## HEWLETT-PACKARD

## HP-41C

## USERS' LIBRARY SOLUTIONS Real Estate



## NOTICE

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## INTRODUCTION

This HP-41C Solutions book was written to help you get the most from your calculator. The programs were chosen to provide useful calculations for many of the common problems encountered.

They will provide you with immediate capabilities in your everyday calculations and you will find them useful as guides to programming techniques for writing your own customized software. The comments on each program listing describe the approach used to reach the solution and help you follow the programmer's logic as you become and expert on your HP calculator.

## KEYING A PROGRAM INTO THE HP-41C

There are several things that you should keep in mind while you are keying in programs from the program listings provided in this book. The output from the HP 82143A printer provides a convenient way of listing and an easily understood method of keying in programs without showing every keystroke. This type of output is what appears in this handbook. Once you understand the procedure for keying programs in from the printed listings, you will find this method simple and fast. Here is the procedure:

1. At the end of each program listing is a listing of status information required to properly execute that program. Included is the SIZE allocation required. Before you begin keying in the program, press XEO ALPHA SIZE ALPHA and specify the allocation (three digits; e.g., 10 should be specified as 010).
Also included in the status information is the display format and status of flags important to the program. To ensure proper execution, check to see that the display status of the HP-41C is set as specified and check to see that all applicable flags are set or clear as specified.
2. Set the HP-41C to PRGM mode (press the PRGM key) and press GTO $\bullet$ to prepare the calculator for the new program.
3. Begin keying in the program. Following is a list of hints that will help you when you key in your programs from the program listings in this handbook.
a. When you see " (quote marks) around a character or group of characters in the program listing, those characters are ALPHA. To key them in, simply press ALPHA, key in the characters, then press ALPHA again. So "SAMFLE" would be keyed in as ALPHA "SAMPLE" ALPHA.
b. The diamond in front of each LBL instruction is only a visual aid to help you locate labels in the program listings. When you key in a program, ignore the diamond.
c. The printer indication of divide sign is /. When you see / in the program listing, press $\rightarrow$.
d. The printer indication of the multiply sign is $\underset{\%}{*}$. When you see $\underset{\%}{\%}$ in the program listing, press $x$.
e. The ${ }^{-}$- character in the program listing is an indication of the APPEND function. When you see ${ }^{-}$, press $\square$ APPEND in ALPHA mode (press and the K key).
f. All operations requiring register addresses accept those addresses in these forms:
nn (a two-digit number)
IND nn (INDIRECT: $\square$, followed fy a two-digit number)
X, Y, Z, T, or L (a STACK address: $\quad$ followed by $\mathrm{X}, \mathrm{Y}, \mathrm{Z}, \mathrm{T}$, or L)
IND X, Y, Z, T or L (INDIRECT stack: $\bullet$ followed by X, Y, Z, T, or L)
Indirect addresses are specified by pressing $\square$ and then the indirect address. Stack addresses are specified by pressing $\bullet$ followed by $\mathrm{X}, \mathrm{Y}, \mathrm{Z}, \mathrm{T}$, or L . Indirect stack addresses are specified by pressing $\square$ and $\mathrm{X}, \mathrm{Y}, \mathrm{Z}, \mathrm{T}$, or L .

## Printer Listing

```
01*LBL "SAM
PLE*
    B2 .THIS IS
    A .
    03 *\vdashSAMPLE
    04 AVIEN
    04 6
    0 6 ~ E N T E R ! ~ ! ~
    07 -2
    08 <
    09 ABS
    16 STO INL
L
11 "R3="
    12 HRCL 03
    13 AVIEW
    14 RTN
```


## Keystrokes



Display
$01 \operatorname{LBL}^{\top}$ SAMPLE
$02^{\top}$ THIS IS A
$03^{\top}$ - SAMPLE
04 AVIEW
056
06 ENTER $\nearrow$
07-2
08 /
09 ABS
10 STO IND L
$11^{\top}$ R3 $=$
12 ARCL 03
13 AVIEW
14 RTN

## TABLE OF CONTENTS

1. INCOME PROPERTY ANALYSIS ..... 1This program computes capitalization rate, spendable in-come, spendable income rate, taxable income, equity incomeand equity income rate for a piece of income property.
*2 MORTGAG
This program provides the basic ..... 7 This program provides the basic tools for analysis of mort- gage performance. Calculations include amortization period, full term yield, and intermediate yield given either a bal- loon payment or a prepayment at a specified point in time.
2. MORTGAGE PRICING ..... 14 This program calculates the price of a wrap-around mort- gage discounted to yield a user specified percentage.
3. AMOUNT OF EQUITY AT ANY TIME. ..... 19 Given the purchase price, mortgage amount, interest rate and payment, this program solves for the equity at any given time.
4. WRAP-AROUND MORTGAGE. ..... 23
This program calculates the periodic yield to the lender of a wrap-around (refinancing) mortgage, with or without a balloon payment. It also determines the periodic pay- ment necessary to amortize a mortgage.
5. INTERNAL RATE OF RETURN. ..... 28 This program calculates the IRR (discount rate of return or yie1d) for up to 41 cash flows. Each additional Memory Module adds 64 more cash flows.
6. VARIABLE ANALYSIS OF REAL ESTATE INVESTMENT ..... 32This program takes the tax bracket, interest rate andpayment period of the loan as inputs plus three of thefollowing variables and computes the fourth: cash flowafter taxes, amount financed, depreciation amount andnet operating income.
*8. REAL ESTATE INVESTMENT ANALYSIS FOR PROPERTY AND LAND... 3This program is designed to do a complete before and aftertax cash flow analysis. Program considers closing costs,excess depreciation, capital gains, loan reduction andappreciation of the investment.
7. ELLWOOD INCOME VALUATION FOR INCOME PROPERTY APPRAISAL., 44This program is a substitute for the tables commonly usedin appraising real estate income streams to derive a valuefor a property given a required return on equity.
8. RESIDENTIAL ANALYSIS (RENT OR BUY)........................ 49 This program analyzes, on a yearly basis, the investment potential of residential property by computing: increased sales value, tax savings, actual cost (cash outlay minus tax savings), and equity growth versus rental payments.

* Requires one Memory Module


## INCOME PROPERTY ANALYSIS



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.

Note: 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 particularly since it takes explicit tax consequences into consideration.

References: National Institute of Real Estate Brokers income property analysis data sheet.
HP-67 /HP-97 Users' Library program 非00512D by Jack Buster.

Example: Determine the performance over the next five years of an investment with the following particulars:
$\$ 750,000.00=$ Purchase price
$\$ 635,000.00=$ Loan amount
9.75\% = Interest rate
\$ 95,000.00 = Land value
\$ 7,000.00 = Month1y payment
$\$ 112,500.00=$ Net Operating Income
40\% = Income tax bracket
35 yrs. = Building life
Use inflation/appreciation rates of: current year=7\%; next year=7.5\%

Note: Keystrokes assume there is a printer.
Keystrokes:
Display:
[XEQ] [ALPHA] SIZE [ALPHA] 016
[XEQ] [ALPHA] IPA [ALPHA] INT ?
9.75 [ENTER $\uparrow 12[\div][R / S]$ PMT ?

7000 [R/S] LOAN AMT ?
635000 [R/S]
750000 [R/S]
112500 [R/S]
35 [ $\mathrm{R} / \mathrm{S}$ ]
95000 [R/S]
40 [R/S]
$7[\mathrm{R} / \mathrm{S}]$

NOI ?
LIFE ?
LAND VAL. ?
TAX BRACKET?
\%CAP. RT. $=15.00$
$\mathrm{YR}=1.00$
TAXABLE $=32,887.48$
SPEND. $=15,345.01$
RATE $=13.34$
EQTY=38,446.77
RATE $=33.43$
INF/AP RATE ?
$Y R=2.00$
TAXABLE=43,118.33
SPEND. $=19,127.67$
RATE $=10.04$
$\mathrm{EQTY}=44,585.28$
RATE $=23.39$


|  | Initialize <br> Input and store data <br> Calculate Capitalization rate <br> Increment and display year |  | Calculate taxable income <br> Calculate spendable income and rate |
| :---: | :---: | :---: | :---: |




## MORTGAGE YIELD

(Requires one Memory Module)

This program provides the basic tools for analysis of mortgage performance. By entering the periodic (monthly) interest rate of a mortgage, the monthly payment amount, the amount owing on the mortgage, and the purchase price of the note, the following calculations are possible:

```
total amortization period;
full term yield;
yield at a specified point in time;
yield at a specified prepaying balloon;
successive yields at different prepayment points; and
total amount of prepaying balloon, total amount of
accumulated monthly payments, and total amount of cash
paid on the mortgage.
```

References: HP-67 Standard Pac program SD-05A, Annuities and Compound Amounts, and HP-80 reference book, Real Estate Applications. HP-67/HP-97 Users' Library program 非00741D by Jack Buster.

Example:
Assume you have 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.

Keystrokes:
[USER]
[XEQ] [ALPHA] SIZE [ALPHA] 017
[XEQ] [ALPHA] MYLD [ALPHA]
8.5 [ENTER $\uparrow 12$ [ $\div$ ] [R/S]

140 [R/S]
11125 [R/S]
7200 [R/S]
[A]
[B]
[C]
5000 [R/S]
[D]
75.92 [R/S]
[E]
[R/S]
[R/S]
[D]
$24[\mathrm{R} / \mathrm{S}]$
[E]
[R/S]
[R/S]
[D]
$48[\mathrm{R} / \mathrm{S}]$
(etc.)

Display:
(set USER mode)

INT ?
PMT ?
PV ?
PURCH. P. ?
7,200.00
T. PERIOD=117.24 (months)

YIELD=19.96 (\%)
BAL ?
MONTHS=75.92
MONTHS ?
YIELD=20.98
BALLOON=5,000.00
$\sum$ PMTS $=10,628.80$
C.R. $=15,628.80$

MONTHS ?
YIELD=34.76
BALLOON=9,530.16
$\Sigma$ PMTS $=3,360.00$
C. R. $=12,890.16$

MONTHS ?
YIELD=24.25

| Months from purchase <br> to prepayment | Yie1d | Balloon <br> Amount | Payments <br> Received | Cash <br> Received |
| :---: | :---: | ---: | ---: | ---: |
| 24 | $34.76 \%$ | 9530.16 | 3360.00 | 12890.16 |
| 48 | $24.25 \%$ | 7640.91 | 6720.00 | 14360.91 |
| 72 | $21.24 \%$ | 5402.92 | 10080.00 | 15482.92 |
| 96 | $20.18 \%$ | 2751.81 | 13440.00 | 16191.81 |
| 117.24 | $19.96 \%$ | .13 | 16413.60 | 16413.73 |



| ```G1*LEL "MML I'* G2 CF G1 03 CLEG 04 "IHT ?" G5 PROMPT GG ETO 12 07 "PMT ?" 08 PROMFT 09 GTO 13 10 "PY ?" 11 FROMFT 12 STO 1\epsilon 13 "PUECH. F 14 PROMPT 15 STO EG 16 STOF 17*LBL A 18 XEQ G1 19 "T. FERI OD" 20 XEQ 日2 z1*LEL @1 226 23 STO 11 24 XEQ EG 25 RCL 10 26 LASTX 27 - 2G RCL 1G 29 LAST% 30- 3 32 LH 33 RCL 日% 3 4 ~ L H 35 36 STO 11 3% RTH 33*LEL E4 39 1 40 STO 1E 41 XEQ EG 42 STO 16 4 3 ~ E T H 44*LEL 06 45 1 46 ETO E5 47 ECL 12 43%``` | Initialize and store data <br> Calculate Amortization period <br> Calculate balloon amt. <br> Calculation subroutine |  | Calculate yield <br> Calculate $\mathrm{f}(\mathrm{i})$ and $f^{\prime}(i)$ |
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## REGISTERS, STATUS, FLAGS, ASSIGNMENTS ${ }^{¹}$



## MORTGAGE PRICING

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.

Note: Only two levels of mortgage are considered; no thirds. Do not mix annual payment mortgages with monthly payment mortgages.

Reference: HP-67/HP-97 Users' Library program \#00513D by Jack Buster.
Example: 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:

Keystrokes:
[XEQ] [ALPHA] SIZE [ALPHA] 021
[XEQ] [ALPHA] MPRC [ALPHA]
9.5 [ENT $\uparrow$ ] 12 [ $\div$ ] [R/S]
1161.67 [R/S]

125647 [R/S]
10.25 [ENT $\uparrow$ ] 12 [ $\div$ ] [R/S]

2300 [R/S]
214123 [R/S]
22.5 [ENT $\uparrow$ ] 12 [ $\div$ ] [ $\mathrm{R} / \mathrm{S}$ ]
[R/S]
[R/S]

Display:

I1 ?
PMT1 ?
PV1 ?
I2?
PMT2 ?
PV2 ?
YIELD ?
AMORT. P. $=246.00$
AMORT. P. $=186.44$
PRICE=57,510.36



${ }^{18}$ REGISTERS, STATUS, FLAGS, ASSIGNMENTS


## AMOUNT OF EQUITY AT ANY TIME

For a loan with full amortization after a stated number of years, given:

$$
\begin{aligned}
\mathrm{n} & =\text { number of payments made } \\
\mathbf{i} & =\text { periodic interest rate } \\
\mathrm{PMT} & =\text { periodic payment } \\
\mathrm{PP} & =\text { purchase price } \\
\mathrm{DS} & =\text { down payment } \\
\mathrm{NS} & =\text { net sales price }
\end{aligned}
$$

This program calculates purchase price equity EPP and net sales equity ES.


|  |  |  |  | SIZE: 010 |
| :---: | :---: | :---: | :---: | :---: |
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1 | Load the program |  |  |  |
| 2 | Initialize the program |  | [XEQ] EQTY | N. PMTS MADE |
| 3 | Input: Number of payments made; | n | [R/S] | INT ? |
|  | Periodic interest rate; | i | [R/S] | PMT ? |
|  | Periodic payment; | PMT | [R/S] | PURCH. P. ? |
|  | Purchase price; | PP | [R/S] | \$ DOWN ? |
|  | Down payment (\$); | \$D | [R/S] | NET SALES P. ? |
|  | and net sales price. | NS | [R/S] |  |
| 4 | Find purchase price equity |  |  | EPP=\$( ) |
| 5 | Calculate net sales equity |  | [R/S] | ES=\$( ) |
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## ${ }^{2}$ REGISTERS, STATUS, FLAGS, ASSIGNMENTS



## WRAP-AROUND MORTGAGE

A wrap-around mortgage is essentially the same as a refinancing mortgage, except that the new mortgage is a junior lien mortgage granted by a different lender, who assumes the payments on the existing mortgage, which remains in full force. The new (second) mortgage is thus "wrapped around" the existing mortgage. The "wrap-around" lender advances the net difference between the new (second) mortgage and the existing mortgage in cash to the borrower, and receives as net cash flow the difference between the debt service on the new (second) mortgage and debt service on the existing mortgage.

This program calculates the periodic yield to the lender of a wrap-around mortgage, with or without a balloon payment. A routine to solve for the periodic payment necessary to amortize a mortgage is also available. The value of each mortgage, as well as the periodic payments, life of each mortgage (number of periods remaining), and balloon payment on the wraparound mortgage (if it exists) must be entered to calculate the yield.
$P V_{2}-P V_{1}=\frac{\operatorname{PMT}_{2}\left[1-(1+i)^{-n_{2}}\right]}{i}-\frac{\operatorname{PMT}_{1}\left[1-(1+i)^{-n_{1}}\right]}{i}+B A L(1+i)^{-n_{2}}$

Reference: HP-67/HP-97 Users' Library program 非00127D
Example: A mortgage loan on an income property has a balance of $\$ 200,000$. The loan has a remaining life of 12 years, and a monthly payment of $\$ 2030.21$. A lender has agreed to "wrap" a $\$ 300,000$ second mortgage at $9.5 \%$, with full amortization in level monthly payments over 12 years. What is the effective yield (IRR) to the lender on net cash advanced?

Keystrokes:
[USER]
[XEQ] [ALPHA] SIZE [ALPHA] 011
[XEQ] [ALPHA] WAM [ALPHA] N1 ?
[B]
144 [R/S]
9.5 [R/S]

300000 [R/S]
[A]
144 [R/S]
2030.21 [R/S]

200000 [R/S]
144 [R/S]
3499.12 [R/S]

300000 [R/S]
0 [R/S]

Display:
(set USER mode)

N ?
I ?
PV ?
PMT $=3,499.12$
N1?
PMT 1 ?
PV1 ?
N2 ?
PMT2 ?
PV2 ?
BALLOON ?

|  |  |  |  | SIZE:011 |
| :---: | :---: | :---: | :---: | :---: |
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1. | Load the program and set USER mode. |  | [USER] |  |
| 2. | Initialize the program. |  | [ XEQ ] WAM | N1 ? |
| 3. | Key in the following information from the |  |  |  |
|  | original mortgage: |  |  |  |
|  | * Number of months remaining | $\mathrm{n}_{1}$ | [R/S] | PMT1 ? |
|  | * Monthly payment | $\mathrm{PMT}_{1}$ | [R/S] | PV1 ? |
|  | * Remaining balance | $\mathrm{PV}_{1}$ | [R/S] | N2 ? |
| 4. | Key in the following information from the |  |  |  |
|  | wrap-around mortgage: |  |  |  |
|  | * Number of months | $\mathrm{n}_{2}$ | [ $\mathrm{R} / \mathrm{S}$ ] | PMT2 ? |
|  | * Monthly payment | $\mathrm{PMT}_{2}$ | [R/S] | PV2 ? |
|  | * Total wrap-around amount | $\mathrm{PV}_{2}$ | [R/S] | BALLOON ? |
|  | * Balloon amount | Balloon | [ $\mathrm{R} / \mathrm{S}$ ] |  |
|  | The annual yield is displayed. |  |  | \%YIELD $=(\quad)$ |
| 5. | To find the payment amount on wrap-around |  |  |  |
|  | mortgage |  | [B] | N ? |
| 6. | Key in the following information: |  |  |  |
|  | * Total number of months | n | [R/S] | I ? |
|  | * Annual interest rate | i | [ $\mathrm{R} / \mathrm{S}]$ | PV ? |
|  | * Loan amount | PV | [ $\mathrm{R} / \mathrm{S}$ ] | $\mathrm{PMT}=(\quad)$ |
|  | The monthly payment is displayed. |  |  |  |
| 7. | To restart main program, press [A] and go |  |  |  |
|  | to step 3. |  | [A] | N1 ? |
| - | - |  |  |  |
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| 日1＊LEL＂WAM <br> D2＊LEL $\quad$－ 03 ＂Hi ？ 04 PROMPT 05 CHS <br> 06 STO 01 07 ＂PMT1 ？＂ 08 PROMPT 09 STO 63 19 ＂FVi？ 11 PROMPT 12 CHS <br> 13 STO 65 14 ＂H2 ？ 15 PROMFT 16 CHS <br> 17 STO 62 18 ＂PMT2 ？＂ 19 PROMPT 20 STO 14 21 ＂FVZ ？＂ 22 PROMPT $23 \mathrm{ST}+05$ 24 ＂BALLDON ？•• <br> 25 PROMPT <br> 26 STO 10 <br> 271 E－3 <br> 25 STO 06 $29 *$ LEL 00 301 <br> 31 RCL 66 <br> 321 <br> $33+$ <br> 34 STO 07 <br> 35 RCL 02 <br> उद． $\mathrm{Y}+\mathrm{X}$ <br> 37 STO 09 <br> 38 － <br> 39 RCL 14 46 ＊ <br> 411 <br> 42 RCL 97 <br> 43 RCL 01 <br> 44 Үけス <br> 45 STO 08 <br> 46 － <br> 47 FCL 63 48 ＊ | Input and store data <br> Calculate \％ yield <br> Newton＇s method is used to find i |  | Display annual yield <br> Input and store data |
| :---: | :---: | :---: | :---: |



REGISTERS, STATUS, FLAGS, ASSIGNMENTS ${ }^{27}$


## INTERNAL RATE OF RETURN

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 41 cash flows with no Memory Module ( 64 more for each additional Memory Module), this program calculates the periodic IRR.

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

The program solves the following equation iteratively for IRR:

where $\quad n=$ the number of cash flows and

$$
\mathrm{CF}_{\mathbf{j}}=\text { the } j \text { th cash flow. }
$$

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. Problems which involve a large number of cash flows will have long execution times.

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

| 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) |

Keystrokes:
[USER]
Display:
[XEQ] [ALPHA] SIZE [ALPHA] 014
[XEQ] [ALPHA] IRR [ALPHA] CF,1 ?
46423 [R/S]
40710 [R/S]
:
311406 [R/S]
[A]
250000 [ $\mathrm{R} / \mathrm{S}$ ]
$\mathrm{CF}, 2$ ?
$\mathrm{CF}, 3$ ?
$\vdots$
$\mathrm{CF}, 11$ ?
INV ?
IRR $=13.98$



REGISTERS, STATUS, FLAGS, ASSIGNMENTS ${ }^{*}$


## VARIABLE ANALYSIS OF REAL ESTATE INVESTMENT

This program is designed to take tax bracket, loan interest rate and payment period of the loan as inputs plus three of the following four variables and computes the fourth: cash flow after taxes (CFAT), financed amount, depreciation, and net operating income (NOI). Cash flow before taxes (CFBT) may also be calculated.

```
CFBT = NOI - (principal + interest)
CFAT = NOI - (p+i) - [NOI - interest - deprec] [tax]
```

Reference: HP-67/HP-97 Users' Library program 非01407D by Thomas Thorpe
Example: A client desires to purchase an investment property. His tax bracket is $25 \%$ and you know that a $91 / 4 \%$, 30 year loan is obtainable. He indicates a need for a CFAT of $\$ 1000$. He expects a NOI of $\$ 4000$ per year and plans to depreciate the property at a $\$ 2000$ per year rate. What should the financed amount of the loan be to meet his requirements? What is the CFBT?

Solution:

Keystrokes:
[USER]
[XEQ] [ALPHA] SIZE [ALPHA] 015
[XEQ] [ALPHA] VANYS [ALPHA]
25 [R/S]
9.25 [R/S]

30 [R/S]
1000 [R/S]
[R/S]
2000 [R/S]
4000 [R/S]
[A]
33040.94 [R/S]

Display:
(set USER mode)

TAX B. ?
INT. ?
TERM ?
CFAT ?
PV ?
DEP. ?
NOI ?
$P V=33,040.94$
PV ?
CFBT=738. 16


| 91＊LEL＂YAH | Initialize input | 49 PROMFT |  |
| :---: | :---: | :---: | :---: |
| ＇S＂ | and store data | 56 STO 12 |  |
| Q2 19．1 |  | 51 XEQ Qe |  |
| 03 STO 11 |  | 52 RCL 14 |  |
| 04 －TAX E． |  | 53 RCL 05 |  |
| ？${ }^{\circ}$ |  | 54 － |  |
| 05 FROMPT |  | 55 ＂CFET＂ |  |
| 0615 E |  | 56 XEQ 97 |  |
| 97 |  | $57+$ LEL 13 |  |
| $085 T 0 \mathrm{EG}$ |  | 59 XEQ 95 | Calculate DEP |
| 09 ＂IHT ？${ }^{10}$ |  | 59 XEQ 95 |  |
| 16 PROMPT |  | 60 RCL 14 |  |
| 1112 Ez |  | 61 RCL EG |  |
| 12 |  | Ez－ |  |
| 13 GT0 日1 |  | 63 RCL 69 |  |
| 14 ＂TERM ？ |  | 64 ： |  |
| 15 PROMPT |  | 65 RCL 9.5 |  |
| 1612 |  | $6.6+$ |  |
| 17 ＊ |  | $6 \cdot \mathrm{FCL} 14$ |  |
| 18 STO 日2 |  | 6.8 － |  |
| 19 CF 22 |  | 69 RCL 16 |  |
| 20＂CFAT ？ |  | $7 \mathrm{C}+$ |  |
| 21 XEQ 99 |  | 71 RCL EG |  |
| 22 ISG 11 |  | 72 |  |
| 23 ＂F4 ${ }^{2}$ |  | 73 ＂DEF＇． |  |
| 24 XEQ 09 |  | 74 XEQ 日 |  |
| 25 ＂DEF ${ }^{\text {\％}}$ |  | 75＊LEL 14 |  |
| 26 XEQ 99. |  | 76 XEQ 68 | Calculate NOI |
| 27 ＂H0I ${ }^{2}$ |  | 77 XEQ 95 |  |
| $\begin{array}{lll}28 & X E D & 99 \\ 29 & G 0 & \text { IHT }\end{array}$ |  | 78 RCL 96 |  |
| 29 GTO IHD |  | 79 RCL 13 |  |
| 36＋LEL 16 |  | 86 |  |
| $31 \times E 0$ Q6 | Calculate CFAT | $82 *$ |  |
| 32 XEQ 95 |  | E3 CHS |  |
| 33 FCL 14 |  | 34 RCL 65 |  |
| 34 REL GE |  | E5＋ |  |
| 35 － |  | 86 RCL 16 |  |
| 36 RCL 13 |  | $87+$ |  |
| 37 R－ |  | Es RCL 96 |  |
| 38 RCL G日 |  | 891 |  |
| 39 ¢ |  | $96-$ |  |
| 4 4 CHS |  | 91 CHS |  |
| 41 RCL 4.5 |  | 92 HMOI． |  |
| 43 FCL 14 |  | $94 \times E Q$ OT |  |
| 44 ＋ |  | 95＊LBL 12 |  |
| 45 ＂CFAT＂ |  | 96 E4 | Calculate PV |
| 46 XEQ 佰 |  | 97 STO 12 |  |
| 47＊LEL ${ }^{48} \mathrm{FV}$ | Calculate CFBT | 98 XEQ 98 |  |



## Program Listings



REGISTERS, STATUS, FLAGS, ASSIGNMENTS ${ }^{37}$


## REAL ESTATE INVESTMENT ANALYSIS FOR PROPERTY AND LAND

## (Requires one Memory Module)

This program is designed to do a complete before and after tax cash flow analysis plus the gain or loss if the investment were sold at the end of a given year. The program considers closing costs at time of purchase and sale, excess depreciation, capital gains, loan reduction and appreciation of the investment. At the end of each year the return on investment (down payment) is computed to allow an analysis of time to sell to maximize your return. The following assumptions are made:
$--c l o s i n g$ costs at time of purchase $=3 \%$ of purchase price (line 59)
--cost of sale $=7 \%$ of selling price (line 94)
--depreciation is $85 \%$ of purchase price on a 20 year schedule (lines 66, 194, and 175)
--return on investment calculation is based on down payment amount
--a 30 year loan is assumed - 360 payments (line 136)
Land analysis is possible by entering 0.0 for the depreciation factor and income.
Note: A1l numbers entered must be $\geq 0$. If the gain is a negative number, the return on investment calculation will produce an error indication. Press CLX and continue.

Reference: HP-67/HP-97 Users' Library program 非01117D by Thomas Thorpe.

Example: You have a chance to purchase an investment property for $\$ 52,000$ with financing of $9 \%, 30 \mathrm{yr}$ and $20 \%$ down ( $\$ 41,600$ financed amount). Analysis indicates a $\$ 6000 / y e a r$ income and expenses per year of $\$ 1300$. You elect to use accelerated depreciation of $125 \%$. You are in a $28 \%$ tax bracket and expect the investment to appreciate at a $5 \%$ per year rate. If you purchase the property, how long will you have to hold it to maximize the return on investment?

| Year | 1 | 2 | 3 | 4 | 5 | 6 |
| :--- | ---: | :---: | :---: | ---: | ---: | ---: |
| CFBT | 683.32 | 683.32 | 683.32 | 683.32 | 683.32 | 683.32 |
| CFAT | $1,185.91$ | $1,130.11$ | $1,076.62$ | $1,025.20$ | 975.59 | 927.56 |
| GAIN | $10,038.42$ | $13,220.34$ | $16,531.10$ | $19,978.04$ | $23,568.99$ | $27,312.26$ |
| ROI | $-3.48 \%$ | $12.75 \%$ | $16.70 \%$ | $17.73 \%$ | $17.78 \%$ | $17.46 \%$ |

Point to sell $\uparrow$

Solution:

Keystrokes:
[XEQ] [ALPHA] SIZE [ALPHA] 023
[XEQ] [ALPHA] REI [ALPHA]
52000 [R/S]
9 [R/S]
6000 [R/S]
52000 [ENT $\uparrow$ ] . 8 [ x$][\mathrm{R} / \mathrm{S}$ ]
1300 [R/S]
$1.25[\mathrm{R} / \mathrm{S}]$
$.28[\mathrm{R} / \mathrm{S}]$
$.05[\mathrm{R} / \mathrm{S}]$
[R/S]
[R/S]
[R/S]
[R/S]
[R/S]
[R/S]
(etc.)

Display:

PRICE ?
INT ?
INCOME ?
PV ?
EXPENSES ?
DEP. FACT. ?
TAX B. ?
APP. ?
$Y E A R=1.00$
$\mathrm{CFBT}=683.32$
CFAT=1,185.91
GAIN $=10,038.42$
ROI $=-3.48$
YEAR $=2.00$
$\mathrm{CFBT}=683.32$


|  | Initialize and store data <br> Calculate results |  |
| :---: | :---: | :---: |



## REGISTERS, STATUS, FLAGS, ASSIGNMENTS ${ }^{\circledR 1}$



## ELLWOOD INCOME VALUATION FOR INCOME PROPERTY APPRAISAL

Given a loan proportion to fair market value, the annual interest rate and term of the loan (payable in equal monthly installments), the projection period in years, the expected appreciation or depreciation of the property during the projection period, and the desired return on equity, the program computes the Ellwood factor. The value of the property which will give the desired rate of return on equity is then determined by dividing the level income stream by the E11wood coefficient.

Note: 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 that.

Reference: This program is a translation of the Hp-65 Users' Library program 非728A by Kelvin C. Vanderlip, Jr.

Example: A property will produce an even cash flow before debt service of $\$ 10,000$ and is to be mortgaged at $80 \%$ of fair market value. The loan is for 19 years at a $10.2 \%$ interest rate. The property is to be sold in 5 years and is expected to depreciate $10 \%$. What price will produce a $6.3 \%$ yield on investment?

Keystrokes:
[USER]
[XEQ] [ALPHA] SIZE [ALPHA] 009
[XEQ] [ALPHA] ELL [ALPHA]
19 [R/S]
10.2 [R/S]

80 [R/S]
5 [R/S]
10 [CHS ] [R/S]
6.3 [R/S]
[A]
10000 [R/S]

Display:
(set USER mode)

LOAN TERM ?
LOAN INT ?
LOAN PROP. ?
YRS PROJ. ?
APP. ?
YIELD ?
COEF=0.11
AAI ?
VALUE=91,042.54

|  |  |  |  | SIZE: 009 |
| :---: | :---: | :---: | :---: | :---: |
| STEP | INSTRUCTIONS | INPUT | FUNCTION | DISPLAY |
| 1 | Load the program and set USER mode |  | [USER] |  |
| 2 | Initialize the program |  | [ XEQ ] ELL | LOAN TERM ? |
| 3 | Input: loan term (years); | term | [R/S] | LOAN INT ? |
|  | loan interest (\%); | int | [R/S] | LOAN PROP. ? |
|  | loan proportion (\%) ; | prop | [R/S] | YRS PROJ. ? |
|  | no. of yrs. of projection; | proj | [ $\mathrm{R} / \mathrm{S}]$ | APP. ? |
|  | apprec. (+) or deprec. (-) (\%) ; | app | [R/S] | YIELD ? |
|  | and desired equity yield (\%). | yield | [R/S] |  |
| 4 | The Ellwood Coef. is displayed automatical |  |  | $\operatorname{COEF}=(\quad)$ |
| 5 | To compute value |  | [A] | AAI ? |
| 6 | Input level income stream | AAI | [R/S] | VALUE = ( ) |
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|  | Input and store data <br> Calculate Coef． | 46 XEQ 65 <br> 47 ； <br> 48 LASTX <br> 491 <br> $56-$ <br> 51 <br> $52 \quad 12$ <br> 53 ： <br> 54 RCL EC <br> $55:$ <br> 56 RCL EG <br> 57 ：t <br> 581 <br> $59+$ <br> 60 REL GG <br> 61 － <br> 62 FCL 95 <br> 63 FEL 97 <br> 64 ， <br> $65-$ <br> 6E STO GE <br> 67 RCL 04 <br> 6312 <br> 69 ： <br> 7 REL E 1 <br> 71 XEQ 日G <br> 721 <br> $73-$ <br> 74 RCL 63 <br> 75 RCL 11 <br> 76 XEQ 6日 <br> 771 <br> TS <br> 79 <br> EO CHS <br> $\varepsilon_{1} 1$ <br> S2＋ <br> 33 RCL EE <br> 84 ＊ <br> 85 FCL 57 <br> 86 <br> 87 FCL 日G <br> $89+$ <br> 39 REL 98 <br> 96 <br> 91 STO 90 <br> 92 ＂COEF．． <br> 93 XEQ 69 <br> 94 STOF <br> $95+$ LEL 14 <br> 96 |
| :---: | :---: | :---: |


|  | $97+$ |  | 51 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $98 \times \gamma$ |  |  |  |  |
|  | 99 ソt\％ |  |  |  |  |
|  | 1 OE FTH |  |  |  |  |
|  | 101＊LEL H | Calculate value |  |  |  |
|  | 10こ＂AFI ？＂ |  |  |  |  |
|  | 103 PROMF＇T |  |  |  |  |
|  | 104 RCL GE |  |  |  |  |
|  | 165 |  |  |  |  |
|  | 166＂VFLJE＂ |  | 60 |  |  |
|  | 103＊LEL 99 | Display routine |  |  |  |
|  | 108＂ト＝ | Display routine |  |  |  |
|  | 1 19 ARCL |  |  |  |  |
|  | 110 FFOMPT |  |  |  |  |
|  | 111 RTH |  |  |  |  |
|  | $112-E H I$ |  |  |  |  |
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| 50 |  |  | 00 |  |  |

${ }^{48}$ REGISTERS, STATUS, FLAGS, ASSIGNMENTS


## RESIDENTIAL ANALYSIS

## (Rent or Buy)

This program analyzes, on a yearly basis, the investment potential of residential property by computing: increased sales value, tax savings, actual cost (cash outlay minus tax savings), and equity growth versus rental payments.

The following are definitions of the output terms:

1. Sales Price. The original sales price plus the cumulative annual growth (appreciation), the estimated market value at the end of the year indicated.
2. Loan Balance. The amount of the loan remaining at the end of the year indicated.
3. Paid on Loan. The amount of the principal for the year indicated.
4. Property Tax. The property tax paid annually, adjusted to include the same growth factor rate as used in sales price.
5. Interest. The total interest paid on the loan for the year indicated.
6. Cash Outlay. Total annual payments made on principal, interest and property tax (PIT).
7. Tax Savings. Based on buyer's estimated tax bracket, this figure is the actual tax savings he will receive by purchasing the house and deducting interest and property tax payments on his income tax return.
8. Actual Cost. The cash outlay less tax savings.
9. Average PIT. The cash outlay (principal, interest and taxes) divided by 12 .
10. Average Cost. The actual cost figure divided by 12.
11. Equity. The market value less the loan balance. Equity includes down payment, payments on principal, and cumulative growth (appreciation).
12. Tax Savings. (same as number 7 above)
13. Rent. The cumulative amount of rent which would be paid by the buyer if the house were rented instead of purchased. It reflects the same growth factor as the sales price.

Reference: HP-67/HP-97 Users' Library program 非01806D by J. Bradley Flippin.

| Example: | $\$ 65,900$ | List Price |
| :--- | :---: | :--- |
| $\$ 50,000$ | Loan Balance |  |
| 30 years | Loan Years |  |
| $8.5 \%$ | Interest |  |
| $6 \%$ | Growth Rate |  |
| $22 \%$ | Buyer's Tax Bracket |  |
| $\$ 800$ | Property Tax |  |
| $\$ 400$ | Monthly Rent |  |

Solution:

|  | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Sales Price | 69,854 | 74,045 | 78,488 | 83,197 | 88,189 |
| Loan Balance | 49,622 | 49,211 | 48,763 | 48,276 | 47,745 |
| Annua1 |  |  |  |  |  |
| Paid on Loan | 378 | 411 | 448 | 487 | 530 |
| Property Tax | 800 | 848 | 899 | 953 | 1,010 |
| Interest | 4,235 | 4,202 | 4,166 | 4,126 | 4,083 |
| Cash Outlay | 5,413 | 5,461 | 5,512 | 5,566 | 5,623 |
| Tax Savings | 1,108 | 1,111 | 1,114 | 1,117 | 1,120 |
| Actual Cost | 4,306 | 4,350 | 4,398 | 4,449 | 4,503 |
| Monthly |  |  |  |  |  |
| Average PIT | 451 | 455 | 459 | 464 | 469 |
| Average Cost | 359 | 363 | 367 | 371 | 375 |
| Cumulative Sum |  |  |  |  |  |
| Equity | 20,232 | 24,835 | 29,725 | 34,922 | 40,444 |
| Tax Savings | 1,108 | 2,219 | 3,333 | 4,450 | 5,571 |
| Rent | 4,800 | 9,888 | 15,281 | 20,998 | 27,058 |

It is assumed that the system contains a printer.

Keystrokes:
[XEQ] [ALPHA] SIZE [ALPHA] 014
[XEQ] [ALPHA] RES [ALPHA]
65900 [R/S]
50000 [R/S]
$30[\mathrm{R} / \mathrm{S}]$
$8.5[\mathrm{R} / \mathrm{S}]$
$6[\mathrm{R} / \mathrm{S}]$
22 [R/S]
800 [R/S]
400 [R/S]
5 [R/S]

Display:

LIST P. ?
BAL. ?
TERM ?
INT. ?
APP. ?
TAX B. ?
P. TAX ?

RENT ?
SPAN ?
$\mathrm{YR}=1$.
S.P. $=69,854$.

BAL=49,622.
PD. $=378$.
P. TAX $=800$.

INT $=4,235$.
C. $0 .=5,413$.
T.S. $=1,108$.
A.C. $=4,306$.
A. PIT=451.
A.C. $=359$.

EQTY=20,232.
T.S. $=1,108$.

RENT $=4,800$.
$\mathrm{YR}=2$.
(etc through year 5)

User Instructions

*These keystrokes are not necessary when there is a printer in the system.

| - 1 *LEL "RES <br> 02 CLRG <br> 0.3 SF z1 <br> 04 "LIST F. ?. <br> 05 PROMPT <br> 06 STO 01 <br> 07 "BAL. <br> 08 PROMPT <br> 09 STO 02 <br> 10 . TERM ? <br> 11 PROMPT <br> 12 STO 13 <br> 13 . INT ? . <br> 14 PROMPT <br> 1512 E 2 <br> 16 <br> 17 STO 04 18 . APF. <br> 19 PROMPT <br> 201 E2 <br> 21 <br> $225 T 005$ <br> 23 "TAX E. <br> ? <br> 24 FROMPT <br> 251 EZ <br> 26 <br> 27 STG De <br> 28 "F. THX <br> 29 PROMFT <br> 30 STO ET <br> 31 "REHT?" <br> 32 PREMFT <br> 3312 <br> 34 ST* 03 <br> 35 * <br> 36 STO 98 <br> 37 "SFAH ?" <br> 38 PROMPT <br> 391 ES <br> 49 <br> 411 <br> $42 \mathrm{ST}+04$ <br> $43 \mathrm{ST}+65$ <br> $44+$ <br> 45 STO 09 <br> 46 RCL 04 | Initialize and store data |  | Compute results |
| :---: | :---: | :---: | :---: |



## REGISTERS, STATUS, FLAGS, ASSIGNMENTS ${ }^{〔}$



## NOTES

## HEWLETT-PACKARD

HP-41C

## USERS' LIBRARY SOLUTIONS Bar Codes <br> Real Estate





| MORTGAGE PRICING | HEWLETT PACKARD |
| :--- | :--- |
|  | SOLUTION BOOK: |
| PROGRAM REGISTERS NEEDED: 34 | REAL ESTATE |






```
VARIABLE ANALYSIS OF
REAL ESTATE INVESTMENT
PROGRAM REGISTERS NEEDED: 49


ROW 6 (21-25)


ROW 7 (25-27)


ROW 8 (27-32)


ROW 9 (32-44)


ROW 10 ( \(45-48\) )


ROW 11 (48-55)


ROW 12 (55-60)


ROW 13 (61-73)


ROW 14 (73-77)


ROW 15 (78-90)


ROW 16 (91-97)


ROW 17 ( 98 - 106)


ROW 18 (107 - 119)







NOTES
(h) HEWLETT PACKARD

\section*{Hewlett-Packard Software}

In terms of power and flexibility, the problem-solving potential of the HP-41C programmable calculator is nearly limitless. And in order to see the practical side of this potential, HP has 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.

\section*{Application Pacs}

To increase the versatility of your HP-41C, HP has an extensive library of "Application Pacs". These programs transform your HP-41C into a specialized calculator in seconds. Included in these pacs are detailed manuals with examples, minature plug-in Application Modules, and keyboard overlays. Every Application Pac has been designed to extend the capabilities of the HP-41C.

You can choose from:

\author{
Aviation \\ Clinical Lab \\ Circuit Analysis \\ Financial Decisions \\ Mathematics
}

\author{
Structural Analysis \\ Surveying \\ Securities \\ Statistics \\ Stress Analysis \\ Games
}

\author{
Home Management \\ Machine Design \\ Navigation \\ Real Estate \\ Thermal and Transport Science
}

\section*{Users' Library}

The Users' Library provides the best programs from contributors and makes them available to you. By subscribing to the HP-41C Users' Library you'll have at your fingertips literally hundreds of different programs from many different application areas.

\section*{* Users' Library Solutions Books}

Hewlett-Packard offers a wide selection of Solutions Books complete with user instructions, examples, and listings. These solution books will complement our other software offerings and provide you with a valuable tool for program solutions.

You can choose from:
```

Business Stat/Marketing/Sales
Home Construction Estimating
Lending, Saving and Leasing
Real Estate
Small Business
Geometry
High-Level Math
Test Statistics
Antennas
Chemical Engineering
Control Systems
Electrical Engineering
Fluid Dynamics and Hydraulics
Fluid Dynamics and Hydraulics

```

\author{
Civil Engineering \\ Heating, Ventilating \& Air Conditioning \\ Mechanical Engineering \\ Solar Engineering \\ Calendars \\ Cardiac/Pulmonary \\ Chemistry \\ Games \\ Optometry I (General) \\ Optometry II (Contact Lens) \\ Physics \\ Surveying
}

\footnotetext{
* Some books require additional memory modules to accomodate all programs.
}

\section*{REAL ESTATE}

INCOME PROPERTY ANALYSIS
MORTGAGE YIELD
MORTGAGE PRICING
AMOUNT OF EQUITY AT ANY TIME
WRAP-AROUND MORTGAGE
INTERNAL RATE OF RETURN
VARIABLE ANALYSIS OF REAL ESTATE INVESTMENT
REAL ESTATE INVESTMENT ANALYSIS FOR PROPERTY AND LAND ELLWOOD INCOME VALUATION FOR INCOME PROPERTY APPRAISAL RESIDENTIAL ANALYSIS (RENT OR BUY)

\section*{hp) HEWLETT}```

