01	
	RCL 8	34 08	
040	-	51	
	STO 4	33 04	
	RCL C	34 13	
	RCL 9	34 09	
	÷	81	
	STO 3	33 03	
	RCL 5	34 05	
	X	71	
	X	71	
	h RTN	35 22	
050 *	g LBL a	32 25 11	
	CL REG	31 43	Initialize
	P ≥ S	31 42	
	CL REG	31 43	
	CL X	44	
	h RTN	35 22	
*	*f LBL 3	31 25 03	
	0	00	
	STO B	33 12	
	2	02	
060	1	01	
	ST I	35 33	Figure
	RCL E	34 15	
	RCL A	34 11	Yield
	RCL C	34 13	
	X	71	Routine
	+	61	
	RCL D	34 14	
	-	51	
	RCL A	34 11	
070	÷	81	
	RCL D	34 14	
	÷	81	
	.	83	
	9	09	
	CHS	42	
	x ≤ y	32 71	
	x ≥ y	35 52	
	f GSB 5	31 22 05	
	x = 0	31 51	
080	h RTN	35 22	
*	f LBL 6	31 25 06	
	f GSB 0	31 22 00	
	+	61	
	RCL D	34 14	
	-	51	
	RCL 8	34 08	
	RCL A	34 11	
	RCL 7	34 07	Calculate f(i) and
	÷	81	
090	X	71	f'(i)
	STO 6	33 06	
	RCL 4	34 04	
	RCL 9	34 09	
	÷	81	
	-	51	
	RCL 5	34 05	
	X	71	
	RCL C	34 13	
	X	71	
100	RCL 9	34 09	
	÷	81	
	RCL 6	34 06	
	RCL E	34 15	
	X	71	
	-	51	
	÷	81	
	CHS	42	
	f GSB 5	31 22 05	
	RCL B	34 12	
110	÷	81	
	f RND	31 24	
	x ≠ 0	31 61	

REGISTERS

0	1	2	3	4	5	6	7	8	9
Price	Used	Used	$\pm \frac{PMT}{i}$	$\frac{-n}{(1-(1+i)}$	1 or 1+i	$\frac{-n-1}{n(1+i)}$	1+i	$1+i^{-n}$	i/100
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
			i	Balloon					

A	B	C	D	E	I
n	i	PMT	PV	Balloon	Used

67 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS
	GTO 6	22 06	
	RCL B	34 12	
	h RTN	35 22	
*	f LBL 5	31 25 05	Convert to % and add to R_B
	EEX	43	
	2	02	
	X	71	
120	STO + (i)	33 61 24	
	h RTN	35 22	
*	f LBL C	31 25 13	Control routine for prepayment yield
	STO 1	33 01	
	P≷S	31 42	
	RCL B	34 12	
	STO 4	33 04	
	P≷S	31 42	
	f GSB A	31 22 11	
	STO 2	33 02	
130	RCL 1	34 01	
	-	51	
	STO A	33 11	
	f LBL 9	31 25 09	
	f GSB 4	31 22 04	
	STO E	33 15	
	RCL 0	34 00	
	STO D	33 14	
	RCL 1	34 01	
	STO A	33 11	
140	f GSB 3	31 22 03	
	1	01	
	2	02	
	X	71	
	f LBL 2	31 25 02	Successive prepayment yield loop
	R/S	84	
	STO 1	33 01	
	RCL 2	34 02	
	x≷y	35 52	
	-	51	
150	STO A	33 11	
	P≷S	31 42	
	RCL 4	34 04	
	P≷S	31 42	
	STO B	33 12	
	GTO 9	22 09	
*	f LBL E	31 25 15	Summation routine
	RCL E	34 15	
	-x-	31 84	
	RCL 1	34 01	
160	RCL C	34 13	
	X	71	
	-x-	31 84	
	+	61	
	-x-	31 84	
	GTO 2	22 02	
*	f LBL B	31 25 12	
	f GSB A	31 22 11	
	RCL B	34 12	

STEP	KEY ENTRY	KEY CODE	COMMENTS
	STO 1	33 01	
170	RCL D	34 14	
	STO 2	33 02	
	RCL 0	34 00	
	STO D	33 14	
	f GSB 3	31 22 03	
	RCL 2	34 02	
	STO D	33 14	
	RCL 1	34 01	
	STO B	33 12	
	R↓	35 53	
180	R↓	35 53	
	1	01	
	2	02	
	X	71	
	h RTN	35 22	
*	f LBL D	31 25 14	Figure Prepayment Period
	E+	21	
	f GSB A	31 22 11	
	STO 1	33 01	
	RCL D	34 14	
190	STO 2	33 02	
	RCL E+	34 21	
	STO D	33 14	
	f GSB A	31 22 11	
	RCL 1	34 01	
	STO A	33 11	
	-	51	
	CHS	42	
	RCL 2	34 02	
	STO D	33 14	
200	x≷y	35 52	
	h RTN	35 22	
210			
220			

LABELS

A n	B FT Yield	C prepaid yield	D prepay period	E Summation	0
a Initialize	b	c	d	e	1
0 Calculate	1	2	3 i routine	4 PV routine	2
5 % routine	6 iterate	7	8	9	3

FLAGS

SET STATUS

FLAGS			TRIG	DISP
	ON	OFF		
0	☐	☒	DEG ☒	FIX ☒
1	☐	☒	GRAD ☐	SCI ☐
2	☐	☒	RAD ☐	ENG ☐
3	☐	☒		n 2

Program Description I

Program Title *Mortgage Pricing No. 1*

Contributor's Name *Jack B. Buster*
Address *P. O. Box 8062*
City *Anchorage* **State** *Alaska* **Zip Code** *99508*

Program Description, Equations, Variables

This program will calculate the price of a mortgage which involves two different payment streams one of which is monthly and the other user selectable. The program will compensate for mortgages with a monthly payment too low to amortize the balance in the absence of the periodic balloon. Insertion of one step will allow the user to determine the total amortization period. Required data for input is as follows:

Interest rate of mortgage
Monthly payment amount
Present value of mortgage
Desired yield
Periodic balloon period
Periodic balloon amount
Number of months until first balloon

Operating Limits and Warnings

None known

Program Description II

Sketch(es)

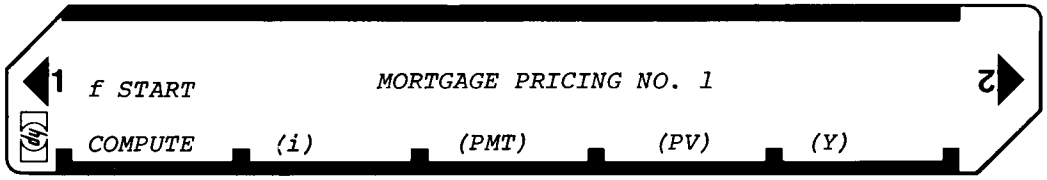
Sample Problem(s) *Purchaser desires to purchase mortgages for 24% yield. He is asked to purchase a mortgage with a face value of $12,000.00 payable at $80 per month with a balloon payment of $1,000 each June all to include 9% interest. The purchase date will be August.(10 months to first balloon payment)*

Solution(s) *Keystrokes:*

[f] [A]	*0.00*	
[9] [ENTER] [1] [2] [÷] [STO] [B]	*0.75*	*(Interest rate)*
[8] [0] [STO] [C]	*80.00*	*(Monthly payment)*
[1] [2] [0] [0] [0] [STO] [D]	*12000.00*	*(Present value)*
[2] [4] [STO] [E]	*24.00*	*(Desired yield)*
[1] [0] [0] [0] [STO] [0]	*1000.00*	*(Annual balloon)*
[1] [0] [STO] [1]	*10.00*	*(Months to 1st balloon)*
[A] (1 minute 20 seconds)	*7060.63*	*(Mortgage price)*

Reference(s) *Additional comments. The program operates by considering the two income streams from the mortgage separately. The first section keeps track of the number of payments until the balance is low enough to amortize on the monthly payment alone. Then a loop is established alternately decrementing the pay off period by the number of months per balloon and the balance by the balloon amount. Finally, each stream is evaluated at the desired yield and the periodic stream adjusted to mortgage purchase date.*

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2			
2	Initialize		f A	0.00
3	Calculate & enter monthly interest rate	(i)	STO B	i/12
4	Enter monthly payment amount	(PMT)	STO C	PMT
5	Enter present value of mortgage	(PV)	STO D	PV
6	Enter desired yield as a percent	(Y)	STO E	Y
7	Enter periodic balloon payment amount		STO 0	
8	Enter months until first balloon payment		STO 1	
9	Enter months of balloon period		STO 2	
	(Omit step if balloon period is 12 months)			
10	Compute price		A	
	The total amortization period in months is available in r_6.			

67 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS
001	f LBL A	31 25 11	
	RCL D	34 14	
	RCL B	34 12	Will note amortize without balloon?
	f %	31 82	
	RCL C	34 13	
	g x>y	32 81	
	GTO 5	22 05	If yes skip rest.
	F? 1	35 71 01	First loop?
	GTO 6	22 06	
010	-	51	
	RCL 1	34 01	
	f LBL 8	31 25 08	
	X	71	
	RCL 0	34 00	
	h x≷y	35 52	
	-	51	
	RCL D	34 14	
	h x≷y	35 52	
	-	51	
020	STO D	33 14	
	1	01	Increment balloon counter.
	E+	21	
	RCL 2	34 02	
	STO + 6	33 61 06	
	SF 1	35 51 01	
	GTO A	22 11	If no try again
	f LBL 5	31 25 05	
	GSB E	31 22 15	Compute term
	RCL 1	34 01	
030	STO + 6	33 61 06	
	RCL E+	34 21	
	f x=0	31 51	
	GTO 7	22 07	
	RCL A	34 11	
	RCL 2	34 02	
	-	51	
	f LBL 2	31 25 02	
	STO A	33 11	
	RCL 2	34 02	
040	STO + 6	33 61 06	
	GSB D	31 22 14	Compute balance
	RCL 0	34 00	
	g x>y	32 81	Is balloon larger?
	GTO 3	22 03	
	-	51	
	STO D	33 14	
	1	01	Increment balloon counter.
	E+	21	
	GSB E	31 22 15	Compute new term
050	RCL 2	34 02	
	g x>y	32 81	Need balloon?
	GTO 4	22 04	
	-	51	
	GTO 2	22 02	
	f LBL 3	31 25 03	
	h x≷y	35 52	
	STO 5	33 05	
	GTO 1	22 01	
	f LBL 4	31 25 04	
060	h x≷y	35 52	
	STO + 6	33 61 06	
	f LBL 1	31 25 01	
	RCL 6	34 06	
	RCL 2	34 02	
	-	51	
	STO A	33 11	Compute discounted value of monthly income stream.
	RCL E	34 15	
	1	01	
	2	02	
070	÷	81	
	STO B	33 12	
	GSB D	31 22 14	
	STO + 5		Hold total
	RCL E+	34 21	
	STO A	33 11	Compute value of periodic income steam.
	RCL E	34 15	
	STO B	33 12	
	RCL 0	34 00	
	STO C	33 13	
080	GSB D	31 22 14	
	RCL E	34 15	
	1	01	
	2	02	Set up and compute present value of discounted periodic income stream adjusted to purchase date
	÷	81	
	STO B	33 12	
	h x≷y	35 52	
	STO E	33 15	
	RCL 1	34 01	
	1	01	
090	2	02	
	÷	81	
	STO A	33 11	
	0	00	
	STO C	33 13	
	g GSB d	32 22 14	GTO calculate routine
	RCL 5	34 05	Add partial totals and show price.
	+	61	
	h RTN	35 22	
	f LBL 0	31 25 00	Calculate routine for terms and balances
100	1	01	
	ST I	35 33	
	RCL B	34 12	
	f %	31 82	
	STO 9	33 09	
	+	61	
	STO 7	33 07	
	RCL A	34 11	
	CHS	42	
	y^x	35 63	
110	STO 8	33 08	
	1	01	
	RCL 8	34 08	

REGISTERS

0 Balloon amount	1 mos. to 1st ball.	2 term of balloon	3 used	4 used	5 partial total	6 monthly payments	7 used	8 used	9 used
S0	S1	S2	S3	S4 balloon counter	S5	S6	S7	S8	S9

A	B	C	D	E	I
Mortgage term	interest rate	monthly payment	balance	yield	used

67 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS
	-	51	
	STO 4	33 04	
	RCL C	34 13	
	RCL 9	34 09	
	÷	81	
	STO 3	33 03	
	h RC I	35 34	
120	x	71	
	x	71	
	h RTN	35 22	
	g LBL a	32 25 11	Initialization routine.
	f CL REG	31 43	
	f P≥S	31 42	
	f CL REG	31 43	
	1	01	
	2	02	
	STO 2	33 02	
130	h CF 1	35 61 01	
	CL X	44	
	h RTN	35 22	
	f LBL E	31 25 15	Calculation routine for term of mortgage.
	0	00	
	STO A	33 11	
	f GSB 0	31 22 00	
	0	00	
	LST X	35 82	
	-	51	
140	RCL D	34 14	
	LST X	35 82	
	-	51	
	÷	81	
	f LN	31 52	
	RCL 7	34 07	
	f LN	31 52	
	÷	81	
	STO A	33 11	
	h RTN	35 22	
150	f LBL D	31 25 14	Remaining balance routine.
	1	01	
	STO D	33 14	
	f GSB 0	31 22 00	
	STO D	33 14	
	h RTN	35 22	
	f LBL 6	31 25 06	
	-	51	
	RCL 2	34 02	
	GTO 8	22 08	
160	f LBL 7	31 25 07	
	RCL A	34 11	
	RCL 1	34 01	
	-	51	
	GTO 2	22 02	
	g LBL d	32 25 14	Calculation routine for adjusting periodic income
	1	01	
	STO D	33 14	
	h CF 1	35 61 01	

STEP	KEY ENTRY	KEY CODE	COMMENTS
	RCL D	34 14	
170	f x=0	31 51	stream to present value at mortgage purchase date.
	h SF 1	35 51 01	
	1	01	
	h ST I	35 33	
	RCL B	34 12	
	f %	31 82	
	STO 9	33 09	
	+	61	
	STO 7	33 07	
	RCL A	34 11	
180	CHS	42	
	h y^x	35 63	
	STO 8	33 08	
	RCL E	34 15	
	x	71	
	1	01	
	RCL 8	34 08	
	-	51	
	STO 4	33 04	
	RCL C	34 13	
190	RCL 9	34 09	
	÷	81	
	h F? 1	35 71 01	
	CHS	42	
	STO 3	33 03	
	h RC I	35 34	
	x	71	
	x	71	
	+	61	
	STO D	33 14	
200	h RTN	35 22	
210			
220			

LABELS

A CALCULATE	B	C	D Balance	E Term
a initialize	b	c	d adjusted price	e
0 used	1 used	2 used	3 used	4 used
5 used	6 used	7 used	8 used	9

FLAGS

0
1 used
2
3

SET STATUS

FLAGS			TRIG	DISP
	ON	OFF		
0	☐	☒	DEG ☒	FIX ☒
1	☐	☒	GRAD ☐	SCI ☐
2	☐	☒	RAD ☐	ENG ☐
3	☐	☒		n 2

Program Description I

Program Title MORTGAGE PRICING NO. 2

Contributor's Name Jack B. Buster

Address P. O. Box 8062

City Anchorage **State** Alaska **Zip Code** 99508

Program Description, Equations, Variables This program will calculate the price of a wrap around mortgage discounted to yield a user specified percentage. The required data input is the target yield of the wrap around and for each mortgage the monthly payment ., interest rate (monthly), and the remaining principal balance.

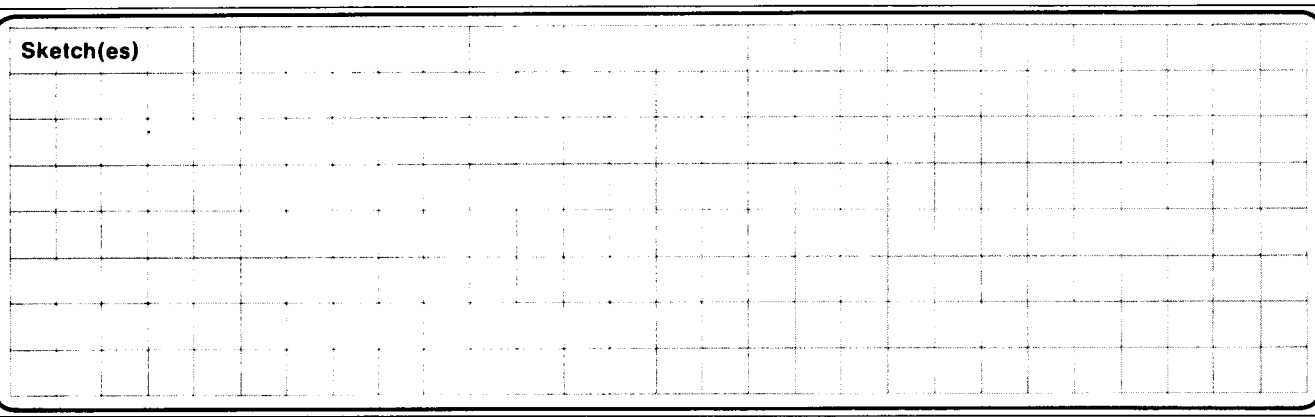
Operating Limits and Warnings

Only two levels of mortgage are considered; no thirds.

Do not mix annual payment mortgages with monthly payment mortgages.

Program Description 11

Sketch(es)



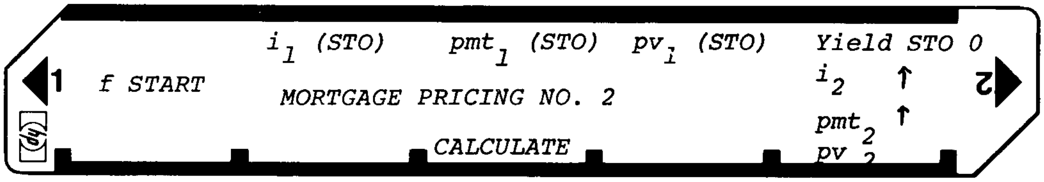
Sample Problem(s) *An investor is offered the opportunity to purchase a wrap around (second) mortgage at an annual yield of 22.5%. The first mortgage is $125,647.00 payable at the rate of $1,161.67 per month including 9.5% interest. The second (wrap around) mortgage is $214,123.00 payable at $2,300.00 per month including 10.25% interest. What will the investor pay for the mortgage?*

Solution(s)

(1)	Initialize	f A	0.00
(2)	Load i for first	9.5 ÷ 12 STO B	0.79
(3)	Load pmt for first	1161.67 STO C	1161.67
(4)	Load pv for first	125647 STO D	125647.00
(5)	Load yield	22.5 ÷ 12 STO 0	1.88
(6)	Load i for second	10.25 ÷ 12 ENTER	0.85
(7)	Load pmt for second	2300 ENTER	2300.00
(8)	Load pv for second	214123	214123.
(9)	Calculate	C	57510.36

Reference(s)

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS		OUTPUT DATA/UNITS
1	Load sides 1 and 2 of card				
2	Initialize		f	A	
3	Enter 1st periodic interest rate	i/12	STO	B	
4	Enter 1st monthly payment	pmt_1	STO	C	
5	Enter 1st principal balance	pv_1	STO	D	
6	Enter periodic yield	Y/12	STO	0	
7	Enter 2nd periodic interest rate	$i_2/12$	ENTER		
8	Enter 2nd monthly payment	pmt_2	ENTER		
9	Enter 2nd principal balance	pv_2			
10	Calculate price		C		price
11	For amortization period of first mortgage		A		months
12	For amortization period of second enter				
	data as follows:				
	Periodic interest rate		STO	B	
	monthly payment		STO	C	
	principal balance		STO	D	
	Calculate		A		months

67 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS
001 *	f LBL A	31 25 11	
	0	00	
	STO A	33 11	
	GSB 0	31 22 00	Calculate total amortization period
	RCL E	34 15	
	LST X	35 82	
	-	51	
	RCL D	34 14	
	LST X	35 82	
010	-	51	
	Divide	81	
	f LN	31 52	
	RCL 7	34 07	
	f LN	31 52	
	Divide	81	
	STO A	33 11	
	h RTN	35 22	
*	f LBL C	31 25 13	Calculate price
	f P ex S	31 42	
020	STO 0	33 00	pv_2 to R_{so}
	h ↓	35 53	
	STO 1	33 01	pmt_2 to R_{s1}
	h ↓	35 53	
	STO 2	33 02	i_2 to R_{s2}
	f P ex S	31 42	
	GSB A	31 22 11	figure 1st pay-off period
	f P ex S	31 42	
	STO 7	33 07	
	RCL B	34 12	
030	STO 3	33 03	
	RCL C	34 13	
	STO 4	33 04	housekeep
	RCL D	34 14	
	STO 5	33 05	
	RCL 0	34 00	
	STO D	33 14	
	RCL 1	34 01	
	STO C	33 13	
	RCL 2	34 02	
040	STO B	33 12	
	f P ex S	31 42	
	GSB A	31 22 11	figure 2nd pay-off period
	f P ex S	31 42	
	STO 6	33 06	
	RCL 1	34 01	
	RCL 4	34 04	
	-	51	
	STO C	33 13	
	RCL 7	34 07	
050	STO A	33 11	housekeep
	f P ex S	31 42	
	RCL 0	34 00	
	STO B	33 12	
	GSB D	31 22 14	Figure first paymen stream
	STO 2	33 02	
	f P ex S	31 42	
	RCL 6	34 06	
	RCL 7	34 07	
	-	51	
060	STO A	33 11	housekeep
	RCL 1	34 01	
	STO C	33 13	
	f P ex S	31 42	
	GSB D	31 22 14	figure second payment stream
	STO E	33 15	
	0	00	
	STO C	33 13	
	f P ex S	31 42	Adjust, total and stop.
	RCL 7	34 07	
070	STO A	33 11	
	f P ex S	31 42	
	GSB D	31 22 14	
	STO + 2	33 61 02	
	RCL 2	34 02	
	H RTN	35 22	
*	f LBL D	31 25 14	Pricing routine
	1	01	
	STO D	33 14	
	GSB 0	31 22 00	
080	+	61	
	STO D	33 14	
	h RTN	35 22	
*	f LBL 0	31 25 00	
	RCL D	34 14	
	1	01	Calculation subroutine
	STO 5	33 05	
	RCL B	34 12	
	f %	31 82	
	STO 9	33 09	
090	+	61	
	STO 7	33 07	
	RCL A	34 11	
	CHS	42	
	y^x	35 63	
	STO 8	33 08	
	RCL E	34 15	
	X	71	
	1	01	
	RCL 8	34 08	
100	-	51	
	STO 4	33 04	
	RCL C	34 13	
	RCL 9	34 09	
	Divide	81	
	STO 3	33 03	
	RCL 5	34 05	
	X	71	
	X	71	
	h RTN	35 22	
110 *	g LBL a	32 25 11	Initialize
	CL REG	31 43	
	CL X	44	

REGISTERS

0 Yield	1	2 used	3 used	4 used	5 used	6	7 used	8 used	9 used
S0 pv_2	S1 pmt_2	S2 i_2	S3 i_1	S4 pmt_1	S5 pv_1	S6 n_2	S7 n_1	S8	S9
A pay-off perds.	B i_1 and i_n	C pmt & pmt_n	D pv_1 & pv_n	E used	I				

67 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS
	f P ex S	31 42	
	CL REG	31 43	
	h PTN	35 22	----------
120			
130			
140			
150			
160			
170			
180			
190			
200			
210			
220			

LABELS					FLAGS
A Amortization	B	C Calculate	D PV	E	0
a initialize	b	c	d	e	1
0 calc. rout.	1	2	3	4	2
5	6	7	8	9	3

SET STATUS

FLAGS			TRIG		DISP	
	ON	OFF				
0	☐	☒	DEG	☒	FIX	☒
1	☐	☒	GRAD	☐	SCI	☐
2	☐	☒	RAD	☐	ENG	☐
3	☐	☒			n	2

Program Description I

Program Title Yearly Amortization Schedule

Contributor's Name Hewlett-Packard
Address 1000 N.E. Circle Blvd.
City Corvallis **State** Oregon **Zip Code** 97330

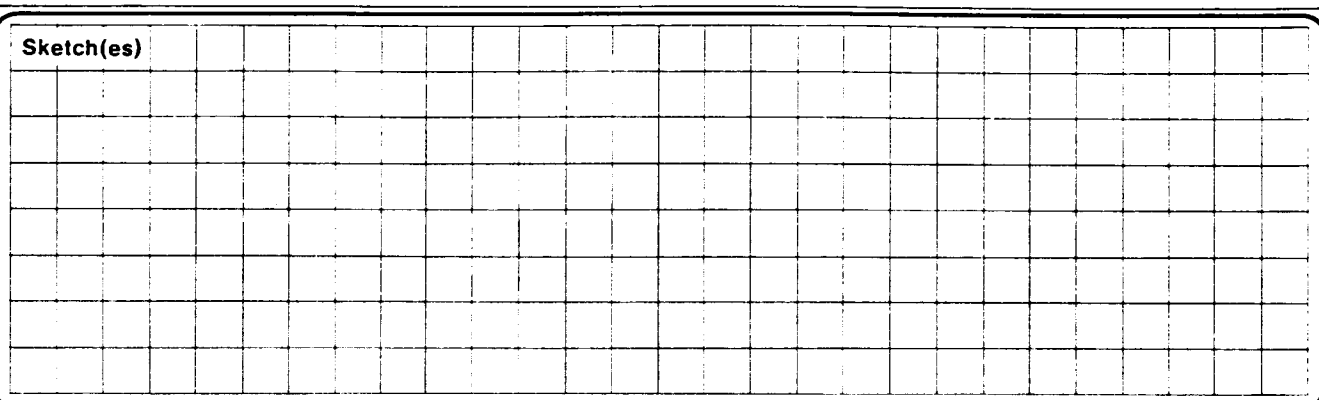
Program Description, Equations, Variables This program finds both the total interest paid over a specified number of years and the remaining balance at the end of the last specified year, given the monthly interest rate, monthly payment amount, loan amount, and the beginning and ending years being considered. An option is also available to generate a yearly amortization schedule.

All calculations assume that monthly payments occur, however the schedule generated is on an annual basis.

Operating Limits and Warnings Calculator performs all internal calculations to ten digits.

Program Description 11

Sketch(es)



Sample Problem(s) Generate a yearly amortization schedule for the first 3 years of a $30,000, 7% mortgage having monthly payments of $200.

What is the accumulated interest for the 4th year, and what is the remaining balance at the end of that time?

Solution(s)

[f] [E] ---------->	1.00	
1 [ENTER↑] 3[A]-------->	3.00	
7 [ENTER↑] 12 [÷] [B]-->	0.58	
200 [C] ---------->	200.00	1.00 ***
30000 [D] ---------->	30000.00	2090.15 ***
[f] [A] ---------->		309.81 ***
		29690.19 ***
		2090.19 ***
		2.00 ***
		2067.79 ***
		322.21 ***
		29357.97 ***
		4157.97 ***

Reference(s)

4 [ENTER↑] 4 [A]------->	4.00	
[E] ---------->	2018.02	
[R/S] ---------->	28619.77	
		3.00 ***
		2043.77 ***
		356.23 ***
		29001.75 ***
		6201.75 ***

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1.	Load side 1 and side 2.			
2.	Optional: Select print/pause mode for amortization schedule.		f E	1.00or0.00
3.	Key in			
	• Starting year number	Y1	↑	Y1
	• Ending year number	Y2	A	Y2
	• Monthly interest rate	i(%)	B	i(%)
	• Monthly payment amount	PMT	C	PMT
	• Initial loan amount	PV	D	PV
4.	Compute the total interest paid between years Y1 and Y2 inclusive and the remaining balance at the end of year Y2.		E	Σ INT
			R/S	BAL
	OR			
5.	Generate the yearly amortization schedule between years Y1 and Y2 inclusive. If the print/pause mode is on (1.00), the results are printed automatically.		f A	Y1
6.	Caclulate the amount paid to interest for year Y1.		R/S	PMT to INT
7.	Calculate amount paid to principal for year Y1.		R/S	PMT to PRIN
8.	Calculate remaining balance at the end of year Y1.		R/S	BAL
9.	Calculate total interest paid between years Y1 and Y2 inclusive.		R/S	TOT INT
10.	Increment Y1 for next period. If Y1≤Y2, go to step 6 for next period's values. Otherwise, stop.		R/S	Y1 + 1
11.	For a new case, go to step 2 and change appropriate input values.			

97 Program Listing 1

STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	
002	STO1	35 01	$Y2 \rightarrow R_1$
003	X≷Y	-41	
004	STO0	35 00	$Y1 \rightarrow R_0$
005	X≷Y	-41	
006	RTN	24	
007	*LBLB	21 12	
008	EEX	-23	
009	2	02	$i/100 \rightarrow R_2$
010	÷	-24	
011	STO2	35 02	
012	LSTX	16-63	
013	x	-35	
014	RTN	24	
015	*LBLC	21 13	
016	STO3	35 03	$PMT \rightarrow R_3$
017	RTN	24	
018	*LBLD	21 14	
019	STO4	35 04	$PV \rightarrow R_4$
020	RTN	24	
021	*LBLE	21 15	
022	1	01	
023	RCL2	36 02	
024	+	-55	
025	STO5	35 05	$(1+i/100) \rightarrow R_5$
026	RCL1	36 01	
027	1	01	
028	2	02	
029	x	-35	$12(Y2)=N$
030	GSB1	23 01	
031	STO7	35 07	$BAL_N \rightarrow R_7$
032	RCL5	36 05	
033	RCL0	36 00	
034	1	01	
035	2	02	
036	x	-35	
037	1	01	
038	2	02	$(Y1)12-12=N$
039	-	-45	
040	GSB1	23 01	
041	CHS	-22	
042	RCL7	36 07	
043	+	-55	
044	STO8	35 08	$BAL_N - BAL_{N-12} \rightarrow R_8$
045	RCL1	36 01	
046	1	01	
047	2	02	
048	x	-35	
049	RCL0	36 00	
050	1	01	
051	2	02	
052	x	-35	
053	-	-45	
054	1	01	
055	2	02	
056	+	-55	$12(Y2-Y1+1)$

STEP	KEY ENTRY	KEY CODE	COMMENTS
057	RCL3	36 03	$BAL_N - BAL_{N-12} + 12(Y2-Y1+1) = INT$
058	x	-35	
059	+	-55	
060	RTN	24	
061	RCL7	36 07	
062	R/S	51	
063	*LBL1	21 61	
064	CHS	-22	
065	Y^x	31	$(1+i/100)^{-N} \rightarrow R_6$
066	STO6	35 06	
067	1	01	
068	-	-45	
069	RCL2	36 02	
070	÷	-24	
071	RCL3	36 03	$\left[PMT\frac{(1+i/100)^{-N}-1}{i/100}+PV\right]$
072	x	-35	
073	RCL4	36 04	
074	+	-55	
075	RCL6	36 06	$\left[\frac{1}{(1+i/100)^{-N}}\right]$
076	÷	-24	
077	RTN	24	
078	R/S	51	
079	*LBLa	21 16 11	
080	RCL0	36 00	
081	F0?	16 23 00	
082	SPC	16-11	
083	GSB9	23 09	
084	1	01	
085	RCL2	36 02	$(1+i/100) \rightarrow R_5$
086	+	-55	
087	STO5	35 05	
088	RCL0	36 00	
089	1	01	
090	2	02	$12(Y1)=N$
091	x	-35	
092	GSB1	23 01	
093	STO8	35 08	
094	RCL5	36 05	
095	RCL0	36 00	
096	1	01	
097	2	02	
098	x	-35	
099	1	01	$12(Y1)-12=N$
100	2	02	
101	-	-45	
102	GSB1	23 01	
103	RCL8	36 08	
104	-	-45	
105	STO9	35 09	
106	RCL3	36 03	
107	1	01	
108	2	02	
109	x	-35	INT_{Y1}
110	X≷Y	-41	
111	-	-45	$PRINC_{Y1}$
112	GSB9	23 09	

REGISTERS

0	1	2	3	4	5	6	7	8	9
Y1	Y2	i/100	PMT	PV	1+i/100	$(1+i/100)^{-N}$	BAL_N	BAL_N-BAL_{N-12}	PRINC
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
113	RCL9	36 09	
114	GSB9	23 09	BAL
115	RCL8	36 08	
116	GSB9	23 09	
117	RCL0	36 00	
118	1	01	
119	2	02	
120	x	-35	12(Y1)•PMT-(PV-BAL)
121	RCL3	36 03	
122	x	-35	=TOT INT
123	RCL4	36 04	
124	RCL8	36 08	
125	-	-45	
126	-	-45	
127	GSB9	23 09	
128	1	01	
129	ST+0	35-55 00	
130	RCL1	36 01	
131	1	01	
132	2	02	
133	x	-35	
134	RCL0	36 00	
135	1	01	
136	2	02	
137	x	-35	12(Y1)≤12(Y2)?
138	X≤Y?	16-35	
139	GTOa	22 16 11	
140	1	01	
141	2	02	
142	÷	-24	- - - - - - - - - -
143	RTN	24	
144	*LBLe	21 16 15	Print Mode Option
145	F0?	16 23 00	
146	GTO2	22 02	
147	SF0	16 21 00	
148	1	01	
149	RTN	24	
150	*LBL2	21 02	
151	0	00	
152	CF0	16 22 00	
153	RTN	24	
154	*LBL9	21 09	
155	F0?	16 23 00	
156	GTO3	22 03	
157	R/S	51	
158	RTN	24	
159	*LBL3	21 03	
160	PRTX	-14	
161	RTN	24	
162	R/S	51	

STEP	KEY ENTRY	KEY CODE	COMMENTS
170			
180			
190			
200			
210			
220			

LABELS

A Y1↑Y2	B i	C PMT	D PV	E INT;RB	0 Print?
a Sched.	b	c	d	e Print?	1
0	1 Used	2 Used	3 Used	4	2
5	6	7	8	9 Used	3

FLAGS

SET STATUS

FLAGS		TRIG	DISP
	ON OFF		
0	☐ ☑	DEG ☑	FIX ☑
1	☐ ☑	GRAD ☐	SCI ☐
2	☐ ☑	RAD ☐	ENG ☐
3	☐ ☑		n 2

Program Description I

Program Title Amount of equity at any time

Contributor's Name APD

Address 19310 Pruneridge Avenue

City Cupertino **State** Ca **Zip Code** 95014

Program Description, Equations, Variables For a periodic repayed loan with full amortization after a stated number of years, given:

n (number of payments made),

i (periodic interest rate),

PMT (periodic payment),

Pp (purchase price)

D$ (down payment), or D% (percent down), or Ns (net sales price).

This program calculates purchase price equity Epp and net sales equity Es.

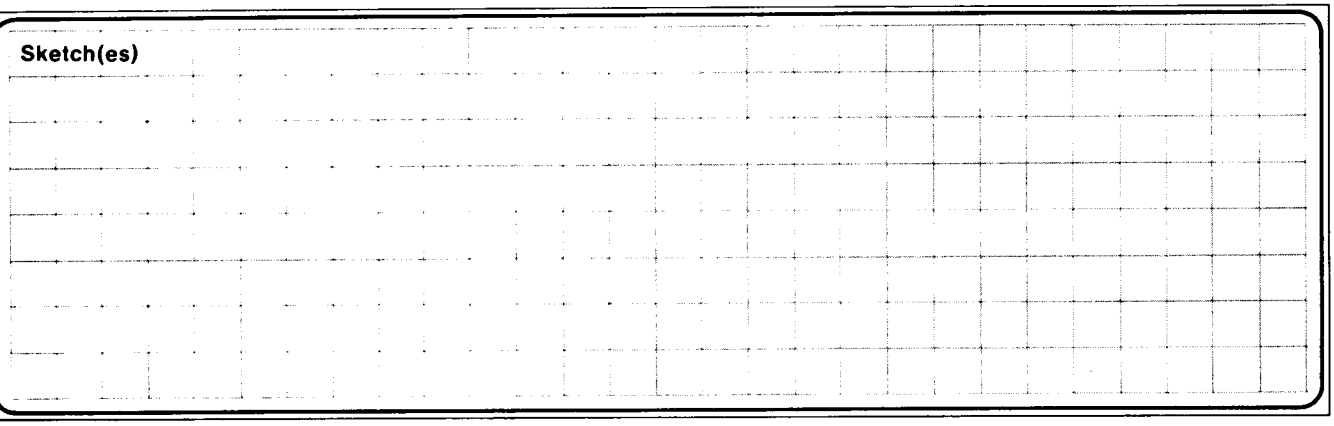
$$Epp = Ns - Es$$

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

Operating Limits and Warnings

Program Description II

Sketch(es)



Sample Problem(s) (1) Pp = $45000, D$ = $4500, i = 7.5% annual, n = 72, PMT = $283.18, Ns = $63900. What are Es and Epp?

(2) The same as the above, but with PMT = $251.72, and D% = 20%. What are Es and Epp?

Solution(s) (1) 72 [A] 7.5 [ENT] 12 [÷] [B] 283.18 [C] 45000 [D] 4500 [f] [A] 63900 [f] [D] [E]→7222.35 (Epp) [f] [E]→26122.35 (Es)

(2) 72 [A] 7.5 [ENT] 12 [÷] [B] 251.72 [C] 45000 [D] 20 [f] [B] 63900 [f] [D] [E]→11420.27 (Epp) [f] [E]→30320.27 (Es)

Reference(s) This program is a translation of the HP-65 User's Library program #229A submitted by Fred Sommer.

User Instructions

STEP	INSTRUCTIONS		INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1				
2	Input: no. of payments made,	n	n	A	
	periodic interest rate	i	i	B	
	periodic payment	PMT	PMT	C	
	purchase price	Pp	Pp	D	
	down payment	D$	D$	f a	
	or % down	D%	D%	f b	
	(optional) net sales price	Ns	Ns	f d	
3	Calculate purchase price equity			E	Epp
4	Calculate net sales equity			f E	Es
5	For a new case, go to step 2.				

LABELS					FLAGS
A n	B i	C PMT	D P_p	E →Epp	0
a D$	b D%	c	d N_s	e →Es	1
0	1	2	3	4	2
5	6	7	8	9	3

SET STATUS

FLAGS	ON	OFF
0	☐	☑
1	☐	☑
2	☐	☑
3	☐	☑

TRIG	
DEG	☑
GRAD	☐
RAD	☐

DISP	
FIX	☑
SCI	☐
ENG	☐
n	2

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	# pmts made→R_A
002	STOA	35 11	
003	RTN	24	
004	*LBLB	21 12	Period interest rate→R_B
005	EEX	-23	
006	2	02	
007	÷	-24	
008	STOB	35 12	$1 + \frac{i}{100} \rightarrow R_9$
009	1	01	
010	+	-55	
011	STO9	35 09	
012	RTN	24	
013	*LBLC	21 13	Periodic payment → R_C
014	STOC	35 13	
015	RTN	24	
016	*LBLD	21 14	Purchase price → R_D
017	STOD	35 14	
018	RTN	24	
019	*LBLE	21 15	
020	SF1	16 21 01	Purchase price equity
021	RCLD	36 14	
022	*LBL9	21 09	Equity subroutine
023	STO4	35 04	
024	RCLD	36 14	
025	F0?	16 23 00	
026	GTO8	22 08	
027	RCL1	36 01	
028	GTO7	22 07	
029	*LBL8	21 08	
030	RCL2	36 02	
031	%	55	
032	STO1	35 01	
033	*LBL7	21 07	
034	-	-45	
035	STO0	35 00	
036	RCLB	36 12	
037	x	-35	
038	RCLC	36 13	
039	÷	-24	
040	1	01	
041	X≷Y	-41	
042	-	-45	
043	1/X	52	
044	LN	32	
045	RCL9	36 09	
046	LN	32	
047	÷	-24	
048	STO5	35 05	
049	*LBL1	21 01	
050	1	01	
051	RCL9	36 09	
052	RCLA	36 11	
053	RCL5	36 05	
054	-	-45	
055	Y^x	31	
056	-	-45	
057	RCLB	36 12	
058	÷	-24	
059	RCLC	36 13	
060	x	-35	
061	F1?	16 23 01	
062	GTO0	22 00	
063	RCL3	36 03	
064	GTO1	22 01	
065	*LBL0	21 00	
066	RCLD	36 14	
067	*LBL1	21 01	
068	X≷Y	-41	
069	-	-45	
070	PRTX	-14	
071	SPC	16-11	
072	RTN	24	
073	*LBLa	21 16 11	
074	STO1	35 01	$ down → R_1
075	CF0	16 22 00	
076	RTN	24	
077	*LBLb	21 16 12	
078	STO2	35 02	% down → R_2
079	SF0	16 21 00	
080	RTN	24	
081	*LBLd	21 16 14	
082	STO3	35 03	Net sales price → R_3
083	RTN	24	
084	*LBLe	21 16 15	
085	CF1	16 22 01	Net sales equity
086	RCL2	36 02	
087	GTO9	22 09	
088	R/S	51	

100		
110		

REGISTERS

0 amount financed	1 $ down	2 % down	3 net sales price	4 Used	5 term of loan	6	7	8	9 1 + i
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A # pmts made	B i	C payment	D purchase price	E	I

Program Description I

Program Title ELLWOOD INCOME VALUATION FOR INCOME PROPERTY APPRAISAL

Contributor's Name Hewlett-Packard Co.

Address 19310 Pruneridge Avenue

City Cupertino **State** CA **Zip Code** 95014

Program Description, Equations, Variables

Given a loan proportion to fair market value (δ), the annual interest rate on the loan (i_1) and the term of the loan (payable monthly in equal installments) (n_1); and given the horizon of the projection in years (n_2) and the expected appreciation or depreciation of the property at the end of n_2 years ($\pm\alpha$); and given the desired return on equity (i_2) the program computes the ELLWOOD factor by which the level income stream must be multiplied to find the value of the property which will give the desired rate of return on equity.

Value = AAI*

$$\left[\frac{\left[1-\delta-\frac{(1+\alpha)}{(1+i_2)^{n_2}}\right]+\delta\left[\frac{i_1\left(i_1/12+1\right)^{n_1(12)}}{\left(i_1/12+1\right)^{n_1(12)}-1}\right]\left[\frac{(1+i_2)^{n_2}-1}{i_2(1+i_2)^{n_2}}\right]+\delta\left[1-\frac{\left(i_1/12+1\right)^{n_2(12)}-1}{\left(i_1/12+1\right)^{n_1(12)}-1}\right]}{\frac{(1+i_2)^{n_2}-1}{i_2(1+i_2)^{n_2}}}\right]$$

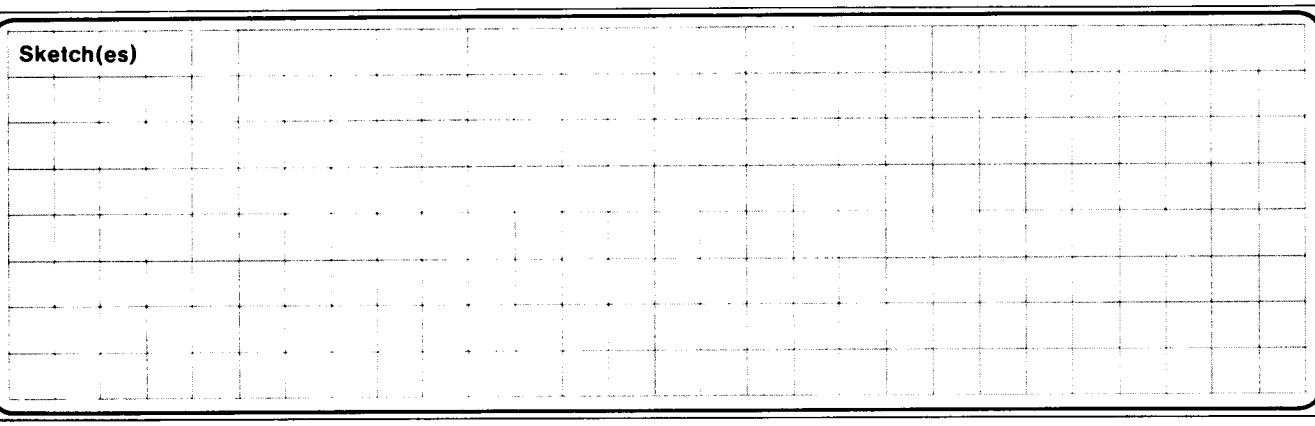
The actual "Ellwood" coefficient is stored in Register **0**; the program produces its reciprocal which should be multiplied by the income stream.

Operating Limits and Warnings $\delta > 0$

This valuation technique is ubiquitous in spite of the fact that it does not explicitly take tax consequences into account. Investors should beware of shortcut techniques such as this one.

Program Description II

Sketch(es)



Sample Problem(s)

A property will produce an even cash flow before debt service of $10,000. It is to be mortgaged at 80% of fair market value; the loan is for 19 years and has a 10.2% interest rate. The property is to be sold in 5 years and it is expected to depreciate 10% during the 5-year period. At what price will it produce a 6.3% yield on investment?

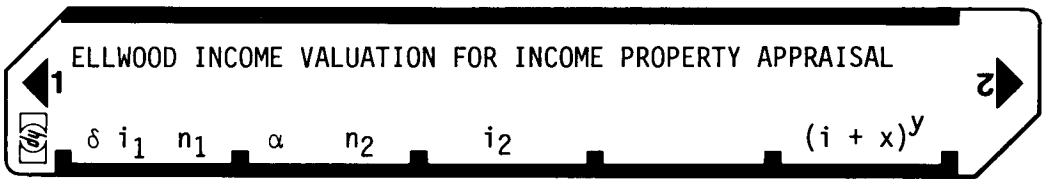
N_1 = 19
i_1 = 10.2% (.102)
i_2 = 6.3% (.063)
δ = 80% (.80)
α = -10% (-.10)
AAI = $10,000

Solution(s)

Factor = 9.1043
Value = $91,043
Ellwood coefficient = .109838765

Reference(s) This program is a translation of the HP-65 User's Library program #728A by Kelvin C. Vanderlip, Jr.

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Enter program			
2	Loan proportion (decimal form)	δ	↑	
3	Loan interest rate (decimal form)	i_1	↑	
4	Loan term, years	n_1	A	δ
5	% Appreciation (+) or depreciation (-)	α	↑	
	(decimal form)			
6	Number of years of projection	n_2	B	$1 + \alpha$
7	Desired equity yield	i_2	C	1/Ell.factor
8	Annual income stream	$AAI	x	value($)
	(optional)			
9	Ellwood factor		E	Ell. factor
	(for a new desired equity yield, go to 7;			
	for a new horizon or change in appreciation/			
	depreciation, go to 5)			

LABELS					FLAGS
A δ↑i_1↑n_1	B α↑n_2	C i_2	D	E Ell.Factor	0
a	b	c	d	e	1
0 Used	1	2	3	4	2
5	6	7	8	9	3

SET STATUS		
FLAGS	TRIG	DISP
ON OFF	DEG ☑	FIX ☑
0 ☐ ☑	GRAD ☐	SCI ☐
1 ☐ ☑	RAD ☐	ENG ☐
2 ☐ ☑		n 2
3 ☐ ☑		

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	
002	1	01	
003	2	02	
004	×	-35	
005	STO3	35 03	$n_1 \times 12 \rightarrow R_3$
006	CLX	-51	
007	LSTX	16-63	
008	÷	-24	
009	STO1	35 01	$i_1/12 \rightarrow R_1$
010	R↓	-31	
011	STO6	35 06	$\delta \rightarrow R_6$
012	RTN	24	
013	*LBLB	21 12	
014	STO4	35 04	$n_2 \rightarrow R_4$
015	CLX	-51	
016	1	01	
017	+	-55	
018	STO5	35 05	$1 + \alpha \rightarrow R_5$
019	RTN	24	
020	*LBLC	21 13	
021	STO2	35 02	$i_2 \rightarrow R_2$
022	RCL4	36 04	
023	X≠Y	-41	
024	GSB0	23 00	$(1 + i_2)^{n_2}$
025	STO7	35 07	
026	1	01	
027	-	-45	
028	RCL7	36 07	
029	÷	-24	
030	RCL2	36 02	
031	÷	-24	
032	STO8	35 08	
033	RCL1	36 01	
034	RCL3	36 03	
035	RCL1	36 01	
036	GSB0	23 00	
037	×	-35	
038	LSTX	16-63	
039	1	01	
040	-	-45	
041	÷	-24	
042	1	01	
043	2	02	
044	×	-35	
045	RCL8	36 08	
046	×	-35	
047	RCL6	36 06	
048	×	-35	
049	1	01	
050	+	-55	
051	RCL6	36 06	
052	-	-45	
053	RCL5	36 05	
054	RCL7	36 07	
055	÷	-24	
056	-	-45	
057	STO0	35 00	
058	RCL4	36 04	
059	1	01	
060	2	02	
061	×	-35	
062	RCL1	36 01	
063	GSB0	23 00	
064	1	01	
065	-	-45	
066	RCL3	36 03	
067	RCL1	36 01	
068	GSB0	23 00	
069	1	01	
070	-	-45	
071	÷	-24	
072	CHS	-22	
073	1	01	
074	+	-55	
075	RCL6	36 06	
076	×	-35	
077	RCL7	36 07	
078	÷	-24	
079	RCL0	36 00	
080	+	-55	
081	RCL8	36 08	
082	÷	-24	
083	STO0	35 00	Ellwood Factor → R_0
084	1/X	52	
085	RTN	24	
086	*LBL0	21 00	
087	1	01	
088	+	-55	
089	X≠Y	-41	
090	Y^X	31	
091	RTN	24	
092	*LBLE	21 15	
093	RCL0	36 00	Display Ellwood Factor
094	RTN	24	
095	R/S	51	

110

REGISTERS

0	1	2	3	4	5	6	7	8	9
Ell. fac	$i_1/12$	i_2	$n_1 \times 12$	n_2	$1 + \alpha$	δ	Used	Used	
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I

Program Description I

Program Title INCOME PROPERTY ANALYSIS

Contributor's Name JACK B. BUSTER

Address P. O. BOX 8062

City ANCHORAGE **State** ALASKA **Zip Code** 99508

Program Description, Equations, Variables

$$\text{Capitalization Rate} = \frac{\text{Net Operating Income}}{\text{Purchase Price}}$$

$$\text{Taxable Income} = \text{Net Operating Income} - \text{Depreciation} - \text{Interest}$$

$$\text{Spendable Income} = \text{Net Operating Income} - \text{Payments} - \text{Income tax}$$

$$\text{Spendable Income Rate} = \frac{\text{Spendable Income}}{\text{Equity}}$$

$$\text{Equity Income} = \text{Net Operating Income} - \text{Interest} - \text{Income tax}$$

$$\text{Equity Income Rate} = \frac{\text{Equity Income}}{\text{Equity}}$$

$$\text{Interest} = PMT\left[12 - \frac{(1+i)^{12-n}\left[1-(1+i)^{-12}\right]}{i}\right]$$

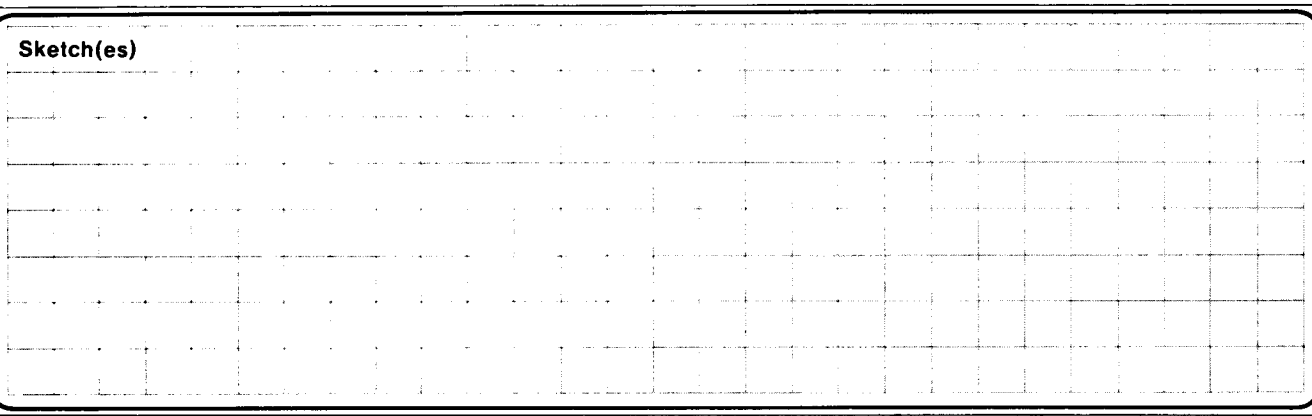
The above variables are the generally accepted parameters for the analysis and evaluation of income properties. This program follows the standard NIREB recommended format. Net Operating Income is gross income decreased by vacancies and operating expenses.

Operating Limits and Warnings

This program will operate with only one level of mortgage, i.e. properties with second mortgages cannot be analyzed by this program. This valuation or analysis technique is ubiquitous particularily since it takes explicit tax consequences into consideration.

Program Description II

Sketch(es)



Sample Problem(s) An investor wishes to know the performance of a large apartment complex over the next five yearswith respect to initial capitalization rate, taxable income, net spendable income, spendable income rate, equity income, and equity income rate. The following particulars apply:

Purchase Price	$ 750,000.00	Inflation/Appreciation rate:	
Loan Amount	635,000.00	Current year:	= 7%
Interest rate	9 3/4%	Next year:	= 7 1/2%
Land Value	$ 95,000.00	Next Year:	= 8%
Building life	35 years	Thereafter:	= 8 1/2%
Monthly payment	$ 7,000.00		
Net Operating Income	$ 112,500.00		
Income tax bracket	40%		

SAMPLE SOLUTION

Cap rate = 15.00	Year 1	Year 2	Year 3	Year 4	Year 5
Taxable	32,887.48	43,118.33	54,742.55	67,955.64	82,987.43
Spendable	15,345.01	19,127.67	23,506.10	28,573.12	34,439.61
Rate	13.34 %	10.04 %	8.51 %	7.65 %	7.12 %
Equity	38,446.77	44,585.28	51,559.82	59,487.67	68,506.74
Rate	33.43 %	23.39 %	18.66 %	15.93 %	14.17 %

Solution(s) Input variables as follows:

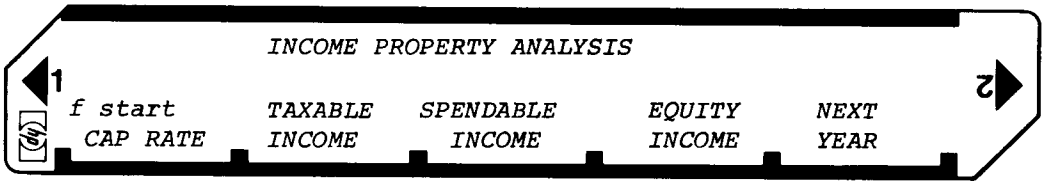
Interest Rate	STO B	(.8125)
Monthly Payment	STO C	
Loan Amount	STO D	
Purchase Price	STO O	
N.O. INCOME	STO 1	
Economic Life	STO 2	
Land value	STO 3	
Tax Bracket	STO 4	(40)

SOLVE AS FOLLOWS:

(1) f A ---Initialize
(2) Store variables
(3) A -----Capitalization Rate
(4) B -----Taxable Income
(5) C -----Spendable Income ----Spendable Income Rate
(6) D -----Equity Income-----Equity Income Rate
(7) Key in inflation rate
(8) E -----Advances totals for one year
(9) Return to step (4) for additional totals

Reference(s) National Institute of Real Estate Brokers income property analysis data sheet.

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load sides 1 and 2			
2	Initialize		f A	
3	Input Data:			
	Interest rate per period		STO B	
	Monthly payment		STO C	
	Loan amount		STO D	
	Purchase price		STO 0	
	Net Operating Income		STO 1	
	Remaining economic life of improvements		STO 2	
	Land value		STO 3	
	Investor's income tax bracket (as a %)		STO 4	
4	CALCULATE Capitalization Rate		A	Cap Rate %
5	CALCULATE Taxable Income		B	Taxable $
6	CALCULATE Net Spendable Income and Rate		C	Spendable $ & %
7	CALCULATE Equity Income and Rate		D	Equity $ & %
8	Input current inflation/appreciation rate		E	years beyond base year
9	Return to step 5 for the next year			

67 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS
001 *	f LBL A	31 25 11	Figure Cap Rate
	RCL 1	34 01	
	RCL 0	34 00	
	Divide	81	
	EEX	43	
	2	02	
	X	71	
	h RTN	35 22	
*	f LBL B	31 25 12	Figure straight line Depreciation
010	DSP 2	23 02	
	h F? 0	35 71 00	
	GTO 1	22 01	
	RCL 0	34 00	
	RCL 3	34 03	
	-	51	
	RCL 2	34 02	
	Divide	81	
	STO 2	33 02	
	1	01	Figure Loan Amortization Period
020	RCL B	34 12	
	f %	31 82	
	STO 9	33 09	
	+	61	
	STO 7	33 07	
	RCL C	34 13	
	RCL 9	34 09	
	Divide	81	
	Enter	41	
	Enter	41	
030	RCL D	34 14	
	-	51	
	Divide	81	
	f LN	31 52	
	RCL 7	34 07	
	f LN	31 52	
	Divide	81	
	STO A	33 11	
*	f LBL 1	31 25 01	Figure Accumulated Interest for 12 months
	f GSB 0	31 22 00	
040	STO 6	33 06	
	RCL 2	34 02	
	+	61	
	CHS	42	
	RCL 1	34 01	
	+	61	
	STO 3	33 03	Figure Taxable
	h RTN	35 22	
*	f LBL 0	31 25 00	
	RCL B	34 12	
050	EEX	43	
	2	02	
	Divide	81	
	STO 9	33 09	
	1	01	
	+	61	
	STO 5	33 05	

STEP	KEY ENTRY	KEY CODE	COMMENTS
	1	01	
	2	02	
	STO 8	33 08	
060	CHS	42	
	y^x	35 63	
	1	01	
	$x \geq y$	35 52	
	-	51	
	RCL 5	34 05	
	RCL 8	34 08	
	RCL A	34 11	Interest Calculation Routine
	-	51	
	y^x	35 63	
070	RCL 9	34 09	
	Divide	81	
	X	71	
	RCL 8	34 08	
	$x \geq y$	35 52	
	-	51	
	RCL C	34 13	
	X	71	
	h RTN	35 22	
*	f LBL C	31 25 13	
080	RCL 4	34 04	Figure Spendable
	EEX	43	
	2	02	
	Divide	81	
	RCL 3	34 03	
	X	71	
	STO 7	33 07	
	RCL C	34 13	
	RCL 8	34 08	
	X	71	
090	STO E	33 15	
	+	61	
	CHS	42	
	RCL 1	34 01	
	+	61	
	-x-	31 84	show spendable
	RCL 0	34 00	
	RCL D	34 14	
	-	51	
	STO 9	33 09	
100	Divide	81	
	EEX	43	
	2	02	
	X	71	
	h RTN	35 22	show rate
*	f LBL D	31 25 14	
	RCL 7	34 07	
	RCL 6	34 06	Figure Equity Income
	+	61	
	CHS	42	
110	RCL 1	34 01	
	+	61	
	-x-	31 84	show equity

REGISTERS

0	1	2	3	4	5	6	7	8	9
Price	N.O.I.	Life	Land val.	tax rate	used	used	tax	12	used
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I
Loan - f Amort.	Interest Rate	Monthly PMT	Loan Balance	USED	Year counter

67 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS
	RCL 9	34 09	
	Divide	81	
	EEX	43	
	2	02	
	X	71	
	h RTN	35 22	
*	f LBL E	31 25 15	
120	RCL E	34 15	Adjust for
	RCL 6	34 06	inflation and
	-	51	housekeep for
	CHS	42	new year's run
	RCL D	34 14	
	+	61	
	STO D	33 14	
	h ↓	35 53	
	STO E	33 15	
	RCL 0	34 00	
130	x≷y	35 52	
	f %	31 82	
	+	61	
	STO 0	33 00	
	RCL 1	34 01	
	RCL E	34 15	
	f %	31 82	
	+	61	
	STO 1	33 01	
	h SF 0	35 51 00	
140	RCL A	34 11	
	RCL 8	34 08	
	-	51	
	STO A	33 11	
	f ISZ	31 34	
	h RC I	35 34	
	DSP 0	23 00	
	h RTN	35 22	
*	g LBL a	32 25 11	
	h CF 0	35 61 00	Initialize
150	f CL REG	31 43	
	CL X	44	
	DSP 2	23 02	
	h RTN	35 22	
160			

STEP	KEY ENTRY	KEY CODE	COMMENTS
170			
180			
190			
200			
210			
220			

LABELS

A	B	C	D	E
Cap Rate	Taxable	Spendable	Equity	Next Year
a	b	c	d	e
Initialize				
0	1	2	3	4
5	6	7	8	9

FLAGS

0	1	2	3
Toggle			

SET STATUS

FLAGS		TRIG		DISP	
	ON OFF				
0	☐ ☒	DEG	☒	FIX	☒
1	☐ ☒	GRAD	☐	SCI	☐
2	☐ ☒	RAD	☐	ENG	☐
3	☐ ☒			n	2

Program Description I

Program Title RETURN ON EQUITY RENTAL PROPERTY

Contributor's Name COLIN E. WALTON

Address 26 SIMKIN AVE, KOHIMARAMARA,

City AUCKLAND 6. **State** NEW ZEALAND **Zip Code**

Program Description, Equations, Variables

GIVEN THE PRESENT VALUE (OR ASKING PRICE) OF AN INVESTMENT PROPERTY, AND MORTGAGE DETAILS, THIS PROGRAM WILL CALCULATE NET ANNUAL INCOME (AFTER INTEREST PAYMENTS) OWNERS EQUITY AND RETURN ON EQUITY EXPRESSED AS A PERCENTAGE.

FURTHER IF A NEW INCOME (EXPECTED FUTURE INCOME) IS INPUT, A SECOND CALCULATION IS PRESENTED ONCE AGAIN SHOWING NET INCOME, EQUITY AN. RETURN ON EQUITY

THIS PROGRAM CALCULATES ON THE BASIS OF A "FLAT" MORTGAGE WHERE ONLY INTEREST PAYMENTS ARE MADE - WHICH ARE COMMON IN INVESTMENT PROPERTIES.

Operating Limits and Warnings

INITIALIZATION MUST BE USED AT BEGINNING (START) BUT THERE-AFTER ALL OR ANY VALUES MAY BE CHANGED

Program Description 11

Sketch(es)

Sample Problem(s)

A RENTAL PROPERTY IS AVAILABLE AT $57000
FLAT MORTGAGE IS AVAILABLE OF $37600 @ 10%
INTEREST
A SECOND FLAT MORTGAGE OF $5000 @ 13%
INTEREST

WEEKLY INCOME FROM THIS PROPERTY IS $125
BUT YOU BELIEVE THIS MAY REASONABLY BE
INCREASED TO $160

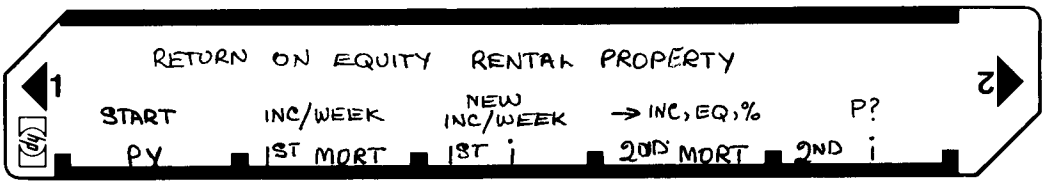
Solution(s)

KEYSTROKES

[f] [A] (INITIALISE)	→	0.00
57000 [A] 37600 [B] 10 [C]	→	10.00
5000 [D] 13 [E]	→	13.00
125 [f][B] 160 [f][C]	→	160.00
[f][D]	→	2090.00 INC
		14400.00 EQUITY
		14.51 %RETURN
		3910.00 N-INC
		14400.00 EQUITY
		27.15 % RETURN

Reference(s)

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	LOAD SIDE 1 AND SIDE 2			
2	INITIALISE		f A	0·00
3	OPTIONAL: SELECT PAUSE PRINT MODE		f E	1·00/0·00
4	INPUT PRESENT VALUE	PV	A	P.V
5	INPUT 1ST MORTGAGE VALUE	1ST MORT	B	1ST MORT
6	INPUT 1ST MORTGAGE ANNUAL INTEREST	1ST i	C	1ST i
7	* INPUT 2nd MORTGAGE VALUE	2nd MORT	D	2nd MORT
8	* INPUT 2nd MORTGAGE ANNUAL INTEREST	2nd i	E	2nd i
9	INPUT WEEKLY INCOME	INC/WEEK	f B	INC/ANNUM
10	**INPUT NEW WEEKLY INCOME	N-INC/WEEK	f C	N-INC/ANNUM
11	COMPUTE RESULTS -		f D	NET INC,
12	FOR NEW CASE GO TO STEP 4			EQUITY,
				% RETURN.
	* THESE ARE OPTIONAL INPUTS			
	** IF NEW WEEKLY INCOME INPUT PRINTER WILL PRINT 2 SETS OF RESULTS			

67 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS
001	* LBL A	21 11	
	STO 1	35 01	
	R/S	51	
	* LBL B	21 12	
	STO 2	35 02	
	R/S	51	
	* LBL C	21 13	
	STO 3	35 03	
	R/S	51	
010	* LBL D	21 14	
	STO 4	35 04	
	R/S	51	
	* LBL E	21 15	
	STO 5	35 05	
	R/S	51	
	* LBL a	21 16 11	
	CLRG	16-53	
	2	02	
	2	02	
020	2	02	
	CHS	-22	
	STO I	35 46	SETS I REG WITH -222 FOR PROGRAM BACK STEP IN PRINT MODE
	CLX	-51	
	R/S	51	
	LBL b	21 16 12	
	ENT ↑	-21	
	5	05	CHANGES WEEKLY INCOME TO ANNUAL
	2	02	
	x	-35	
030	STO 6	35 06	
	R/S	51	
	* LBL c	21 16 13	
	ENT ↑	-21	
	5	05	
	2	02	
	x	-35	
	STO 7	35 07	
	SF 1	16 21 01	
	R/S	51	
040	* LBL d	21 16 14	
	RCL 7	36 07	
	X=0?	16-34	CHECK IF NEW INCOME INPUT - IF NO CANCLE F1
	CF 1	16 22 01	
	RCL 2	36 02	
	RCL 3	36 03	
	%	55	
	STO 8	35 08	
	RCL 4	36 04	
	RCL 5	36 05	
050	%	55	
	ST+ 8	35-55 08	
	RCL 2	36 02	
	RCL 4	36 04	
	+	-55	
	RCL 1	36 01	
	X⇄Y	-41	
	-	-45	
	STO 9	35 09	
	RCL 6	36 06	
060	RCL 8	36 08	
	-	-45	
	FO?	16 23 00	IF FO SET THEN PRINT
	SPC	16-11	
	FO?	16 23 00	
	PRTX	-14	
	FO?	16 23 00	
	GTO i	22 45	GTO(i) CAUSES PROGRAM TO BACKSTEP 222 STEPS TO MISS PSE IN PRINT MODE
	PSE	16 51	
	RCL 9	36 09	
070	FO?	16 23 00	
	PRTX	-14	
	FO?	16 23 00	
	GTO i	22 45	
	PSE	16 51	
	÷	-24	
	1	01	
	0	00	
	0	00	
	x	-35	
080	FO?	16 23 00	
	PRTX	-14	
	FO?	16 23 00	
	GTO i	22 45	
	PSE	16 51	
	F1?	16 23 01	
	GTO 1	22 01	
	R/S	51	
	LBL 1	21 01	LBL 1 DOES NEW INCOME CALCULATON
	RCL 7	36 07	
090	RCL 8	36 08	
	-	-45	
	FO?	16 23 00	
	SPC	16-11	
	FO?	16 23 00	
	PRTX	-14	
	FO?	16 23 00	
	GTO i	22 45	GTO(i) CAUSES PROGRAM TO BACKSTEP 222 STEPS TO MISS PSE IN PRINT MODE
	PSE	16 51	
	RCL 9	36 09	
100	FO?	16 23 00	
	PRTX	-14	
	FO?	16 23 00	
	GTO i	22 45	
	PSE	16 51	
	÷	-24	
	1	01	
	0	00	
	0	00	
	x	-35	
110	FO?	16 23 00	
	RRTX	-14	
	R/S	51	

REGISTERS

0	1 PV	2 1ST MORT	3 1ST i	4 2ND MORT	5 2ND i	6 PRESENT ANNUAL INC.	7 NEW ANNUAL INC	8 TOT INT	9 EQUITY
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I USED.

67 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS
	LBL e	21 16 15	
	FO?	16 23 00	
	GTO 0	22 00	PRINT TOGGLE
	SFO	16 21 00	
	CLX	-51	
	1	01	
	RTN	24	
120	LBL 0	21 00	
	CFO	16 22 00	
	CLX	-51	
	0	00	
	RTN	24	
130			
140			
150			
160			
170			
180			
190			
200			
210			
220			

LABELS					FLAGS	SET STATUS		
A PV	B 1ST MORT	C 1ST i	D 2ND MORT	E 2ND i	0 USED	FLAGS	TRIG	DISP
a START	b INC/WEEK	c NEW INC/WEEK	d RETURN	e P?	1 USED	ON OFF 0 ☐ ☒ 1 ☐ ☒ 2 ☐ ☒ 3 ☐ ☒	DEG ☒ GRAD ☐ RAD ☐	FIX ☒ SCI ☐ ENG ☐ n 2
0 PRINT	1 N-INC PRINT	2	3	4	2			
5	6	7	8	9	3			

Program Description I

Program Title REAL ESTATE INVESTMENT ANALYSIS

Contributor's Name BRUCE R. MURDOCK
Address 6875 Sabado Tarde Rd
City Goleta State Calif Zip Code 93017

Program Description, Equations, Variables This program performs the financial analysis of a real estate investment such as an apartment building. The user enters the first mortgage particulars (principal, yearly interest rate, and number of years loan runs), the second mortgage particulars (principal and yearly interest rate), the net income (gross less utilities, taxes, and services), the down payment (the buyers investment), the value of items to be depreciated at an accelerated rate, the accelerated rate, and the life in years, the yearly straight line acceleration amount, and the buyers tax bracket. A financial analysis for any year of the investment life may now be made. The year number is entered, and the program returns a financial summary that includes the down payment, the first mortgage particulars (principal value, interest rate, life, and monthly payment), the second mortgage particulars (principal value, interest rate, and monthly payment), total monthly payment, total yearly mortgage payment, interest paid to the first, and the second mortgage, total yearly interest, accelerated depreciation summary (original value, acceleration rate, lifetime, depreciation for the selected year), straight line depreciation, and total depreciation for the selected year, interest plus depreciation less income (taxable income writeoff), tax writeoff (tax bracket times taxable income writeoff), yearly cash flow (net monthly income less monthly mortgage payments times twelve), money in pocket (tax savings plus cash flow), payments to principal, and dollars returned on investment (tax savings plus cash flow plus principal payments). By dividing the dollar return on investment by the down payment, the percent return on investment is obtained. The sample calculation shows all the above information for each of the first five years of operation of a hypothetical apartment.

Program Description I

The second mortgage payments are calculated at 10% of the yearly interest rate per month, i.e. the monthly payment for a second with 10% interest rate per year is 1% of the principal per month. This is a typical arrangement for second trust deeds, however, with any loan having a balloon payment, the monthly payments can be flexible, an extreme case is the interest only loan.

The program may be modified to allow entry of a second loan payment. The subroutine that calculates yearly interest uses as inputs, the principal, the monthly interest rate, and the payment, so only the part of the program where the second trust deed monthly payment is calculated need be changed. This section is contained under label B. The coding shown below replaces the existing section of the program under label B, and allows the user to enter the second principal, yearly interest rate as a percent, and the monthly payment. The program will then summarize, as before, the amounts paid to principal and interest each year.

```
026  *LBLB
027   STO6
028     R↓
029   GSB3
030     ÷
031   STO5
032     R↓
033   STO4
034  *LBL1
035   RCL3
036   RCL6
037     -
038   STO7
039    RTN
```

Program Description I

Program Title REAL ESTATE INVESTMENT ANALYSIS

Contributor's Name

Address

City **State** **Zip Code**

Program Description, Equations, Variables

1^{ST} T.D. monthly payment (pmt) $= \dfrac{i_M \cdot PV_1}{1 - \dfrac{1}{(1+i_M)^n}}$

$i_M = \dfrac{i_{yr}}{12}$ = monthly interest rate

n = total number of payments

$n = 12 \times$ # of years

1^{ST} or 2^{ND} interest payments for year k, I_k

$$I_k = 12 \cdot pmt + \left(PV - \frac{PMT}{i_m}\right)\left((1+i_M)^{12} - 1\right)(1+i_m)^{12(k-1)}$$

1^{ST} T.D. payments to principal $= 12 \cdot pmt - I_k$

2^{ND} T.D. monthly payment $= PV_2 \cdot c_{second/yr} / 10$

Operating Limits and Warnings If no first or Second loan exists, a zero principal value may be entered, but a dummy interest rate must be used like 1. Entry of a zero interest rate causes division by zero in the monthly payment calculation, and program execution stops displaying "Error".

Program Description I

Program Title REAL ESTATE INVESTMENT ANALYSIS

Contributor's Name

Address

City **State** **Zip Code**

Program Description, Equations, Variables

accelerated depreciation $= (\text{Bldg value})\frac{R}{n}\left(1-\frac{R}{n}\right)^{k-1}$

R = acceleration rate
k = year number
n = life, yrs

Taxable income writeoff = (Depreciation) + (interest pmts) − (net income)

net income = (gross income) − (taxes) − (insurance) − (utilities) − (services) − (maintainence)

Income tax reduction = (incremental tax brkt)(Taxable income w/o)

Cash flow = net income − mortgage payments (on yearly basis)

money in pocket = Income tax reduction + Cash flow

Total return on investment = money in pocket + payments to principal

% return on investment = Total return / down payment
(the down payment is assumed to be the total investment by the buyer)

Program Description II

Sketch(es)

Sample Problem(s) A $100,000 apartment building is to be purchased with the following financing: 1st mortgage, $80000, 9.5%/yr, 30 years, simple interest; 2nd mortgage: 10000.@ 10%/yr. (payments 1%/mo.); down payment: $10000. The gross yearly rent less utilities, taxes, maintenence, and services is $7000. The building (structure) value is 80000 and is to be depreciated over 20 years at a 125% accelerated rate. The straight line depreciation items are $500/yr (stoves, refrigerators, water heaters, carpets and drapes). Assume the buyer is in the 50% tax bracket combined federal, state, and local. (the tax bracket is the incremental percentage shown in the tax schedules). The analysis is performed for years one through five of building life (investment life).

Solution(s) See attached sheet

Reference(s)

Program Description 1

PROGRAM INPUT

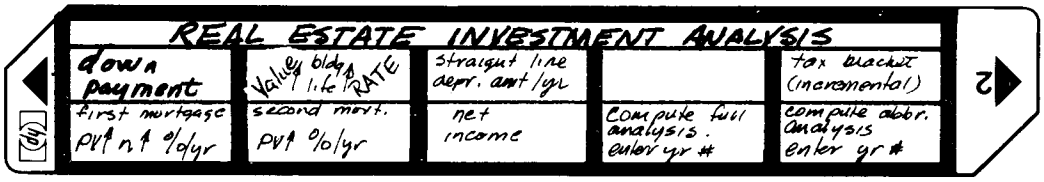
10000.00	GSBa	down payment
80000.00	ENT↑	first principal
30.00	ENT↑	first lifetime, years
9.50	GSBA	first interest rate per year
672.68	***	output, first monthly payment
10000.00	ENT↑	second principal
10.00	GSBB	second yearly interest rate
7000.00	GSBC	net yearly income
80000.00	ENT↑	accelerated depreciation value
20.00	ENT↑	accel. depr. lifetime, years
1.25	GSBb	accel depr. rate
500.00	GSBc	straight line depreciation per year
.50	GSBe	incremental tax bracket (state & fed)
1.00	GSBD	year number for analysis

D returns full analysis
E returns abbreviated analysis

PROGRAM OUTPUT

				2.00 GSBE		3.00 GSBE	
down payment	10000.00	***					
first principal	80000.00	***					
first life, years	30.00	***					
first yearly interest	9.50	***	(percent)				
first monthly payment	672.68	***					
second principal	10000.00	***					
second yearly interest	10.00	***					
second monthly pmt.	100.00	***					
total monthly pmt.	772.68	***					
total yearly pmt.	9272.20	***					
first yearly int.	7578.89	***		7529.93	***	7476.11	***
second yearly int.	990.57	***		968.64	***	944.42	***
total yearly int.	8569.46	***		8498.57	***	8420.53	***
accel depr assets	80000.00	***		80000.00	***	80000.00	***
accel depr rate	1.25	***		1.25	***	1.25	***
accel depr life, years	20.00	***		20.00	***	20.00	***
accel depr	5000.00	***		4687.50	***	4394.53	***
straight line depr.	500.00	***		500.00	***	500.00	***
total depreciation	5500.00	***		5187.50	***	4894.53	***
depr plus int.	14069.46	***		13686.07	***	13315.06	***
net income	7000.00	***		7000.00	***	7000.00	***
taxable income w/o	7069.46	***		6686.07	***	6315.06	***
incremental tax rate	0.50	***		0.50	***	0.50	***
income tax writeoff	3534.73	***		3343.04	***	3157.53	***
yearly cash flow	-2272.20	***		-2272.20	***	-2272.20	***
money in pocket	1262.53	***		1070.84	***	885.33	***
payments to princ.	702.74	***		773.63	***	851.67	***
$ return in invest.	1965.27	***		1844.46	***	1737.00	***
% return on invest.	19.65	***		18.44	***	17.37	***

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load both sides of magnetic card			
2	key in first mortgage particulars			
	a mortgage value (PV_1)	PV_1	↑	
	b mortgage life, years	n	↑	
	c yearly interest rate, percent	i_{yr}	A	monthly pmt (printed)
3	key in Second mortgage particulars			
	a mortgage value (PV_2)	PV_2	↑	
	b yearly interest rate	i_{yr}	B	
4	key in net income per year	net income	C	
5	key in down payment	$ down	f	A
6	key in accelerated depreciation particulars			
	a amount to be depreciated	$	↑	
	b depreciation period or life	n	↑	
	c acceleration rate as decimal	R	f	B
7	key in yearly straight line depreciation amount	$ S/L	f	C
8	key in total incremental tax rate (state & federal) as decimal	tax brkt	f	E
9	key in year number to be analyzed	year	D	summary
10	go back to 9 for another year, or, for abbreviated printout, enter year number	year	E	summary
11	Stop or go back and change problem parameters and rerun.			

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	1ST princ ↑ #yrs ↑ %/yr
002	GSB3	23 03	
003	÷	-24	
004	STO2	35 02	
005	R↓	-31	
006	STO1	35 01	
007	R↓	-31	
008	STO0	35 00	
009	RCL2	36 02	
010	x	-35	
011	RCL1	36 01	
012	GSB4	23 04	
013	CHS	-22	
014	RCL2	36 02	
015	1	01	
016	+	-55	
017	X≠Y	-41	
018	Y^x	31	
019	1	01	
020	X≠Y	-41	
021	-	-45	
022	÷	-24	
023	STO3	35 03	1ST T.O. monthly pmt
024	GSB5	23 05	
025	GTO1	22 01	
026	*LBLB	21 12	2ND princ ↑ %/yr
027	GSB3	23 03	
028	÷	-24	
029	STO5	35 05	
030	R↓	-31	
031	STO4	35 04	
032	*LBL1	21 01	
033	RCL4	36 04	
034	RCL5	36 05	
035	x	-35	
036	1	01	
037	.	-62	
038	2	02	
039	x	-35	
040	STO6	35 06	2ND mo pmt
041	RCL3	36 03	
042	+	-55	
043	STO7	35 07	total monthly pmt
044	RTN	24	
045	*LBLC	21 13	net rental income
046	STO8	35 08	
047	RTN	24	
048	*LBLe	21 16 15	incremental tax bracket
049	STOA	35 11	
050	RTN	24	
051	*LBLa	21 16 11	Down payment
052	STOD	35 14	
053	RTN	24	
054	*LBL6	21 16 12	Accelerated depreciation data
055	P≠S	16-51	
056	STO1	35 01	
057	R↓	-31	
058	STO0	35 00	$ ↑ n ↑ rate
059	R↓	-31	
060	STO2	35 02	
061	P≠S	16-51	
062	RTN	24	
063	*LBLc	21 16 13	straight line depr. per year
064	STOC	35 13	
065	RTN	24	
066	*LBLE	21 15	abbreviated printout
067	GSB6	23 06	
068	STOB	35 12	key in year #
069	GTO0	22 00	
070	*LBLD	21 14	full printout, key in year #
071	STOB	35 12	
072	GSB6	23 06	
073	RCLD	36 14	
074	GSB5	23 05	
075	RCL0	36 00	1ST T.O. Summary
076	PRTX	-14	
077	RCL1	36 01	
078	PRTX	-14	
079	RCL2	36 02	
080	GSB3	23 03	
081	x	-35	
082	PRTX	-14	
083	RCL3	36 03	
084	GSB5	23 05	
085	RCL4	36 04	2ND T.O. Summary
086	PRTX	-14	
087	RCL5	36 05	
088	GSB3	23 03	
089	x	-35	
090	PRTX	-14	
091	RCL6	36 06	
092	GSB5	23 05	
093	RCL7	36 07	total mortgage pay ment summary
094	PRTX	-14	
095	GSB4	23 04	
096	PRTX	-14	
097	*LBL0	21 00	
098	SPC	16-11	
099	RCL2	36 02	
100	RCL3	36 03	
101	RCL0	36 00	
102	GSB2	23 02	
103	STO9	35 09	1ST yearly interest
104	PRTX	-14	
105	RCL5	36 05	
106	RCL6	36 06	
107	RCL4	36 04	
108	GSB2	23 02	
109	PRTX	-14	2ND yearly interest

REGISTERS

0 1ST T.O. principal	1 1/ST period, years	2 1/ST interest %/mo	3 1/ST monthly payment	4 2ND T.O. principal	5 2ND interest %/mo	6 2ND monthly payment	7 total mo. mortgage payments	8 net rental income	9 total yrly mort. interest
S0 bldg life, years	S1 declining balance rate	S2 bldg value $	S3 PV	S4 PMT	S5 i/mo	S6 1+i/mo	S7	S8	S9
A incremental tax bracket	B year #	C straight line depreciation /year	D Down payment	E	I				

97 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS
110	ST+9	35-55 09	
111	RCL9	36 09	Total yearly interest
112	PRTX	-14	
113	GSB6	23 06	
114	P≷S	16-51	
115	RCL2	36 02	
116	PRTX	-14	
117	RCL1	36 01	
118	PRTX	-14	
119	RCL0	36 00	
120	PRTX	-14	
121	÷	-24	accelerated depreciation summary
122	ENT↑	-21	
123	ENT↑	-21	
124	CHS	-22	
125	1	01	
126	+	-55	
127	RCLB	36 12	
128	1	01	
129	-	-45	
130	Y^x	31	
131	RCL2	36 02	
132	x	-35	
133	x	-35	
134	P≷S	16-51	
135	PRTX	-14	
136	RCLC	36 13	s/l depreciation
137	PRTX	-14	
138	+	-55	
139	GSB5	23 05	total depreciation
140	RCL9	36 09	
141	+	-55	
142	PRTX	-14	total depr + interest
143	RCL8	36 08	
144	PRTX	-14	net income
145	-	-45	
146	PRTX	-14	income - int & depr
147	RCLA	36 11	= income writeoff
148	PRTX	-14	incremental tax rate
149	x	-35	
150	PRTX	-14	income tax writeoff
151	RCL8	36 08	
152	RCL7	36 07	
153	GSB4	23 04	
154	-	-45	
155	PRTX	-14	yearly cash flow
156	+	-55	
157	GSB5	23 05	money in pocket
158	RCL7	36 07	= cash flow + tax svgs
159	GSB4	23 04	
160	RCL9	36 09	
161	-	-45	
162	PRTX	-14	total pmts to principal
163	+	-55	
164	PRTX	-14	$ ROI
165	RCLD	36 14	
166	÷	-24	
167	EEX	-23	
168	2	02	
169	x	-35	
170	GSB5	23 05	% ROI
171	*LBL6	21 06	
172	SPC	16-11	
173	SPC	16-11	
174	RTN	24	
175	*LBL2	21 02	yearly interest subroutine
176	P≷S	16-51	
177	STO3	35 03	
178	R↓	-31	
179	STO4	35 04	
180	R↓	-31	
181	STO5	35 05	
182	1	01	
183	+	-55	
184	STO6	35 06	
185	RCLB	36 12	
186	1	01	
187	-	-45	
188	GSB4	23 04	
189	Y^x	31	
190	RCL6	36 06	
191	1	01	
192	2	02	
193	Y^x	31	
194	1	01	
195	-	-45	
196	x	-35	
197	RCL3	36 03	
198	RCL4	36 04	
199	RCL5	36 05	
200	÷	-24	
201	-	-45	
202	x	-35	
203	RCL4	36 04	
204	GSB4	23 04	
205	+	-55	
206	P≷S	16-51	
207	RTN	24	
208	*LBL3	21 03	"1200"
209	1	01	
210	2	02	
211	0	00	
212	0	00	
213	RTN	24	
214	*LBL4	21 04	12 x
215	1	01	
216	2	02	
217	x	-35	
218	RTN	24	
219	*LBL5	21 05	print & space
220	PRTX	-14	
221	SPC	16-11	
222	RTN	24	

LABELS

A 1ST T.D.	B 2ND T.D.	C net income	D compute full output	E compute abbr. output	0
a down payment	b accelerated depreciation	c straight line depreciation	d	e incremental tax bracket	1
0 abbr. printout	1 local loop destination	2 loan interest subroutine	3 1200	4 12x	2
5 prt & space	6 double space	7	8	9	3

FLAGS

	ON	OFF
0	☐	☒
1	☐	☒
2	☐	☒
3	☐	☒

SET STATUS

TRIG	DISP
DEG ☒	FIX ☒
GRAD ☐	SCI ☐
RAD ☐	ENG ☐
	n 2

Program Description I

Program Title INTERNAL RATE OF RETURN

Contributor's Name HEWLETT-PACKARD COMPANY
Address Corvallis Division
1000 N.E. Circle Boulevard
City Corvallis, OR 97330 **State** **Zip Code**

Program Descript

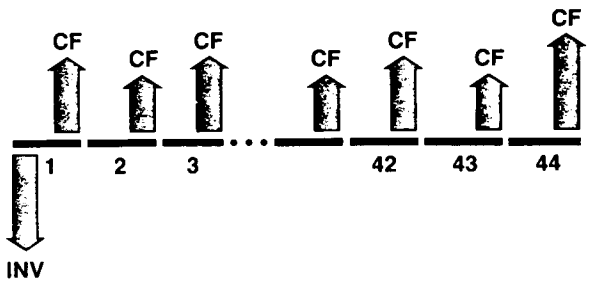


Figure 1

Note:

The above diagram is representative of diagrams which will be used in this pac. The horizontal line represents the time period(s) involved, while the arrows represent the cash flows.

The interest rate that equates the present value of all future cash flows with the original investment is known as the internal rate of return (IRR, also called discounted rate of return or yield). Given a non-zero initial investment and up to 44 **positive** cash flows, this program calculates the periodic IRR. If there are negative as well as positive cash flows, the program accepts up to 22 cash flows.

If more than 44 positive cash flows are entered, all cash flows over 44 will be ignored. There will be no indication, however, that more than 44 cash flows have been entered. Likewise, if more than 22 positive and negative cash flows are entered, erroneous results will occur.

Zero should be entered for periods with no cash flow.

Operating Limits a

When more than 22 cash flows are involved (all of which must be positive), the user is asked to enter the largest cash flow in step 3 because of the storage techniques being used. This value is then used to scale all other cash flows, and depending on these values, accuracy may be reduced. Consequently, the resulting periodic rate of return should be considered accurate to within ±.01% (.0001 decimal). This largest cash flow must be entered again in sequence in step 4. If a cash flow larger than the value entered for CF MAX is keyed in at step 4, erroneous results may occur.

The answer produced is the *periodic rate of return*. If the cash flow periods are

Program Description I

Program Title _____

_____

Contributor's Name _____

Address _____

City _____ **State** _____ **Zip Code** _____

Program Description, Equations, Variables _____

other than annual (monthly, quarterly) the answer should be multiplied by the number of periods per year to determine the annual internal rate of return.

In many instances another program may be more suitable for calculating IRR. If all cash flows are equal and equally spaced, or if all cash flows except the last are equal and equally spaced, DIRECT REDUCTION LOANS (BD-04) is a better choice. If the cash flows occur in groups of uneven amounts, IRR-GROUPS (BD-02) may be more suitable.

This program was designed for optimum operation when the interest rate being solved for is between 0 and 100%. The program will often solve for interest rates outside this range, but occasionally may halt prematurely with ERROR in the display. This is an error condition generated by an intermediate calculation, and indicates that the program cannot solve that particular problem.

The calculated answer may be verified by using DISCOUNTED CASH FLOW ANALYSIS—NET PRESENT VALUE (BD-03), to calculate the net present value. The NPV should be close to 0.

Note:

When the sign of the cash flows is reversed more than once, more than one interest rate is considered correct in the mathematical sense. While this program may find one of the answers, it has no way of finding or indicating other possibilities.

Operating Limits and Warnings _____

Program Description 11

Sketch(es)

Sample Problem(s)

PRINCIPAL EQUATIONS

Unless otherwise stated, all interest rates (i, APR, IRR, NOM, EFF, CR, YLD, etc.) are expressed in decimal form in the equations which follow. Only symbols not defined in the program descriptions are defined here.

Program Number

1. Internal Rate of Return

Solve for IRR in:

$$INV = \sum_{j=1}^{n} \frac{CF_j}{(1 + IRR)^j}$$

where:

n = number of cash flows
CF_j = j^{th} cash flow

Solution(s)

Reference(s)

Program Description 11

Sketch(es)

Example 1:

Income property requiring a $250,000 equity investment and to be sold in ten years is expected to generate the "after tax" cash flows shown below. What is the expected yield or IRR?

Sample Problem(s)

End of Year	Cash Flow	End of Year	Cash Flow
1	$46,423	6	$ 23,199
2	40,710	7	21,612
3	36,638	8	20,037
4	34,097	9	18,460
5	32,485	10	311,406 (property sold)

Keystokes: **Outputs:**

250000 [A] 46423 [C] 40710 [C]
36638 [C] 34097 [C] 32485 [C]
23199 [C] 21612 [C] 20037 [C]
18460 [C] 311406 [C] [D] ⟶ 13.98 (annual IRR is 13.98%)

Example 2:

Property requiring a $30,000 investment will be sold at the end of 2 years. If the investment results in the monthly net cash flows shown below, what is the IRR?

Solution(s)

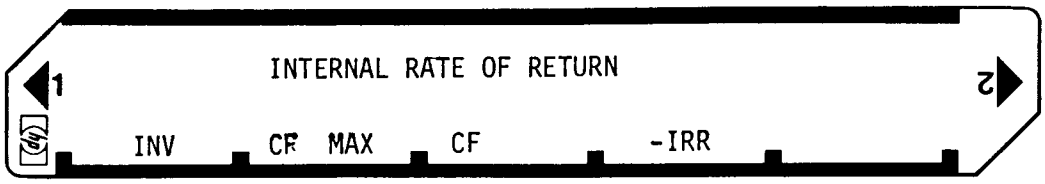
End of Month	Cash Flow	End of Month	Cash Flow
1	$ 16	13	$ 201
2	50	14	195
3	175	15	178
4	181	16	197
5	143	17	210
6	147	18	220
7	151	19	206
8	176	20	194
9	184	21	187
10	193	22	190
11	157	23	201
12	190	24	35,000 (property sold)

Keystrokes: **Outputs:**

30000 [A] 35000 [B]
16 [C] 50 [C] 175 [C] 181 [C]
143 [C] 147 [C] 151 [C] 176 [C]
184 [C] 193 [C] 157 [C] 190 [C] ⟶ 12.00 (12 cash flows input)
201 [C] 195 [C] 178 [C] 197 [C]
210 [C] 220 [C] 206 [C] 194 [C]
187 [C] 190 [C] 201 [C] 35000 [C] ⟶ 24.00 (all cash flows input)
[D] ⟶ 1.15 (monthly IRR)
12 [×] ⟶ 13.79 (an annual IRR of 13.79%)

Reference(s)

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2.			
2	Input initial investment.	INV	A	INV
3	If there are > 22 cash flows, key			
	in the largest cash flow.	CF MAX	B	CF MAX
4	Beginning with the first period,			
	key in all cash flows in sequence,			
	pressing C after each value.	CF	C	# of CFs
5	Calculate the periodic internal			
	rate of return		D	IRR (%)

97 Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLA	21 11	Clear registers
002	CLRG	16-53	
003	P≠S	16-51	
004	CLRG	16-53	
005	STOE	35 15	INV→R_E
006	CF0	16 22 00	Clear flags
007	CF1	16 22 01	
008	RTN	24	
009	*LBLB	21 12	Input largest cash
010	2	02	flow if #CF_s>22
011	x	-35	
012	STO0	35 00	
013	RCLE	36 15	
014	X≠Y	-41	
015	÷	-24	
016	STOE	35 15	INV/2CMAX→R_E
017	LSTX	16-63	
018	SF0	16 21 00	Flag 0 indicates
019	2	02	>22 cash flows
020	÷	-24	
021	RTN	24	
022	*LBLC	21 13	
023	ISZI	16 26 46	
024	F0?	16 23 00	If FO, pack data
025	GSBc	23 16 13	in registers
026	ST+i	35-55 45	
027	X≠Y	-41	
028	RCLI	36 46	
029	F1?	16 23 01	Dispaly # of cash
030	+	-55	flows (add if >22CF)
031	RTN	24	
032	*LBLc	21 16 13	
033	2	02	
034	3	03	
035	RCLI	36 46	
036	X≠Y?	16-32	
037	GT00	22 00	23rd cash flow?
038	1	01	
039	STOI	35 46	Reset I
040	+	-55	
041	CLX	-51	Drop stack and
042	EEX	-23	clear x
043	5	05	
044	ST÷0	35-24 00	2CMAX/10^5→R_0
045	SF1	16 21 01	
046	*LBL0	21 00	
047	R↓	-31	
048	1	01	
049	-	-45	
050	X≠Y	-41	
051	RCL0	36 00	Scale cash flow
052	÷	-24	
053	F1?	16 23 01	If CF_j,j>22, drop
054	INT	16 34	fractional part
055	RTN	24	of CF_j
056	*LBLa	21 16 11	

STEP	KEY ENTRY	KEY CODE	COMMENTS
057	RCLI	36 46	LBL fa sets up I for
058	1	01	count down and keeps
059	0	00	track of original
060	1	01	# of cash flows by
061	x	-35	storing N.N.
062	STOI	35 46	
063	RTN	24	
064	*LBLe	21 16 15	
065	F0?	16 23 00	
066	GT00	22 00	Unpack double
067	INT	16 34	stored cash flows
068	EEX	-23	
069	5	05	
070	÷	-24	
071	RTN	24	
072	*LBL0	21 00	
073	FRC	16 44	
074	RTN	24	
075	*LBLD	21 14	
076	GSBa	23 16 11	Set-up I
077	RCLI	36 46	N N
078	EEX	-23	
079	2	02	
080	÷	-24	
081	STOI	35 46	N.N→I
082	1	01	
083	.	-62	
084	0	00	
085	1	01	1 + i_0→R_D
086	STOD	35 14	
087	*LBL4	21 04	
088	CF0	16 22 00	
089	0	00	
090	STO0	35 00	
091	*LBL5	21 05	
092	RCLI	36 46	
093	INT	16 34	
094	F1?	16 23 01	Get j
095	GSBd	23 16 14	
096	RCLi	36 45	
097	F1?	16 23 01	
098	GSBe	23 16 15	Unpack CF_j
099	ST+0	35-55 00	
100	x	-35	
101	+	-55	f(i) in R_0
102	RCLD	36 14	
103	ST÷0	35-24 00	
104	÷	-24	
105	DSZI	16 25 46	
106	GT05	22 05	
107	F1?	16 23 01	
108	GT00	22 00	
109	*LBL6	21 06	
110	RCL0	36 00	
111	RCLE	36 15	
112	-	-45	

REGISTERS

0 Used	1 Used	2 Used	3 Used	4 Used	5 Used	6 Used	7 Used	8 Used	9 Used
S0 Used	S1 Used	S2 Used	S3 Used	S4 Used	S5 Used	S6 Used	S7 Used	S8 Used	S9 Used
A Used	B Used	C Used	D 1 + i_0	E Used	I Used				

97 Program Listing 11

STEP	KEY ENTRY	KEY CODE	COMMENTS
113	X≷Y	-41	
114	÷	-24	
115	RCLD	36 14	$\frac{f}{f'}(1+i)$
116	×	-35	
117	RCLD	36 14	
118	X≷Y	-41	
119	+	-55	(1 + i) next
120	STOD	35 14	
121	LSTX	16-63	
122	ABS	16 31	
123	EEX	-23	
124	CHS	-22	
125	5	05	f (i)/f'(i)
126	X>Y?	16-34	
127	GTO7	22 07	←DONE!
128	GSBa	23 16 11	
129	GTO4	22 04	
130	*LBL0	21 00	
131	F0?	16 23 00	
132	GTO6	22 06	
133	SF0	16 21 00	
134	GSBb	23 16 12	
135	GTO5	22 05	
136	*LBLb	21 16 12	
137	2	02	Loop back for
138	2	02	lower 22 CF_s
139	RCLI	36 46	
140	+	-55	Reset I to lower
141	STOI	35 46	22 CF_s
142	CLX	-51	
143	+	-55	
144	RTN	24	
145	*LBLd	21 16 14	
146	2	02	Add 22 if flag 0
147	2	02	clear
148	F0?	16 23 00	
149	CLX	-51	
150	+	-55	
151	RTN	24	
152	*LBL7	21 07	Reset R_I for another
153	RCLD	36 14	
154	1	01	pressing of [D]
155	-	-45	
156	STOD	35 14	
157	EEX	-23	R_I must contain
158	2	02	integer here
159	×	-35	
160	RCLI	36 46	
161	LSTX	16-63	
162	×	-35	
163	STOI	35 46	
164	X≷Y	-41	
165	RTN	24	
166	R/S	51	

STEP	KEY ENTRY	KEY CODE	COMMENTS
170			
180			
190			
200			
210			
220			

LABELS

A INV	B CF MAX	C CF	D →IRR	E	0 >22 CF_s
a USED	b USED	c USED	d USED	e USED	1 USED
0 USED	1	2	3	4 USED	2
5 USED	6 USED	7 USED	8	9	3

FLAGS

	ON	OFF
0	☐	☒
1	☐	☒
2	☐	☒
3	☐	☒

SET STATUS

TRIG	DISP
DEG ☒	FIX ☒
GRAD ☐	SCI ☐
RAD ☐	ENG ☐
	n 2

Program Description I

Program Title DEPRECIATION SCHEDULES

Contributor's Name HEWLETT-PACKARD COMPANY
Address Corvallis Division
1000 N.E. Circle Boulevard
City Corvallis, OR 97330 **tate** **Zip Code**

Program Description, Equations, Variables

Three methods of depreciation are commonly used: straight-line, sum-of-the-years'-digits, and declining balance. This program evaluates the depreciation schedules for these three methods, and calculates the crossover point between straight line and declining balance depreciation. For the schedules, the output is the annual depreciation amount (DEP), remaining depreciable amount (RDV), remaining book value (RBV), and the total depreciation to date (TOT DEP), as well as an increment for the next year's schedule.

An option is available to output the depreciation schedule beginning at a specified year. 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 mode is on or off respectively.

Values for the last year of an asset with fractional years life (i.e., the 21st year's values for an asset with 20.5 years life) are calculated correctly. However, all other values represent a full year's depreciation. For this reason only integer values (whole number, 1.0, 2.0, 17.0 etc.) may be entered for YR (the D key). The program makes no checks on this value and generates invalid results if other than whole numbers are entered.

Straight Line Depreciation

The annual depreciation allowance using this method is determined by dividing the cost or other basis of valuation (starting book value) less its estimated salvage value by its useful life expectancy. This program develops the starting book value (SBV), salvage value (SAL), life expectancy (LIFE), and first year of the schedule (YR). (The schedule may be started at any point in the useful life.)

Fractional years life must be entered as an integer plus a fraction. Thus a life of 12 years 3 months would be keyed in as 12.25 for LIFE.

Operating Limits

Sum of the Years' Digits Depreciation

The sum-of-the-years' digits method is an accelerated form of depreciation, allowing more depreciation in the early years of an asset's life than allowed under the straight line method. This program generates the schedule output, given the starting book value (SBV), the salvage value (SAL), expected useful life in years (LIFE), and beginning year (YR) for the schedule. (The schedule may be started at any point in the useful life.)

Fractional years asset life must be entered as an integer plus a fraction. Thus a life of 12 years 3 months would be keyed in as 12.25 for LIFE.

Program Description I

Program Title

Contributor's Name

Address

City **State** **Zip Code**

Program Description, Equations, Variables

Variable Rate Declining Balance Depreciation

The variable rate declining balance method is another form of accelerated depreciation; as such it provides for more depreciation in earlier years and decreasing depreciation in later years. The program generates the depreciation schedule given the starting book value (SBV), salvage value (SAL), useful life expectancy (LIFE), the declining rate factor (FACT), and the first year of the desired schedule (YR). The schedule may be started at any point in the useful life.

The "variable rate" is indicated as either a factor or percent with equal frequency in the business community. Thus, "1.5 declining balance factor" and "150% declining balance" have the same meaning. The number to be keyed in for FACT (E) in this program, should be in factor form, that is 1.25, 1.5, 2, and not 125, 150 or 200.

This method of depreciation is unique in that it may generate depreciation greater than the depreciable value for some assets, while it may not generate sufficient depreciation for others. The crossover calculation (f D) is provided to assist in determining the best time to switch to straight line depreciation (tax laws permitting) so that an asset may be fully depreciated.

Fractional years life must be entered as an integer and a decimal. Thus, a life of 12 years 3 months would be keyed in as 12.25.

Crossover Point

As indicated in the description above, the declining balance method of depreciation may not fully depreciate an asset in the asset's lifetime. In these circumstances there is an optimum point in the useful life where a switch from the declining balance method to the straight line method should be made. This is the "crossover point", the first year in which the depreciation by the straight line method is greater than if depreciation were continued using declining balance method. (In accordance with Internal Revenue Service Publication 534, the straight line depreciation is determined by dividing the remaining depreciable value by the remaining useful life.)

Operating Limits

Program Description 1

Program Title

Contributor's Name

Address

City **State** **Zip Code**

Program Description, Equations, Variables

Given the starting book value (SBV), salvage value (SAL), useful life expectancy (LIFE), and declining balance factor (FACT), this routine calculates the last year that the declining balance method should be used, and the remaining life and remaining book value after this "last year" so that a switch to straight line depreciation can be made. As in the previous routine, the factor (FACT) should be entered in factor form (1.25, 1.5, 2.0), not as a percent (125, 150, 200).

The crossover routine (f D) may be used with the declining balance (f C) and straight line (f A) depreciation routines as follows:

1. Use f D to determine the "crossover point" and associated values.
2. Use f C to generate a declining balance depreciation schedule for the early years up to and including the year indicated as being the "last year". Since the same input values are used, only a value for YR (D) need be keyed in before pressing f C.
3. Now use f A to generate a straight line depreciation schedule for the remaining years. The remaining book value at the end of the last "declining balance year" is keyed in for starting book value (A), and the remaining life is keyed in for the asset's life (C). There is no need to enter the salvage value as it has been retained throughout this process.

   For this portion of the depreciation schedule, the value for "total depreciation to date" will be in error by an amount equal to the amount depreciated during the declining balance calculations.

Operating Limits and Warnings

Program Description 11

Sketch(es)

Sample Problem(s)

Depreciation Schedules

where:

K = value for YR

$TOTDEP_K$ = total depreciation for years 1 through K.

W = integer portion of LIFE

F = decimal portion of LIFE

(i.e., for a LIFE of 12.25 years W = 12 and F = .25)

Straight Line Schedule

$$DEP_K = \frac{SBV - SAL}{LIFE}$$

$$DEP_K \text{ (last year)} = \left(\frac{SBV - SAL}{LIFE}\right) \cdot F$$

$$TOTDEP_K = (K) \cdot \left(\frac{SBV - SAL}{LIFE}\right)$$

Solution(s)

$$RDV_K = (LIFE - K) \cdot \left(\frac{SBV - SAL}{LIFE}\right)$$

$$RBV_K = RDV_K + SAL$$

Reference(s)

Program Description II

Sketch(es)

Sample Problem(s)

Sum-of-the-Years'-Digits Schedule

$$SOYD = \frac{(W + 1)(W + 2F)}{2}$$

$$DEP_K = \left(\frac{LIFE + 1 - K}{SOYD}\right) \cdot (SBV - SAL)$$

$$TOTDEP_K = \left[1 - \frac{(W - K + 1) \times (W - K + 2F)}{2 \times (SOYD)}\right] \cdot (SBV - SAL)$$

$$RDV_K = \left[\frac{(W - K + 1) \times (W - K + 2F)}{2 \times (SOYD)}\right] \cdot (SBV - SAL)$$

$$RBV_K = RDV_K + SAL$$

Solution(s)

Variable Rate Declining Balance Schedule

$$DEP_K = SBV \cdot \left(1 - \frac{FACT}{LIFE}\right)^{K-1} \cdot \left(\frac{FACT}{LIFE}\right)$$

$$TOTDEP_K = SBV \cdot \left[1 - \left(1 - \frac{FACT}{LIFE}\right)^{K}\right]$$

$$RDV_K = (SBV - SAL) - TOTDEP_K$$

$$RBV_K = RDV_K + SAL$$

Reference(s)

Crossover Point—Declining Balance to Straight Line

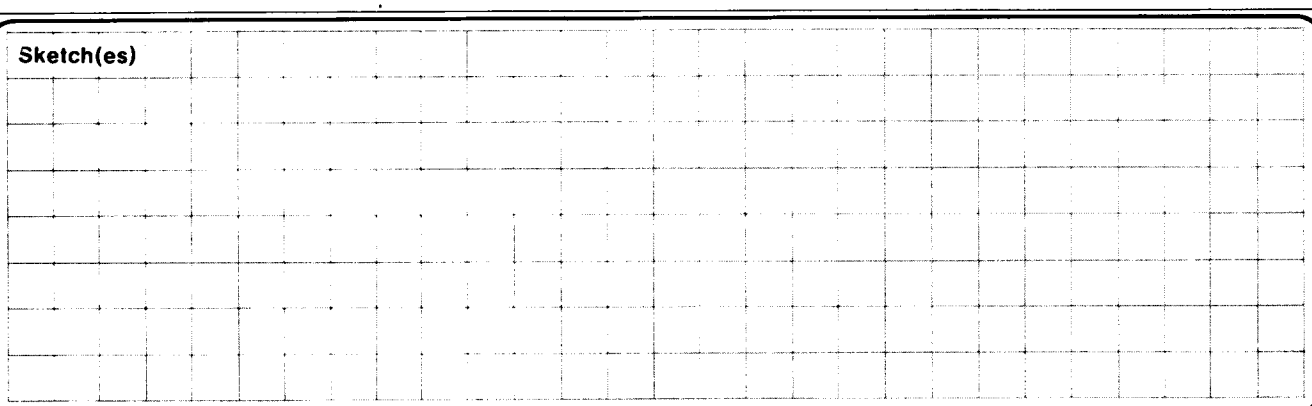
$$SBV \left(1 - \frac{FACT}{LIFE}\right)^{K-1} \cdot \left(\frac{FACT}{LIFE}\right) > \frac{(SBV - SAL) - TOTDEP_{K-1}}{L + 1 - K}$$

where $TOTDEP_{K-1}$ is determined as shown above.

The largest integer value for K which maintains the above relationship is the "last year" to use the Declining Balance depreciation method.

Program Description II

Sketch(es)



Sample Problem(s)

Example 1:

For a starting book value of $375,000, a salvage value of $30,000 and an expected life of 40 years, generate the 1st year's depreciation schedule using each of the common methods. Assume a declining balance factor of 1.5. Then jump ahead to the 15th year and generate the data for that year.

Keystrokes: **Outputs:**

375000 STO A 30000 STO B
40 STO C 1 STO D

Straight Line

Keystrokes	Outputs	
f A →	1.00	(1st year)
R/S →	8625.00	(1st year's depreciation)
R/S →	336375.00	(remaining depreciable value)
R/S →	366375.00	(remaining book value)
R/S →	8625.00	(total depreciation to date)

Solution(s)

Now jump ahead to the 15th year.

Keystrokes: **Outputs:**

Keystrokes	Outputs	
15 STO D f A →	15.00	(15th year)
R/S →	8625.00	(15th year's depreciation)
R/S →	215625.00	(remaining depreciable value)
R/S →	245625.00	(remaining book value)
R/S →	129375.00	(total depreciation after 15 years)

SOYD

Keystrokes	Outputs	
1 STO D f B →	1.00	(1st year)
R/S →	16829.27	(1st year's depreciation)
R/S →	328170.73	(remaining depreciable value)
R/S →	358170.73	(remaining book value)

Reference(s)

Program Description 11

Sketch(es)

Sample Problem(s)

R/S →	16829.27	(total depreciation to date)

Jump ahead to the 15th year.

15 STO D f B →	15.00	(15th year)
R/S →	10939.02	(15th year's depreciation)
R/S →	136737.80	(remaining depreciable value)
R/S →	166737.80	(remaining book value)
R/S →	208262.20	(total depreciation 1st through 15th year)

Declining Balance

1 STO D 1.5 STO E f C →	1.00	(1st year)
R/S →	14062.50	(1st year's depreciation)
R/S →	330937.50	(remaining depreciable value)
R/S →	360937.50	(remaining book value)
R/S →	14062.50	(total depreciation to date)

Solution(s)

Keystrokes:	**Outputs:**	

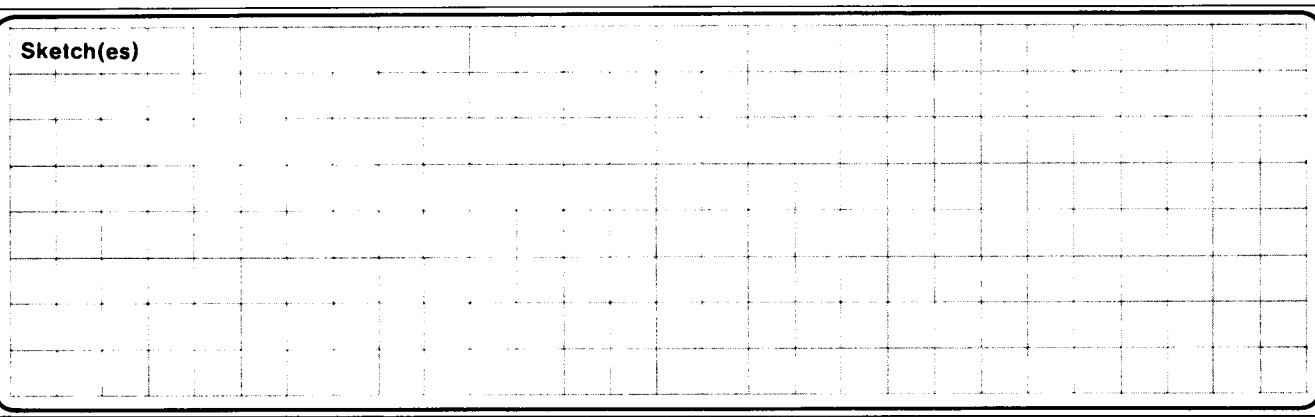
Now jump to the 15th year.

15 STO D f C →	15.00	(15th year)
R/S →	8235.18	(15th year's depreciation)
R/S →	181369.51	(remaining depreciable value)
R/S →	211369.51	(remaining book value)
R/S →	163630.49	(total depreciation 1st through 15th year)

Reference(s)

Program Description II

Sketch(es)



Sample Problem(s)

Example 2:

Having just performed the previous calculation, determine the crossover point and the associated remaining life and remaining book value. Generate the depreciation data for the declining balance "last year," and then switch to the straight line method to generate the depreciation data for the year following the declining balance "last year."

Keystrokes:	Outputs:	
f D →	18.00	(last year to use declining balance)
R/S →	22.00	(asset's remaining life after 18 years)
R/S →	188471.01	(remaining book value after 18th year)
18 STO D f C →	18.00	(18th year)
R/S →	7343.03	(18th year's depreciation)
R/S →	158471.01	(remaining depreciable value)
R/S →	188471.01	(remaining book value)
R/S →	186528.99	(total depreciation 1st through 18th year)
188471.01 STO A 22 STO C		
1 STO D f A →	1.00	(1st year)
R/S →	7203.23	(19th year's depreciation)

Solution(s)

Note:

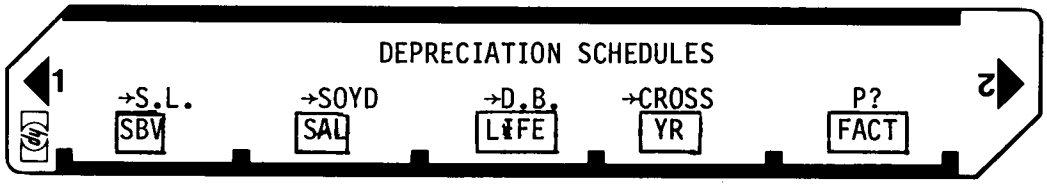
Although 1 was keyed in for YR—the first year of straight line depreciation—this is the 19th year of the asset's life.

Reference(s)

R/S →	151267.78	(remaining depreciable value)
R/S →	181267.78	(remaining book value)

etc.

User Instructions



STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
1	Load side 1 and side 2			
2	Optional: Select print mode		f E	1.00 or 0.00
3	Key in all of the following:			
	• Starting book value	SBV	STO A	SBV
	• Salvage value	SAL	STO B	SAL
	• Life of the asset	LIFE	STO C	LIFE
4	For depreciation schedules,			
	key in:			
	• Year for which depreciation			
	is to be calculated.	YR	STO D	YR
5	To calculate straight line			
	depreciation schedule		f A	YR
			R/S	DEP
			R/S	RDV
			R/S	RBV
			R/S	TOT DEP
			R/S	YR + 1
			etc.	
	For new case go to steps 3 and			
	4 and change appropriate			
	inputs.			

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS

User Instructions

STEP	INSTRUCTIONS	INPUT DATA/UNITS	KEYS	OUTPUT DATA/UNITS
6	Calculate the SOYD schedule		f B	YR
			R/S	DEP
			R/S	RDV
			R/S	RBV
			R/S	TOT DEP
			R/S	YR + 1
			etc.	
	For new case go to steps 3 and			
	4 and change appropriate			
	inputs.			
7	Calculate the declining balance			
	schedule (the appropriate			
	factor must be entered).	FACT	STO E	FACT
			f C	YR
			R/S	DEP
			R/S	RDV
			R/S	RBV
			R/S	TOT DEP
			R/S	YR + 1
			etc.	
	For new case go to steps 3 and			
	4 and change appropriate			
	inputs.			
8	To find crossover point the			
	declining balance factor must			
	be stored.	FACT	STO E	FACT
9	Calculate last year to use de-			
	clining balance method.		f D	LAST YEAR
10	Calculate remaining life.		R/S	REM LIFE
11	Calculate remaining book			
	value.		R/S	RBV

9/Program Listing I

STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBLa	21 16 11	Straight Line
002	F0?	16 23 00	
003	SPC	16-11	
004	RCLD	36 14	k
005	GSB9	23 09	
006	RCLA	36 11	$\frac{SBV-SAL}{LIFE} \rightarrow R_I$
007	RCLB	36 12	
008	-	-45	
009	RCLC	36 13	
010	÷	-24	
011	STOI	35 46	DEP
012	GSB9	23 09	
013	RCLC	36 13	
014	RCLD	36 14	(LIFE-YR)DEP=RDV_k
015	-	-45	
016	RCLI	36 46	
017	x	-35	
018	GSB9	23 09	
019	RCLB	36 12	
020	+	-55	
021	GSB9	23 09	RBV_k
022	RCLI	36 46	
023	RCLD	36 14	$\left(\frac{SBV-SAL}{LIFE}\right)$YR=TOT DEP
024	x	-35	
025	GSB9	23 09	
026	1	01	
027	GSBD	23 14	
028	RCLC	36 13	
029	RCLD	36 14	k≤LIFE?
030	X≤Y?	16-35	
031	GTOa	22 16 11	- - - - - - - - - -
032	RTN	24	
033	*LBLb	21 16 12	SOYD
034	F0?	16 23 00	
035	SPC	16-11	
036	RCLD	36 14	k
037	GSB9	23 09	
038	RCLA	36 11	
039	RCLB	36 12	
040	-	-45	
041	STO8	35 08	
042	RCLC	36 13	
043	GSB2	23 02	$\left(\frac{LIFE+1-k}{SOYD}\right)$(SBV-SAL)
044	STO7	35 07	
045	RCLC	36 13	
046	1	01	
047	+	-55	
048	RCLD	36 14	
049	-	-45	
050	RCL7	36 07	
051	÷	-24	
052	RCL8	36 08	
053	x	-35	
054	GSB9	23 09	DEP_k
055	RCLC	36 13	
056	RCLD	36 14	
057	-	-45	
058	X<0?	16-45	
059	GTO3	22 03	
060	GSB2	23 02	
061	RCL7	36 07	
062	÷	-24	
063	STO4	35 04	
064	RCL8	36 08	
065	x	-35	
066	*LBL3	21 03	
067	STO6	35 06	
068	GSB9	23 09	RDV_k
069	RCLB	36 12	
070	+	-55	
071	GSB9	23 09	RBV_k=RDV_k+SAL
072	1	01	
073	RCL4	36 04	
074	-	-45	
075	RCL8	36 08	
076	x	-35	
077	GSB9	23 09	TOT DEP_k
078	1	01	
079	GSBD	23 14	
080	RCLC	36 13	
081	RCLD	36 14	k≤LIFE?
082	X≤Y?	16-35	
083	GTOb	22 16 12	- - - - - - - - - -
084	RTN	24	
085	*LBL2	21 02	
086	ENT↑	-21	
087	FRC	16 44	$\frac{(1+W)(2F+W)}{2}$
088	ENT↑	-21	
089	+	-55	
090	X≠Y	-41	= SOYD
091	INT	16 34	
092	+	-55	
093	LSTX	16-63	
094	1	01	
095	+	-55	
096	x	-35	
097	2	02	
098	÷	-24	- - - - - - - - - -
099	RTN	24	Declining Balance
100	*LBLc	21 16 13	
101	F0?	16 23 00	
102	SPC	16-11	
103	RCLD	36 14	
104	GSB9	23 09	k
105	GSB4	23 04	
106	RCLD	36 14	
107	1	01	
108	-	-45	
109	Y^x	31	
110	RCLA	36 11	
111	x	-35	
112	RCL8	36 08	

REGISTERS

0	1	2	3	4	5	6	7	8	9
				Used	Used	RDV_k	Used	Used	TOT DEP
S0	S1	S2	S3	S4	S5	S6	S7	S8	S9

A	B	C	D	E	I
SBV	SAL	LIFE	YR	FACTOR	SBV-SAL/LIFE

97 Program Listing II

STEP	KEY ENTRY	KEY CODE	COMMENTS
113	×	-35	
114	STOI	35 46	DEP$_k$
115	GSB9	23 09	
116	1	01	
117	RCL7	36 07	
118	RCLD	36 14	
119	Y^x	31	
120	-	-45	
121	RCLA	36 11	(SBV-SAL)-TOT DEP$_k$
122	×	-35	
123	STO9	35 09	
124	RCLA	36 11	
125	RCLB	36 12	
126	-	-45	
127	RCL9	36 09	
128	-	-45	
129	GSB9	23 09	RDV$_k$
130	RCLB	36 12	
131	+	-55	
132	GSB9	23 09	RBV$_k$
133	RCL9	36 09	
134	GSB9	23 09	TOT DEP$_k$
135	1	01	
136	GSBD	23 14	
137	RCLC	36 13	
138	RCLD	36 14	
139	X≤Y?	16-35	K≤LIFE?
140	GTOe	22 16 13	
141	RTN	24	- - - - - - - - - -
142	*LBLD	21 14	To add to register
143	RCLD	36 14	D
144	+	-55	
145	STOD	35 14	
146	RTN	24	
147	*LBL4	21 04	- - - - - - - - - -
148	1	01	
149	RCLE	36 15	FACT/LIFE→R$_8$
150	RCLC	36 13	
151	÷	-24	
152	STO8	35 08	1-FACT/LIFE→R$_7$
153	-	-45	
154	STO7	35 07	
155	RTN	24	- - - - - - - - - -
156	*LBLe	21 16 15	
157	F0?	16 23 00	Print/pause
158	GTO0	22 00	
159	SF0	16 21 00	
160	1	01	
161	RTN	24	
162	*LBL0	21 00	
163	0	00	
164	CF0	16 22 00	
165	RTN	24	
166	*LBL9	21 09	
167	F0?	16 23 00	
168	GTO1	22 01	
169	R/S	51	
170	RTN	24	
171	*LBL1	21 01	
172	PRTX	-14	
173	RTN	24	- - - - - - - - - -
174	*LBLd	21 16 14	Crossover point
175	0	00	
176	STOD	35 14	
177	GSB4	23 04	
178	*LBL8	21 08	
179	RCL7	36 07	
180	1	01	
181	GSBD	23 14	
182	1	01	
183	-	-45	
184	Y^x	31	
185	RCLA	36 11	
186	×	-35	
187	RCL6	36 06	
188	λ	-35	
189	RCL7	36 07	
190	RCLD	36 14	
191	1	01	
192	-	-45	
193	Y^x	31	
194	RCLA	36 11	
195	×	-35	
196	RCLB	36 12	
197	-	-45	
198	STO9	35 09	
199	RCLC	36 13	
200	1	01	
201	+	-55	
202	RCLD	36 14	
203	-	-45	
204	÷	-24	
205	X≷Y	-41	
206	X>Y?	16-34	
207	GTO8	22 08	
208	RCLD	36 14	
209	1	01	
210	-	-45	
211	GSB9	23 09	Last year
212	RCLC	36 13	
213	X≷Y	-41	
214	-	-45	
215	GSB9	23 09	Remaining life
216	RCL9	36 09	
217	RCLB	36 12	
218	+	-55	
219	GTO9	22 09	RBV
220	R/S	51	

LABELS

A	B	C	D	E
			Used	
[a] St.Line	[b] SOYD	[c] DEC BAL	[d] CROSS	[e] SCHED?
[0] Used	[1] Used	[2] SOYD	[3] Used	[4] Used
[5]	[6]	[7]	[8] Used	[9] Used

FLAGS

[0]	Print?
1	
2	
3	

SET STATUS

FLAGS			TRIG	DISP
	ON	OFF		
0	☐	☑	DEG ☑	FIX ☑
1	☐	☑	GRAD ☐	SCI ☐
2	☐	☑	RAD ☐	ENG ☐
3	☐	☑		n ___

Hewlett-Packard Software

In terms of power and flexibility, the problem-solving potential of the Hewlett-Packard line of fully programmable calculators is nearly limitless. And in order to see the practical side of this potential, we have several different types of software to help save you time and programming effort. Every one of our software solutions has been carefully selected to effectively increase your problem-solving potential. Chances are, we already have the solutions you're looking for.

Application Pacs

To increase the versatility of your fully programmable Hewlett-Packard calculator, HP has an extensive library of "Application Pacs". These programs transform your HP-67 and HP-97 into specialized calculators in seconds. Each program in a pac is fully documented with commented program listing, allowing the adoption of programming techniques useful to each application area. The pacs contain 20 or more programs in the form of prerecorded cards, a detailed manual, and a program card holder. Every Application Pac has been designed to extend the capabilities of our fully programmable models to increase your problem-solving potential.

You can choose from:

Statistics
Mathematics
Electrical Engineering
Business Decisions
Clinical Lab and Nuclear Medicine
Mechanical Engineering
Surveying
Civil Engineering
Navigation
Games

Users' Library

The main objective of our Users' Library is dedicated to making selected program solutions contributed by our HP-67 and HP-97 users available to you. By subscribing to our Users' Library, you'll have at your fingertips, literally hundreds of different programs. No longer will you have to: research the application; program the solution; debug the program; or complete the documentation. Simply key your program to obtain your solution. In addition, programs from the library may be used as a source of programming techniques in your application area.

A one-year subscription to the Library costs $9.00. You receive: a catalog of contributed programs; catalog updates; and coupons for three programs of your choice (a $9.00 value).

Users' Library Solutions Books

Hewlett-Packard recently added a unique problem-solving contribution to its existing software line. The new series of software solutions are a collection of programs provided by our programmable calculator users. Hewlett-Packard has currently accepted over 6,000 programs for our Users' Libraries. The best of these programs have been compiled into 40 Library Solutions Books covering 39 application areas (including two game books).

Each of the Books, containing up to 15 programs without cards, is priced at $10.00, a savings of up to $35.00 over single copy cost.

The Users' Library Solutions Books will compliment our other applications of software and provide you with a valuable new tool for program solutions.

Options/Technical Stock Analysis
Portfolio Management/Bonds & Notes
Real Estate Investment
Taxes
Home Construction Estimating
Marketing/Sales
Home Management
Small Business
Antennas
Butterworth and Chebyshev Filters
Thermal and Transport Sciences
EE (Lab)
Industrial Engineering
Aeronautical Engineering
Control Systems
Beams and Columns
High-Level Math
Test Statistics
Geometry
Reliability/QA
Medical Practitioner
Anesthesia
Cardiac
Pulmonary
Chemistry
Optics
Physics
Earth Sciences
Energy Conservation
Space Science
Biology
Games
Games of Chance
Aircraft Operation
Avigation
Calendars
Photo Dark Room
COGO-Surveying
Astrology
Forestry

REAL ESTATE INVESTMENT

A group of programs in the areas of real estate and investment analysis including Income Property Analysis, Return on Equity Rental Property, Real Estate Investment Analysis, Yearly Amortization Schedule, and Internal Rate of Return.

MORTGAGE YIELD

MORTGAGE PRICING NO. 1

MORTGAGE PRICING NO. 2

YEARLY AMORTIZATION SCHEDULE

AMOUNT OF EQUITY AT ANY TIME

ELLWOOD INCOME VALUATION FOR INCOME PROPERTY APPRAISAL

INCOME PROPERTY ANALYSIS

RETURN ON EQUITY RENTAL PROPERTY

REAL ESTATE INVESTMENT ANALYSIS

INTERNAL RATE OF RETURN

DEPRECIATION SCHEDULES

HEWLETT hp PACKARD

1000 N.E. Circle Blvd., Corvallis, OR 97330

Reorder No. 00097-14012 Printed in U.S.A. 00097-90187
Rev. E 5-78