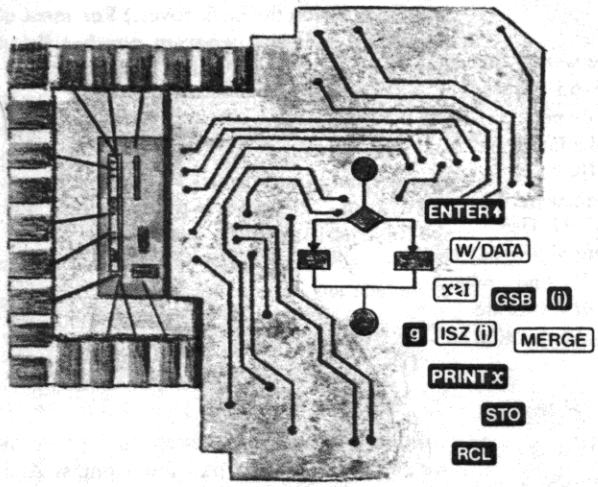


HEWLETT hp PACKARD

HP Key Notes

January 1977 Vol. 1 No. 1

Welcome Aboard!

For slightly over two years, we have been mailing a newsletter, HP-65 KEY NOTE , to HP-65 Users in the United States and in Canada. With the introduction of the HP-67 and HP-97, we decided to go into *worldwide* circulation of the newsletter. Hence: HP KEY NOTES.

As you look through the newsletter you will notice one concession to worldwide circulation: programs highlighted in HP KEY NOTES have two different numbers. This is done merely to satisfy certain computer peculiarities for the Library in the U.S. and the Library in Europe. It is very important that you *use the correct number and order from the right Library*. European Library services are extended to Users in Europe, North Africa, and the Middle East. All other countries must order programs from the Library in Corvallis, Oregon. The two addresses are listed on the back cover of HP KEY NOTES.

Notice that we now show the Library address as in Oregon. Since July of 1976 we have been gradually moving people and equipment to our new factory in Corvallis, Oregon. It has been a mammoth undertaking, and we hope that inevitable problems and delays caused by the move have not seriously inconvenienced anyone.

The photo shows our first completed building (on the right) and a second building nearing completion. (It will be finished in February 1977.) The buildings are on a 139-acre site northeast of Corvallis, which is in the beautiful Willamette Valley, about 80 miles south of Portland.

Although there are people and equipment that still must be moved to Oregon, for all practical purposes, we are here to stay, and (except for European areas) you should use only this address for all business.

Accessories Update

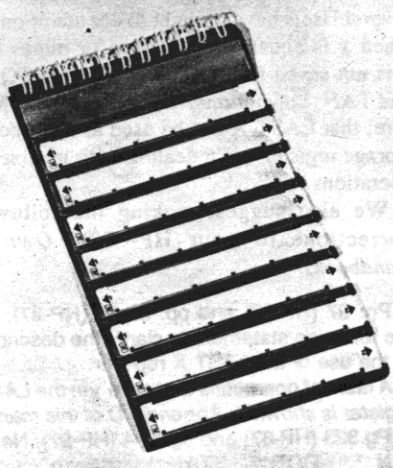
Because some of the accessories for the HP-67/97 calculators can be used for the HP-65, here is an up-to-date report on those accessories.

Foremost on HP-65 owners' "want list" has always been a better method for arranging, storing, and retrieving magnetic cards. Therefore you'll be happy to know that a new HP-67/97 accessory solves that problem. Pictured below is the new Program Card Holder that stores 40 magnetic cards in see-through plastic slots. There's also an open pocket behind each "page" of cards so that you can store notes, instructions, etc. The Program Card Holder can be ordered in three ways:

- A package of three Program Card Holders, model #00097-13142, for $10.
- One pack of 40 Blank Magnetic Cards plus a Program Card Holder model #00097-13141, for $20.
- Three packs of 40 Blank Magnetic Cards plus three Program Card Holders, model #00097-13143, for $45.

Another HP-67/97 accessory you will need in the future is the model #00097-13154 Programming Pad, for $4.00. It replaces all previous Programming Pads, including the one for the HP-65.

All of these—and other—accessories are available in the U.S. from your local HP dealer, or they can be ordered directly from the factory. *In all other countries,* these accessories are available from your HP dealer or from the nearest HP sales office. If you order by mail in the U.S., make checks or money orders payable to Hewlett-Packard and be sure to include any state or local taxes.



All prices in this newsletter are suggested retail prices excluding applicable state and local taxes—Continental U.S.A., Alaska and Hawaii.

User Feedback

Here are two items of interest to many of our HP-67/97 Users. They were brought to our attention, so we are passing them on to you to keep you well-informed and up to date.

SIN^{-1} AND COS^{-1} OF SMALL-MAGNITUDE AGRUMENTS

We want to let you know that several HP-67/97 Users have pointed out a few specific argument values for which sin^{-1} (and to a lesser degree, cos^{-1}) are in error to an extent that could be excessive for some applications. However, these arguments are very small in magnitude and thus infrequently encountered by most Users.

The six specific arguments affected and the resulting errors for $sin^{-1}\ \chi$ are: χ = 0.000003000 (error 0.6%), 0.000004000 (2.5%), 0.000005000 (4.0%), 0.000006000 (7.0%) 0.000007000 (8.0%), 0.000008000 (11.5%). No other values are affected. Notice that changing the magnitude of the above arguments by as little as $\pm$0.000000001 eliminates the larger-than-normal error.

We suggest inserting a note regarding this on page 92 of your *HP-67 Owner's Handbook* or on page 83 of your *HP-97 Owner's Handbook*.

USING LAST X WITH INVERSE TRIG OPERATIONS

The LAST X register is primarily intended for error recovery in the event an undesired function is mistakenly executed; i.e., the "opposite" function can be easily executed on the same number, thus conveniently getting the User back to the previous step in the problem. Furthermore, with trigonometric functions, the *inverse* operation (SIN, SIN^{-1}) can be used to directly return to the previous step in the problem. Thus, LAST X is not essential for easy error recovery when dealing with trig functions.

In addition to this use of LAST X, some Users have found it useful to utilize LAST X as a temporary storage register. However, several Users have brought to our attention that when χ is equal to either zero or minus one, χ is not saved in LAST X for SIN^{-1}, COS^{-1}, and TAN^{-1} operations. We recommend, therefore, that LAST X **not** be used as a temporary storage register when dealing with inverse trig operations.

We also suggest making the following corrections to your HP-67/97 *Owner's Handbooks*.

Pg. 67 (HP-67) and pp. 58-59 (HP-97): Add the following statement to clarify the description of the use of the LAST X register.

A table of operations that save χ in the LAST X register is shown in Appendix D of this manual.

Pg.323 (HP-67) and pg. 294 (HP-97): Next to SIN^{-1}, COS^{-1}, TAN^{-1} shown under **LAST X,** add the following note: *Except for arguments equal to zero or minus one.*

Library Corner

As of December 15, 1976, there were 5,265 programs logged into the HP-65 Users' Library. As you can see, HP-65 owners continue to find new uses for their calculator, and the Library continues to steadily flourish.

As of December 16, 1976, there were 320 programs logged into the HP-67/97 Users' Library. You will find some of them highlighted under "NEW PROGRAMS." And, of course, a large number of initial programs are the individual programs from the Application Pacs.

EUROPEAN LIBRARY NEWS

Although very similar to the Library in the U.S., the European Library is actually part of two "clubs." The official names are "HP-67/97 Users' Club-Europe" and the same for the HP-65. The Library operates much the same as the one in the U.S., but differs in the charges for programs and so forth. Of course, there is a somewhat more critical problem there; a total of 14 different currencies are accepted by the Library. Maybe **that** is why the clubs are located in Switzerland!

There are three applications manuals (no magnetic cards) available in the European area. Two are in French; they are:

- *HP-67/97 Surveying Applications Manual* #00097- 90160
- *HP-67/97 Civil Engineering Applications Manual* #00097- 90161

The third one is in German; it is:

- *HP-67/96 Surveying Applications Manual* #00097- 90162

These three manuals, each of which contains 13 to 20 programs, are available through your nearest HP sales office or dealer in the German and French speaking areas of Europe.

German Civil Engineering Software Available

It should be of interest to all Civil Engineers in German-speaking areas that an extensive range of software is available through the two addresses noted below. Both of these sources have already contributed many programs for the HP-65 and have aquired a very good reputation among their colleagues.

Engineer Bureau Heiniger
Feldweg 8
Wetzikon/Zurich
Switzerland

Engineer Bureau Weckmann
Am Reulert 6
5100 Aachen
Germany

ORDERING PROGRAMS

Any program you see in HP KEY NOTES can be ordered from either the Users' Library in Corvallis, Oregon, or from the Users' Library in Geneva, Switzerland. (Both addresses are on the back cover.) **For most of the world, use the program number listed next to the program's title,** and order from Corvallis. The only exception is if you live in the European areas; in that case, *use the number listed in italic type below the program abstract,* and order from Geneva.

Payment for programs must conform with the instructions from *your* Library area. Always use order forms if possible, and be sure to include any state or local taxes.

NEW PROGRAMS

Following are some interesting programs we've received in the past few months. And, because the HP-67 and HP-97 are in the limelight at present, all the programs listed here are for those calculators. It is also significant that most of the first batch of programs submitted to the Library were games. So that is what you will find here.

We have not listed new HP-65 programs because a new Catalog Update of approximately 2,000 programs was just released. There are, however, two HP-65 programs featured on later pages of this issue. We will feature some new HP-65 programs—perhaps some from Europe or Asia—in the next issue of HP KEY NOTES.

Concentration (00266D)*

The player tries to memorize a random number that is displayed for only 2½ seconds. If you are successful, a larger number will be displayed; if not, a smaller number will be displayed. Credit is given for each correct digit, and the game ends after three misses. Your score is the total number of correct digits, and it is represented by a description of your ability to remember numbers. It can range from a low ability of "total amnesia" to a high of "eidetic memory" on the scoring chart. Also, a difficulty factor can be entered at the start of any game. (111 steps)

Author: **William M. Kolb**
Upper Marlboro, Maryland

**In European areas, order by number 00195D.*

Shooting Gallery (00219D)*

Step right up to the arcade, drop a quarter in the old shooting gallery machine, and try to hit the moving decimal point. You have 12 shots (2 six-guns), but the machine can shoot back! Try to beat the 200-point limit for a free game, but don't let the machine get six or more shots off *at you* or you lose! (140 steps)

Author: **Craig A. Pearce**
Berwyn, Illinois

**In European areas, order by number 00201D.*

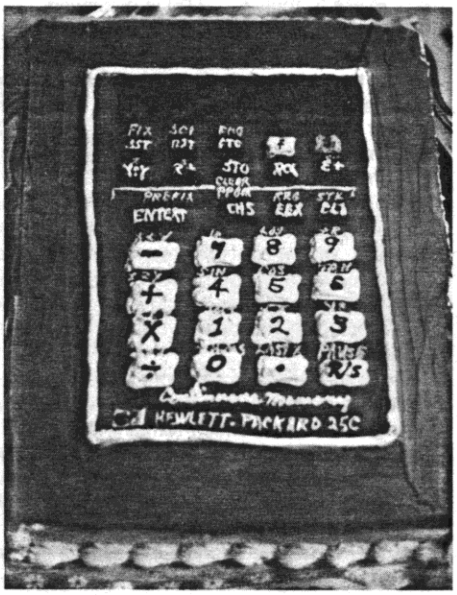
GTO page 12

A High-Calory Calculator

Although this is not a programming trick or tip, it *is* a "far-out" application of HP calculators. Besides, we figured it would both interest and amuse you, and maybe give your spouses an idea for *your* birthday.

Saturday night, October 30, turned out to be quite a surprising time for **Andy Burg** of Los Angeles, California. His fiancée, his sister, and some friends had a surprise birthday party for him, and the birthday cake was, to say the least, most extraordinary—as you can see. What you can't see, however, is the amount of consternation caused by the cake. It took three tries by the baker before it came out anywhere near correct! The final layout was accurate except for the "g" functions. But if Mr. Burg's sister had trouble getting an HP-25C cake correct, can you imagine the problem she would have had with the multitudinous functions on the HP-67?

Anyway, the cake was a huge success, and it did feed 30 people at the surprise costume party. And we thank Mr. Burg for sharing the photo with all of our readers.



Converting HP-65 Programs To The HP-67/97

If you have a lot of HP-65 programs and have purchased an HP-67 or HP-97, you probably want to know how to convert your old programs so you can use them with your new calculator. Remember: Although HP-65 and HP-67/97 blank magnetic cards are interchangeable, *you cannot run an HP-65 program in an HP-67/97, or vice versa*. The HP-65 uses a 6-bit word to represent program steps and the HP-67/97 uses an 8-bit word to do the same thing. (Also, all operations in the HP-67/97 are merged into single program steps.)

So, for the above reasons, there are some things to remember when you convert programs. And, although it is usually advantageous to redevelop and rewrite HP-65 programs to utilize the added features of the HP-67/97, many HP-65 programs can be directly converted to the HP-67/97 by using the following guidelines.

1. A subroutine on the HP-67/97 is called with the GSB key.

HP-65	HP-67/97
LBL	
A	LBL A
⋮	⋮
f^{-1}	
ln	e^x
B	GSB B
⋮	⋮
RTN	RTN

   This also illustrates that all commands on the HP-67/97 are merged.

2. Keys f^{-1} SF1 and f TF1 on theHP-65 have been replaced by CLF 1 and F? 1, respectively, on the HP-67/97. Flag 2 on the HP-65 should be replaced by flag 0 on the HP-67/97. This is because flag 2 on the HP-67/97 clears each time it is tested.

3. There is no HP-67/97 test for flag off (f^{-1} TF1 on the HP-65). You should test for flag on, and then reverse the order of the next two commands. For example:

HP-65		HP-67/97	
⋮		⋮	
f^{-1}	Is flag 1	F?1	Is flag 1 on?
TF1	Off?	GTO 0	Yes, then GTO 0.
GTO	Yes, then	GTO 1	No, then GTO 1.
1	GTO 1.	LBL 0	
2	No, multiply	2	
x	by 2 and	x	
⋮	continue	⋮	

4. Conditionals skip only 1 step, instead of 2, when not satisified. Therefore, in some instances, it may be necessary to call a subroutine in an HP-67/97 program. For example:

HP-65		HP-67/97		
⋮		⋮		
g	x≤y	x≤y?		
1	Yes, add 1 and	GSB 0	Yes, execute routine 0	LBL 0
+	continue.			1
2	No, skip two	2		+
x	steps.	x		RTN
⋮		⋮		

5. In the HP-65, pressing a user-definable key (A through E) when no such label exists in program memory, causes program execution to begin from the top of memory. Similarily, a GTO ⟨label⟩ within a program when the ⟨label⟩ does not exist transfers control to the top of program memory. On the HP-67/97, every label called must be specified, otherwise **Error** will appear on the display.

6. If an *undefined* subroutine (say, C) is called in a running HP-65 program, then C will be ignored and the first RTN encountered will act like a NOP. When an undefined subroutine is called on the HP-67/97, **Error** will appear on the display.

7. If a series of label-return programs are in program memory, and execution is started with R/S, the HP-65 will pass through the first return encountered and stop at the second. The HP-67/97, in the same situation, will stop at the first RTN.

8. The HP-67/97 does not halt on underflow; it places 0 in the display or register and continues program execution.

9. The HP-67/97 does not have a NOP (no operation) statement. If it is necessary to have a "filler" step, you may insert a label (e.g., LBL 9), which is never called.

10. The display formatting of a program is "remembered" on the HP-67/97 magnetic card. The HP-65 command for displaying four decimal places is DSP . 4. On the HP-67/97, this is accomplished by pressing FIX DSP 4.

11. There is no D.MS- key on the HP-67/97. Instead, change the sign (CHS) of the angle (or time) in the display and add with H.MS+.

12. There is no CLEAR STK key on the HP-67/97 because it is usually not essential to program operation. However, if the need arises, pressing CLx ENTER↑ ENTER↑ ENTER↑ gives the same results.

13. The HP-65 uses R_8 for the DSZ operation, while the HP-67/97 uses I, or can decrement and skip indirectly. The following program sums the integers from 1 to n in decreasing order. Simply key in the value of n and press A.

HP-65		HP-67/97
LBL		
A		LBL A
STO 8	$n \rightarrow R_8$	STO I
0	$0 \rightarrow x$	0
LBL		LBL 1
1		RCL I
RCL 8		+
+	$x + R_8 \rightarrow x$	DSZ I
g		GTO 1
DSZ	$R_8 - 1 \rightarrow R_8$	RTN
GTO		
1		
RTN	Display sum (x)	

14. There is no decimal ⇋ octal key on the HP-67/97. If you need this function, you should get program #00173D, *Hex-Octal Arithmetic*, from the HP-67/97 Users' Library.

15. The key f^{-1} on the HP-65 means "do the *opposite* of the next step." For instance, f^{-1} $\sqrt{x}$ means x^2 f^{-1} INT means FRAC, and f^{-1} LOG is 10^x.

Equation Keystrokes ONLY!!

(The following program-editing technique was developed by **C. Ray Kolker,** *Engineering Manager for Faxon Communications Corp. in Pasadena, California. Although Mr. Kolker's contribution is copyrighted, he felt it should be shared with the readers of HP KEY NOTES, and we agreed. Therefore, he gave us permission to print his technique for our readers all over the world. Ed.)*

EQUATION KEYSTROKES *ONLY* REQUIRED TO PROGRAM YOUR HP-65/67/97 PROGRAMMABLES*

You bought a programmable calculator to save precious time and energy while solving math problems, those ranging from the simple to the very complex. Right? Now, would you like a way to save time and energy in the *use* of your programmable calculator?

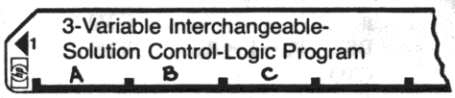
I would like to introduce you to a simple, but extremely versatile, time-saving method of program writing. The expressions $E = mc^2$, $C^2 = A^2 + B^2$, $d = rt$, $X_L = 2\pi fL$, $1/f = 1/p + 1/q$, and $DP = N/PD$ are but a few of the common, often-used three-variable equations. All require exactly the same control-logic or program control instruction key codes. So, why not generate a simple, *universal,* control-logic program card; read it into program memory; key into memory only the equation keystrokes; then record the entire program (control-logic + equations) onto another program card? For instance:

Key this into memory: (HP-67/97)

001 f LBL A	008 f LBL B	015 f LBL C
STO A	STO B	STO C
h F? 3	h F? 3	h F? 3
R/S	R/S	R/S
f LBL 1	f LBL 2	f LBL 3
STO A	STO B	STO C
007 R/S	014 R/S	021 R/S

LOCATING-LABELS FOR INSERTING EQUATIONS

Record onto a program card:



You have just recorded the control-logic for interchangeable solutions for *all* three-variable equations in *any* discipline!! (Solves for: A in terms of B and C, B in terms of A and C, and C in terms of A and B.) Once you have recorded this card, it can be used over and over again.

The hard part of programming is designing the program control-logic keystroke sequence. So, now that that's behind us (forever, we hope, for this type problem; why keep reinventing the wheel?), let's key in the easy part: the equation keystrokes.

EQUATION ENTRY INSTRUCTIONS

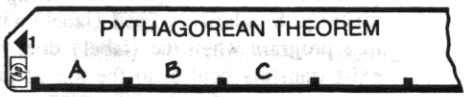
PYTHAGOREAN THEOREM SAMPLE EQUATIONS AND KEYSTROKE SEQUENCES

$A = \sqrt{C^2-B^2}$	$B = \sqrt{C^2-A^2}$	$C = \sqrt{A^2+B^2}$
Equation "A" Keystrokes	Equation "B" Keystrokes	Equation "C' Keystrokes
RCL C	RCL C	RCL A
g x^2	g x^2	g x^2
RCL B	RCL A	RCL B
g x^2	g x^2	g x^2
−	−	+
$f\sqrt{x}$	$f\sqrt{x}$	$f\sqrt{x}$

1. In RUN mode, insert program card with three-variable, interchangeable-solution, control-logic program.

2. Enter equations.
   Equation "A"—In RUN mode, press GTO 1. Switch to W/PRGM mode. Code 31 25 01 is displayed. Key Equation "A" keystrokes into program memory. Switch to RUN mode.
   Equation "B"—In RUN mode, press GTO 2. Switch to W/PRGM mode. Code 31 25 02 is displayed. Key Equation "B" keystrokes into program memory. Switch to RUN mode.
   Equation "C"—In RUN mode, press GTO 3. Switch to W/PRGM mode. Code 31 25 03 is displayed. Key Equation "C" keystrokes into program memory.

3. Record onto a program card:



It's done!! The program is loaded, recorded, and ready to use!

TESTING THE FINISHED PROGRAM

In RUN mode, from the keyboard, perform the following operations:

a) Press 3, then A. 3.00 is displayed.
   Press 4, then B. 4.00 is displayed.
   Press C. Answer 5.00 is displayed.

Notice that input data is entered through two user-defined keys, such as A and B, and the answer is obtained by pressing C.

b) Press B. 4.00 is displayed.
   Press A. 3.00 is displayed.

Notice here that this test verifies that each equation is properly entered into program memory. Actually, when you pressed B, then A, you solved for each of them based on the original solution you made for "C" in step a. (All variables, including the answer variable, were stored in step a.)

Since all variables are stored, it is then convenient to modify data without the necessity for keying in that data which remains the same. If you wish to change only the value of "B", ("A" remaining the same), merely key in a new value from the keyboard (digits keys) and press B. Press C for a new answer.

To see how interchangeable solutions work, solve for:

(Note: Let A = 3, B = 4, C = 5.)

1) C, entering A first then B, press C for answer (step a).
2) C. entering B first then A, press C for answer.
3) A, entering B first then C, press A for answer.
4) A, entering C first then B, press A for answer.
5) B, entering A first then C, press B for answer.
6) B, entering C first then A, press B for answer.

This illustrates that data may be entered in any order; i.e., "A" first, then "B", or "B" first, then "A", etc.

Observe the following:

a) Display information, such as DSP 9, h ENG, etc., may be entered in RUN mode before recording the completed program onto a program card.

(continued)

b) Locating-labels, LBL's 1, 2, 3, etc., may optionally remain, providing convenience in locating the beginning of each equation in the finished program by pressing GTO 1, GTO 2, GTO 3, etc. in RUN mode, or may be deleted if they are required for other uses.

c) If erroneous data is entered, the new data entered will write over the old data. Initialization is never required!!

d) Arithmetic operations may be performed just prior to pressing an "answer" key, but this will make the "answer" key a data input key when it is pressed. Pressing the "answer" key again will make it an "answer" key providing the correct answer.

e) Flag 3, and as many storage registers as there are variables are used.

THERE'S MUCH MORE!!

This program is truly flexible. Look at this!! (Note: Refer to equation entry instructions.)

1) Suppose, using the Pythagorean Theorem, you wish only to solve for "C". Merely insert equation "C" into LBL C, using GTO 3. The A and B keys are then data input keys only. C is the "answer" key.

2) If you need interchangeable solutions of a two-variable equation such as *Volume of a Sphere*, $V = 4\pi r^3/3$, solve algebraically for "r" in terms of "V", then insert equation "r" into LBL A using GTO 1 and equation "V" into LBL B using GTO 2. To use this, enter data through key A or B. B or A becomes an "answer" key. ("LBL C is not used.)

3) If you wish to solve one, two, or three independent, two-variable equations such as *Volume of a Sphere*, just insert equation "V" into LBL A using GTO 1. To use this, merely enter data via key A, then press A again for the answer. The other one- or two-equations would be inserted into LBL's B and C respectively.

4) Or suppose you need interchangeable solutions of a five-variable equation, or solutions of two independent equations, one being a three-variable and the other a two-variable equation (such as Pythagorean Theorem and *Volume of a Sphere*)? Simply expand the three-variable interchangeable-solution program to a five-variable program by adding LBL's D and E as follows:

a) In RUN mode, insert the program card with the three-variable, interchangeable-solution, control-logic program.

b) Press GTO.021. Switch to W/PRGM mode. Step 021, code 84 is displayed.

c) Key this into memory:

022	f LBL D	029	f LBL E
	STO D		STO E
	h F? 3		h F? 3
	R/S		R/S
	f LBL 4		f LBL 5
	STO D		STO E
028	R/S	035	R/S

LOCATING-LABELS

LBL's A, B, C, D, and E can be used for a five-variable interchangeable-solution problem, or LBL's A, B, and C can be used for the Pythagorean Theorem, while LBL's D and E are used for *Volume of a Sphere.*

Interchangeable solutions of up to 10 variables are easily accommodated on the HP-67/97 by simple expansion of this basic program! A similar programming technique can also be accomplished on the HP-65.

Enjoy enlarging your personalized program library with this program writing approach: EQUATION KEYSTROKES *ONLY*!!

Users Club Grows

In just 2½ years, a dedicated group of calculator enthusiasts, inspired and led by **Richard J. Nelson,** have built the *HP-65 Users Club* into a close-knit organization that now includes Users of HP-25/25C/55/65/67/97 programmable calculators.

The club is a volunteer, non-profit, loosely organized, independent, worldwide group of people (now over 1500) who own and use Hewlett-Packard programmable calculators.

The primary objective of the club is to provide a means for HP programmable calculator Users to share their questions, problems, experiences, programs, and professional expertise for the common goal of obtaining the maximum use from their calculators. The club has three main activities:

- Monthly Newsletter. A 10-page (minimum) newsletter called *65 NOTES.*
- Membership Identification. Members receive a membership list, which facilitates locating people with similar interests.
- Program Sharing. Members may participate in individual program exchange by adding their program titles and statistics to the "Share-a-Program" data base.

Local chapters have been formed in many U.S. cities and in foreign countries. One of the most active is the German Chapter, which publishes its own newsletter in German; it is called *DISPLAY* and is edited by **Heinrich Schnepf.**

For a sample newsletter and information about the club, send a self-addressed, business-size (at least 9" long) envelope with postage attached (two 13¢ stamps in U.S., 2 ounces foreign postage) to:

HP-65 Users Club
Richard Nelson, Editor
2541 W. Camden Place
Santa Ana, California 92704, USA

Note: The HP-65 Users Club is not sponsored, nor in any way officially sanctioned, by Hewlett-Packard.)

Tips From The Users Club

These two HP-67 programming tips were recently contributed to the HP-65 Users Club newsletter, 65 NOTES, by **Art Leyenberger** of Ridgewood, New Jersey. He also sent them to us so they could be shared with HP KEY NOTES readers.

TESTING REGISTER CONTENTS OF HP-67

Using the h REG keys of the HP-67, it takes approximately 59 seconds to test all 25 registers for non-zero contents. The usual procedure is to press h REG, which will cause the display of the contents of registers 0 to 9 and 20 to 25. Then, f P≠S must be pressed and h REG pressed again to inspect registers 10 to 19 (the secondary registers). This procedure takes about 59 seconds regardless of the contents of the registers themselves.

If all that is needed is to test each register for non-zero contents, a subroutine may be used. This subroutine takes approximately 12 seconds to complete when the content of each register is zero. The maximum time for this subroutine (when all of the registers contain non-zero amounts) will be about 3 minutes.

If many registers contain non-zero values, this subroutine may be impractical. However, if only a few registers contain non-zero values and one wants to quickly locate these specific registers, this subroutine may be helpful.

To use the subroutine, press A. The display will show the register number and contents for all registers that have a non-zero value stored therein. When finished, the display will show 25.00. The subroutine is:

f LBL A	DSP 0
RCL (i)	f -x-
f x≠0	RCL (i)
GTO B	g x=y
f ISZ	R/S
GTO A	f -x-
f LBL B	f ISZ
h RC I	GTO A

TABULATOR PROGRAM TIPS

Here is a good idea to extend the application of HP-67/97 *Standard Pac* Tabulator Program, #SD-02A.

It may be desirable when creating tables to reverse the column and row parameters. By inputting the number of columns and pressing f A, instead of inputting the number of rows, after the values are entered for each row, the calculator will automatically display the row total. This may be done for each row (for as many rows as you have). Once all of the data has been entered, pressing C will result in the column totals being displayed. Naturally, when using this technique with the tabulator program, the maximum number of columns that you may have will be limited to 24.

Since the number of columns that you have is usually a fixed amount and the number of rows may vary, and when the row totals need to be calculated before being written down, I have found that it is more helpful to use this program in this manner. Also, it seems more logical to work across each row, determine the row totals,

(continued)

and then, when finished calculating, determine the column totals.

Another modification I use with this program (and other programs that I write when the size of the majority of the data to be entered is greater than 1000), is to enter four additional steps after the label A instruction. Starting with line number 28, they are: Enter, EEX, 3, and ×. This procedure allows me to enter the data as multiples of a thousand and lets the program bring the number up to its proper value. For example, the numbers 1000, 25300, 100000, and 750 would be entered as follows: 1, 25.3, 100, and .75. This saves time and reduces the amount of keypressing that I must do. It also helps me to comprehend amounts when I think of them and use them as multiples of a thousand.

OUTSMARTING THE HP-67 "SMART" CARD READER

When using either the HP-67 or HP-97 programmable calculators, one example of the "smart" card reader present in both machines is the programming aid of informing the user that there is additional information to be read from or recorded on the other side of the magnetic card (depending upon what mode the calculator is in, either W/PRGM or RUN). When recording a card, if there are more than 112 steps in the program that is currently in program memory or if there are instructions other than R/S after line 112, the display shows **Crd.** This prompts the user to insert the other side of the card into the card reader slot so that the remaining portion of the program can also be recorded. Likewise, when reading a card, if there is additional information on the other side of the card, after the first pass through the calculator the display will show **Crd** to signal the user of that fact.

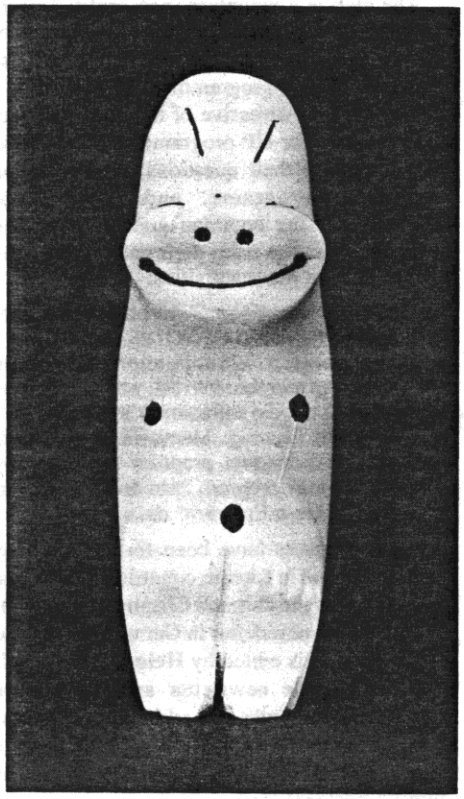
Often, the situtation arises where a program is less than 112 steps long and is recorded on side 1 of a magnetic card. Side 2 of the card may contain data that is necessary to run the program. Unfortunately, if this is the case, when side 1 of the card is read into the calculator, the display will show "0.00" (no prompting occurs). By not seeing **Crd** in the display, the user may forget to read-in side 2. Using the convention of recording a program on side 1 and the data on side 2 of a magnetic card, it would be quite helpful if the card reader would prompt for side 2 when reading a card.

Suppose a program is 90 steps in length and is in the program memory. In the W/PRGM mode, press GTO • 1 1 3, then CL x. Now record the program onto side 1 of a magnetic card. The calculator will then prompt with **Crd** in the display. Switch to the RUN mode and press any key to clear the display. Assuming the proper data is stored in the registers, R(0) thru R(9) and R(A) thru R(E), press W/DATA and pass side 2 of the card through the calculator to record the data onto side 2. Now, once the card is clipped on both sides to protect it, whenever side 1 is read into the calculator, the display will show **Crd** to prompt the user to enter side 2 (which has the data recorded on it).

Although the prompting function of the HP-67/97 is a very useful feature indeed, with the above described technique it becomes even more useful, particularly with non-programming individuals or those who may be unfamiliar with the calculator. This technique proves that the "smart" card reader is in fact smart, but not as smart as the programmer.

What's A Billiken?

The intense desire to acquire one of our new programmable calculators sometimes produces humorous situations. An example is the following letter—and photo. Will this produce results at the factory? Well, don't count on it. Orders are filled in the sequence received, and all of that depends on availability, the number of orders extant, and the volume of production. And, because we do not just "stamp-out" HP-67's and HP-97's, sometimes you have to wait a while to get one. But, anyway, here's an amusing (and *very* clever!) letter to one of our Customer Service people.



"This little Walrus Ivory Carving is called a 'Billiken.' It's an 'Alaskan Good Luck Charm' for your desk, and every morning when you arrive at work, if you rub his belly your wishes will be looked upon with favor.

I am not saying he will grant your every wish, but just looking at his smiling face will brighten your day with sunshine. I am sending him to you as my Alaskan Emissary to expedite the shipment of my HP-97. He is my *chargé d' affaires,* my representative in Court.

Your Majesty, I beg of you not to banish my Ammbassador from your Kingdom, for he speaks for me.

In years past, we Alaskans have been treated as poor step-children in our petitions to the South-48. Our requests for services either have been ignored or placed upon the bottom of the pile so that we have become very devious in achieving equal attention.

I pray that his smiling countenance will kindle a warmth that will grow from a tiny spark into a roaring conflagration, and you will bestow upon my kneeling figure one small desire, an HP-97."

Rapid Reverse Branching Made Easy

Some HP-67/97 owners have asked us for more information about rapid reverse branching as it applies to where a program will branch, based on the negative number stored in the I-register. Well, **Art Leyenberger** of Ridgewood, New Jersey, has come up with a clever idea that should clarify this function. Let's let him tell it in his words.

With regard to the rapid reverse branching capability of the calculator, I would like to offer what I think is a useful aid in determining where a program will branch to, based on the negative number stored in the I-register. For myself, at least, this formula makes the process clearer than that described in the handbook. With this formula, it is easy to determine the line number of a reverse branch instruction simply by plugging in the values of L and (i).

$$L1 = L + (i)$$

Where:

L1 = line number to which program will branch.

L = line number of the GTO or GSB instruction.

(i) = the negative number currently stored in I.

NOTE: If, after calculation of the formula, L1 is a negative number, add 224 to it to obtain the line number to which the program will branch.

HP-67/97 Programming Tips

After you have read your *Owner's Handbook* and have mastered the *operation* of your new HP-67 or HP-97, you'll want to devise clever ways to program various functions. However, because of the nature of programming, everyone isn't likely to think of every way there is to formulate routines. So, in each issue of HP KEY NOTES, we'll try to bring you innovative tips you can use.

SAVING SPACE WITH REGISTER ARITHMETIC

In many instances, the register arithmetic of the HP-67 and HP-97 can be used to save program steps. For instance, if you needed to calculate:

$$A(x + y^2)$$

$$A(x - y^2)$$

where A is stored in R_0, x is stored in R_1, and y is stored in R_2, you could do it in the stack using the code below.

001 LBL A		008 RCL 1	
002 RCL 1		009 RCL 2	
003 RCL 2		010 x^2	
004 x^2		011 −	
005 +		012 RCL A	
006 RCL A		013 x	$A(x-y^2)$ in x
007 x	$A(x+y^2)$ in x	014 RTN	

GTO page 9

A SOFTWARE BARGAIN HARD TO BEAT

Here is a bargain you won't want to miss! We have on hand a limited supply of "used" HP-65 application pacs that you can buy at a greatly reduced price. By "used" we mean that they have been on dealer's shelves and were traded back to us for the new HP-67/97 pacs, or they are some of the pacs returned to us on our 15-day free trial offer. But, because of various regulations, they cannot be sold as new products; therefore, *all* are marked "used".

In case you are not familiar with all of our application pacs, we have listed the contents of each pac on the back of this sheet. Look over the list carefully. The manual, alone, is probably worth the price!!

As with any "bargain," there are a few stipulations. One, the offer is good only in the United States (including Hawaii and Alaska). Two, not only are supplies limited, but there is a limit of only 10 pacs to a customer. And three, you must allow up to 4 weeks for delivery.

Although these are all officially "used" items, *they will be covered by our same Full One-Year Warranty that covers any new calculator or software pac.* (Warranty available on request.)

So, for a rare, *bona fide* bargain, fill in the order blank below and mail it with your check or money order as soon as possible. Be sure to include any state or local taxes, and don't forget to type or print your address and zip code in the address block. Don't delay, this offer is good only as long as the supply lasts.

HEWLETT hp PACKARD

If you are claiming a tax-exempt status, please enter your tax-exempt number. _____

00065-67001 Math Pac 1 ..... ___
00065-67002 Math Pac 2 ..... ___
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00065-67004 Medical Pac 1 ..... ___
00065-67005 Stat Pac 1 ..... ___
00065-67007 E.E. (Elec. Engrg.) Pac 1 ..... ___
00065-67042 Aviation Pac 1 ..... ___
00065-67044 Finance Pac 1 ..... ___
00065-67045 Navigation Pac 1 ..... ___
00065-67050 Chemical Engrg. Pac 1 ..... ___
00065-67051 Stress Analysis Pac 1 ..... ___
00065-67053 Stat Pac 2 ..... ___
00065-67056 E.E. Pac 2 (Microwave) ..... ___

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MAIL TO: HEWLETT-PACKARD
P.O. Box 3400
Corvallis, Oregon 97330

The HP-65

can be "tailor made" for your profession.

Pre-recorded programs let you transform your HP-65 into a specialized calculator-in seconds.

To concentrate the capabilities of the HP-65 in your field of interest, you can select from an ever-expanding variety of pre-recorded magnetic program cards packaged in Application Pacs. Each Pac contains cards for up to 40 programs, a detailed manual on the Pac, and a set of Pocket Instruction Cards for listing your program instructions.

FINANCE PAC 1

These 38 programs (on 40 pre-recorded cards) help give you fast answers to complex problems in investment analysis, loans, leasing, savings and annuities, business statistics and other business and financial applications. Included are programs for:

- COMPOUND AMOUNT
- DIRECT REDUCTION LOAN
- DIRECT REDUCTION LOAN WITH BALLOON PAYMENT
- SINKING FUND

Other programs are:

- PERIODIC SAVINGS, ANNUITY DUE
- PRESENT VALUE, ANNUITY DUE
- PRESENT VALUE, ANNUITY DUE WITH BALLOON PAYMENT
- SAVINGS-COMPOUNDING PERIODS DIFFERENT FROM PAYMENT PERIODS
- NOMINAL TO EFFECTIVE/EFFECTIVE TO NOMINAL RATE CONVERSION
- DIRECT REDUCTION LOAN; ACCUMULATED INTEREST/REMAINING BALANCE
- DIRECT REDUCTION LOAN; AMORTIZATION SCHEDULE
- ADD-ON RATE INSTALLMENT LOAN
- CONSTANT PAYMENT TO PRINCIPAL LOAN AMORTIZATION SCHEDULE
- INTEREST REBATE – RULE OF 78'S
- INTERNAL RATE OF RETURN, UNEVEN CASH FLOWS
- DISCOUNTED CASH FLOW ANALYSIS, NET PRESENT VALUE
- STRAIGHT LINE DEPRECIATION SCHEDULE
- SUM-OF-THE YEAR'S DIGITS DEPRECIATION SCHEDULE
- VARIABLE RATE DECLINING BALANCE DEPRECIATION SCHEDULE
- CROSSOVER POINT-DECLINING BALANCE TO STRAIGHT LINE
- DAYS BETWEEN DATES
- BOND PRICE AND YIELD
- ACCRUED SIMPLE INTEREST
- LINEAR REGRESSION (Trend Line)
- EXPONENTIAL CURVE FIT (Growth Curve)
- TOTAL, AVERAGE AND PERCENT OF TOTAL
- MOVING AVERAGES
- INVOICING

00065-67044 ..... **$45.00**

MATH PAC 1

This basic series of 40 programs (on 40 pre-recorded cards) speeds the handling of problems in algebra, trigonometry, analytic geometry and calculus. It covers:

- HYPERBOLIC FUNCTIONS
- FIRST ORDER DIFFERENTIAL EQUATION
- SOLUTION OF A TRIANGLE (Given a, b, c or a, b, C)
- 3 x 3 MATRIX INVERSION
- FIFTH DEGREE POLYNOMIAL EQUATION
- FACTORS OF AN INTEGER

Other programs are:

- GREATEST COMMON DIVISOR, LEAST COMMON MULTIPLE
- ARITHMETIC AND HARMONIC PROGRESSIONS
- GEOMETRIC PROGRESSION
- FUNCTIONS OF x AND y
- QUADRATIC EQUATION
- CUBIC EQUATION
- FOURTH DEGREE POLYNOMIAL EQUATION
- SIMULTANEOUS EQUATIONS IN TWO UNKNOWNS
- SIMULTANEOUS EQUATIONS IN THREE UNKNOWNS
- SYNTHETIC DIVISION
- RECTANGULAR, SPHERICAL CONVERSIONS
- TRANSLATION AND/OR ROTATION OF COORDINATE AXES
- ANGLE CONVERSIONS
- SECONDARY VALUES OF $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$
- TRIGONOMETRIC FUNCTIONS
- INVERSE HYPERBOLIC FUNCTIONS
- SOLUTION OF A TRIANGLE (GIVEN a, A, C or a, B, C)
- SOLUTION OF A TRIANGLE (GIVEN B, b, c)
- SPHERICAL TRIANGLES
- AREA OF A TRIANGLE
- AREA OF A POLYGON
- CIRCLE DETERMINED BY THREE POINTS
- EQUALLY SPACED POINTS ON A CIRCLE
- POLYGONS INSCRIBED IN AND CIRCUMSCRIBED ABOUT A CIRCLE
- UNIT CONVERSIONS: C →F; ft, in → cm; lb →kg
- UNIT CONVERSIONS: mi →km; gal → ltr; yd →m; ac →ft²
- POLYNOMIAL EVALUATION (Real)
- LINEAR AND LAGRANGIAN INTERPOLATIONS
- FINITE DIFFERENCE INTERPOLATION
- NUMERICAL INTEGRATION (Discrete Case)
- SIMPSON'S RULE FOR NUMERICAL INTEGRATION
- ROOTS OF f(X) = 0 IN AN INTERVAL
- DETERMINANT AND CHARACTERISTIC EQUATION OF A 3 x 3 MATRIX
- 2 x 2 MATRIX OPERATIONS

00065-67001 ..... **$45.00**

MATH PAC 2

A variety of advanced mathematical functions is provided by the 37 programs (40 pre-recorded cards) in this Pac. The programs are:

- BASE CONVERSION
- COMPLEX FUNCTIONS $1/z$, $z_1 \cdot z_2$, $1/z$
- GAUSSIAN QUADRATURE FOR $\int_{\frac{1}{2}}^{2} f(x)dx$
- BESSEL FUNCTION $J_n(x)$
- COMPLETE ELLIPTIC INTEGRALS

Other programs are:

- COMPLEX ARITHMETIC
- COMPLEX TRIGONOMETRIC AND HYPERBOLIC FUNCTIONS
- COMPLEX INVERSE TRIGONOMETRIC AND HYPERBOLIC FUNCTIONS
- OCTAL ARITHMETIC
- INTEGER BASE CONVERSION
- COMPLEX FUNCTIONS z^n, $z^{1/n}$
- COMPLEX FUNCTIONS e^z, $\ln z$, a^z, $\log_a z$
- COMPLEX FUNCTIONS z^w, $z^{1/w}$, $\log_w z$
- POLYNOMIAL EVALUATION (Complex)
- INTERSECTIONS OF A LINE AND A CONIC SECTION
- VECTOR PRODUCTS AND ANGLE BETWEEN VECTORS
- PARTIAL SUM AND PARTIAL PRODUCT
- GAUSSIAN QUADRATURE FOR $\int_{-1}^{1} f(x)dx$
- KELVIN FUNCTIONS
- EULER Φ FUNCTION
- GAMMA FUNCTION
- INCOMPLETE GAMMA FUNCTION
- ERROR FUNCTION AND COMPLEMENTARY ERROR FUNCTION
- CONFLUENT HYPERGEOMETRIC FUNCTION
- GAUSSIAN HYPERGEOMETRIC FUNCTION
- CHEBYSHEV POLYNOMIAL
- LEGENDRE POLYNOMIAL
- HERMITE POLYNOMIAL
- LAGUERRE POLYNOMIAL
- SINE INTEGRAL
- COSINE INTEGRAL
- EXPONENTIAL INTEGRAL
- FRESNEL INTEGRALS

00065-67002 ..... **$45.00**

STAT PAC 1

Basic and advanced functions – 37 programs (40 pre-recorded cards) – selected from the areas of general statistics; distribution functions; curve fittings; and test statistics. Programs included in this Pac are:

- MEAN, STANDARD DEVIATION, STANDARD ERROR
- RANDOM NUMBER GENERATOR
- ANALYSIS OF VARIANCE (One Way)
- MULTIPLE LINEAR REGRESSION
- 2 x k CONTINGENCY TABLE
- SUMS FOR TWO VARIABLES
- BASIC STATISTICS (Two Variables)

Other programs are:

- MEAN, STANDARD DEVIATION, STANDARD ERROR (Grouped Data)
- PERMUTATION AND COMBINATION ARITHMETIC, GEOMETRIC, HARMONIC AND GENERALIZED MEANS
- MOMENTS, SKEWNESS AND KURTOSIS (Grouped or Ungrouped Data)
- NORMAL DISTRIBUTION
- INVERSE NORMAL INTEGRAL
- CHI-SQUARE DISTRIBUTION
- t DISTRIBUTION
- F DISTRIBUTION
- BIVARIATE NORMAL DISTRIBUTION
- LOGARITHMIC NORMAL DISTRIBUTION
- WEIBULL DISTRIBUTION
- BINOMIAL DISTRIBUTION
- NEGATIVE BINOMIAL DISTRIBUTION
- HYPERGEOMETRIC DISTRIBUTION
- POISSON DISTRIBUTION
- LINEAR REGRESSION
- EXPONENTIAL CURVE FIT
- POWER CURVE FIT
- LOGARITHMIC CURVE FIT
- LEAST SQUARES REGRESSION OF $y = cx^a + dx^b$
- PARABOLIC CURVE FIT
- PAIRED t STATISTIC
- t STATISTIC FOR TWO MEANS
- CHI-SQUARE EVALUATION
- BARTLETT'S CHI-SQUARE STATISTIC
- SPEARMAN'S RANK CORRELATION COEFFICIENT
- MANN-WHITNEY STATISTIC
- KENDALL'S COEFFICIENT OF CONCORDANCE
- BISERIAL CORRELATION COEFFICIENT

00065-67005 ..... **$45.00**

STAT PAC 2

Thirty-one programs (40 pre-recorded cards) provide solutions in the areas of general statistics, distribution functions, curve fitting, analysis of variance, test statistics, probability, quality control, and queing theory.

- PARTIAL AND MULTIPLE CORRELATION COEFFICIENTS
- MOVING AVERAGES (Order 2 to 8)
- HISTOGRAM (12 Intervals)
- F DISTRIBUTION WITH ODD DEGREES OF FREEDOM
- ERLANG DISTRIBUTION (Gamma Distribution)
- GEOMETRIC CURVE FIT
- GOMPERTZ CURVE FIT
- WEIBULL DISTRIBUTION PARAMETER CALCULATION
- WEIGHTED REGRESSION (Special Case)
- POLYNOMIAL APPROXIMATION
- TWO WAY ANALYSIS OF VARIANCE (No Replications)
- TWO WAY ANALYSIS OF VARIANCE (With Replications)
- LATIN SQUARE
- ANALYSIS OF COVARIANCE (One Way)
- ONE SAMPLE TEST STATISTICS FOR THE MEAN
- TEST STATISTICS FOR THE CORRELATION COEFFICIENT
- DIFFERENCES AMONG PROPORTIONS
- BEHRENS-FISHER STATISTIC
- KRUSKAL-WALLIS STATISTIC
- MEAN-SQUARE SUCCESSIVE DIFFERENCE
- 3 x K CONTINGENCY TABLE
- THE RUN TEST FOR RANDOMNESS
- INTRACLASS CORRELATION COEFFICIENT
- FISHER'S EXACT TEST FOR A 2 x 2 CONTINGENCY TABLE
- PROBABILITY OF NO REPETITIONS IN A SAMPLE (Birthday Problem)
- $\bar{x}$ and R CONTROL CHARTS
- p AND c CONTROL CHARTS
- OPERATING CHARACTERISTIC CURVE (Type A)
- OPERATING CHARACTERISTIC CURVE (Type B)
- SINGLE- AND MULTI-SERVER QUEUES (Infinite Customers)
- SINGLE- AND MULTI-SERVER QUEUES (Finite Customers)

00065-67053 ..... **$45.00**

EE PAC 1

Thirty-five programs (40 pre-recorded cards) provide functions for use in electronic and electrical engineering projects. Topics addressed include impedance matching filter design; transmission line calculation; parameter conversion; power supply design; transistor biasing; control system and waveform analyses. The programs are:

- REACTANCE CHART
- IMPEDANCE OF LADDER NETWORK
- TRANSMISSION LINE IMPEDANCE TRANSFORMATION
- S⇄Y PARAMETER CONVERSION
- FOURIER SERIES

Other programs are:

- SERIES RESONANT CIRCUIT
- PARALLEL RESONANT CIRCUIT
- T ATTENUATOR
- PI ATTENUATOR
- WYE-DELTA OR DELTA-WYE TRANSFORMATION
- MINIMUM-LOSS PAD MATCHING
- PI NETWORK IMPEDANCE MATCHING
- BAND PASS FILTER DESIGN
- ACTIVE FILTER – LOW PASS
- ACTIVE FILTER – HIGH PASS
- BUTTERWORTH FILTER
- CHEBYSHEV FILTER
- CAPACITANCE OF PARALLEL PLATES
- SELF-INDUCTANCE OF STRAIGHT ROUND WIRE
- INDUCTANCE OF A SINGLE-LAYER CLOSE-WOUND COIL
- SKIN EFFECT AND COIL Q
- TRANSFORMER DESIGN
- REED RELAY DESIGN
- IMPEDANCE OF TRANSMISSION LINE
- MICROSTRIP TRANSMISSION LINE
- POWER SUPPLY RECTIFIER CIRCUITS
- CONTROLLED RECTIFIER CIRCUITS
- INTEGRATED CIRCUIT CURRENT SOURCE
- TRANSISTOR BIAS
- JFET BIAS AND TRANSCONDUCTANCE
- PHASE-LOCKED LOOP
- DECIBEL CONVERSION
- VOLTAGE TO dBm
- WIRE TABLES Al & ANNEALED Cu
- HEAT SINKS

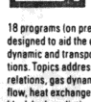
00065-67007 ..... **$45.00**

EE PAC 2 (Microwave)

Twenty-seven programs (40 pre-recorded cards) will assist the microwave circuit designer in making microwave measurements, designing transistor amplifiers, computing transmission line properties and certain system properties, and performing difficult related mathematical operations.

- MISMATCH ERROR LIMITS
- MULTIPLE MISMATCH ERROR LIMITS
- SMITH CHART: RADIALLY SCALED PARAMETERS
- SMITH CHART: IMPEDANCE ⇄ REFLECTION COEFFICIENT
- MICROSTRIP CALCULATIONS (three cards)
- TRANSMISSION LINE CALCULATIONS (three cards)
- CUTOFF FREQUENCY IN COAX
- RECTANGULAR WAVEGUIDE CALCULATIONS
- FREQUENCY CONVERSIONS
- PULSE SPECTRUM ANALYSIS
- SPURIOUS RESPONSES
- FM SIDEBAND LEVEL
- MODULATION INDEX FOR SPECIFIED CARRIER SUPPRESSION
- CONSTANT-EXCESS NOISE MEASUREMENT
- NOISE FIGURE OF CASCADED NETWORKS
- IMPEDANCE MATCHING
- UNILATERAL DESIGN: FIGURE OF MERIT, MAXIMUM UNILATERAL GAIN
- UNILATERAL DESIGN: GAIN CIRCLES
- UNILATERAL DESIGN: NOISE FIGURE CIRCLES
- BILATARAL DESIGN: STABILITY FACTOR, MAXIMUM GAIN, OPTIMUM MATCHING (three cards)
- BILATERAL DESIGN: GAIN CIRCLES
- BILATERAL DESIGN: STABILITY CIRCLES
- LOAD AND SOURCE MAPPING
- LINEAR AND LAGRANGIAN INTERPOLATION
- PARAMETER CONVERSION: S⇄Y, Z, G, H (six cards)
- PARAMETER CONVERSION: S⇄T (two cards)
- COMPLEX MATRIX OPERATIONS (two cards)

00065-67056 ..... **$45.00**



CHEMICAL ENGINEERING PAC 1 (Thermal and Transport Science)

18 programs (on pre-recorded cards) designed to aid the engineer in thermodynamic and transport process calculations. Topics addressed include P-V-T gas relations, gas dynamics, incompressible flow, heat exchangers, heat conduction, black body radiation, and curve fitting.

- IDEAL GAS EQUATION OF STATE
- REDLICH – KWONG EQUATION OF STATE
- REVERSIBLE POLYTROPIC PROCESS FOR AN IDEAL GAS
- ISENTROPIC FLOW FOR IDEAL GASES
- ONE DIMENSIONAL NORMAL SHOCKS FOR IDEAL GASES

Other programs are:

- FLUID TRANSPORT NUMBERS (NUSSELT – HEAT & MASS, REYNOLDS, STANTON, LEWIS, SCHMIDT, BIOT, AND PRANDTL)
- FANNING FRICTION FACTOR AND CONDUIT FLOW
- CONSERVATION OF ENERGY
- VON KÁRMÁN ANALOGY FOR HEAT AND MASS TRANSFER
- HEAT EXCHANGER ANALYSIS (HEAT TRANSFER AND EFFECTIVENESS FOR CROSS-FLOW, COUNTER-FLOW, PARALLEL-FLOW AND PARALLEL-COUNTER-FLOW HEAT EXCHANGERS)
- HEAT TRANSFER THROUGH COMPOSITE CYLINDERS AND WALLS
- STRAIGHT FIN EFFICIENCY
- NATURAL CONVECTION (ESTIMATE COEFFICIENTS FOR VERTICAL CYLINDERS AND WALLS, AND HORIZONTAL CYLINDERS AND PLATES)
- BLACK BODY THERMAL RADIATION TEMPERATURE OR CONCENTRATION PROFILE FOR A SEMI-INFINITE SOLID
- HYDROCARBON COMBUSTION
- CURVE FITTING (LINEAR, EXPONENTIAL, AND POWER)
- UNIT CONVERSIONS

00065-67050 ..... **$45.00**

STRESS ANALYSIS PAC 1

25 programs (on 39 pre-recorded cards) designed to aid the engineer in the calculation of the properties of structural elements. Topics addressed include vector statics, section properties, interference fits, stress analysis, flat plates, beams and columns. Programs included in this Pac are:

- TWO DIMENSIONAL VECTOR OPERATIONS
- STATIC EQUILIBRIUM OF A POINT
- STATIC EQUILIBRIUM OF A RIGID BODY

Other programs are:

- PROPERTIES OF RECTANGULAR SECTIONS
- PROPERTIES OF CIRCULAR SECTIONS
- PROPERTIES OF ANNULAR SECTIONS
- COMPOSITE SECTION PROPERTIES
- BENDING STRESS IN BEAMS OR TORSIONAL SHEAR STRESS IN CIRCULAR SHAFTS
- LINEAR OR ANGULAR DEFORMATION OF A SHAFT
- THIN-WALLED PRESSURE VESSELS
- STRESS IN THICK-WALLED CYLINDERS
- INTERFERENCE FITS
- MOHR CIRCLE FOR STRESS
- SODERBERG'S EQUATION FOR FATIGUE
- CIRCULAR PLATES WITH SIMPLY SUPPORTED EDGES
- CIRCULAR PLATES WITH FIXED EDGES
- RECTANGULAR PLATES (SIMPLY SUPPORTED AND WITH FIXED EDGES)
- COMPRESSIVE BUCKLING
- ECCENTRICALLY LOADED COLUMNS
- RECTANGULAR, REINFORCED CONCRETE SECTIONS
- BOLT TORQUE

The next four programs calculate deflection, slope, moment, and shear for various beam geometries.

- CANTILEVER BEAMS
- SIMPLY SUPPORTED BEAMS
- BEAMS FIXED AT BOTH ENDS
- BEAMS FIXED AT ONE END AND SIMPLY SUPPORTED AT THE OTHER

00065-67051 ..... **$45.00**

SURVEYING PAC 1

Because surveying practices differ from country to country, different versions are offered. Contact your local Hewlett-Packard sales office for the exact contents of Surveying Pac 1 in your country. The U.S. version consists of 34 programs (on 34 pre-recorded cards) dealing with traversing; curves; triangles and intersections; pre-determined area; and earthwork. The Pac contains:

- FIELD ANGLE TRAVERSE
- HORIZONTAL CURVE LAYOUT
- BEARING-DISTANCE INTERSECT
- STADIA REDUCTIONS
- VOLUME BY AVERAGE END AREA

Other programs are:

- BEARING TRAVERSE
- CLOSURE FOR FIELD ANGLE AND BEARING TRAVERSES
- INVERSE FROM COORDINATES
- SIDESHOTS
- COORDINATE TRANSFORMATION
- COMPASS RULE ADJUSTMENT
- TRANSIT RULE ADJUSTMENT
- TWO INSTRUMENT RADIAL SURVEY
- CURVE SOLUTION – Given △ & R or △ & T
- CURVE SOLUTION – Given R & T or R & L
- CURVE SOLUTION – Given △ & C or R & C
- ELEVATIONS ALONG A VERTICAL CURVE
- TRIANGLE SOLUTION – Given SSS or SAS
- TRIANGLE SOLUTION – Given SSA
- TRIANGLE SOLUTION – Given ASA or AAS
- BEARING-BEARING INTERSECT
- DISTANCE-DISTANCE INTERSECT
- DISTANCE FROM A POINT TO A LINE
- TAPING CORRECTIONS
- EDM SLOPE REDUCTION – Given Zenith Angle
- EDM SLOPE REDUCTION – Given △ Elevation
- FIELD ANGLE CHECK
- THREE WIRE LEVELING
- SLOPE STAKING – Given Centerline Terrain Elevation
- SLOPE STAKING – Given Centerline Cut/Fill
- AZIMUTH OF THE SUN
- PREDETERMINED AREA – Line Through a Point
- PREDETERMINED AREA – Two Sides Parallel
- VOLUME OF BORROW PIT

00065-67003 ..... **$45.00**

MACHINE DESIGN PAC 1

Thirty-five programs (40 pre-recorded cards) provide solutions for the machine designer in dynamics, vibrations, linkages, cams, gears, springs, power transmission, and machine geometries.

- CONSTANT ACCELERATION – TIME
- CONSTANT ACCELERATION – VELOCITY
- KINETIC ENERGY
- FREE VIBRATIONS
- VIBRATION FORCED BY $F_0 \cos\omega t$
- FORCED OSCILLATOR WITH ARBITARY FUNCTION
- FOURIER SERIES
- CRITICAL SHAFT SPEED
- FOUR BAR FUNCTION GENERATOR
- PROGRESSION OF FOUR BAR SYSTEM
- LINEAR PROGRESSION OF SLIDER CRANK
- ANGULAR PROGRESSION OF SLIDER CRANK
- CAM DATA STORAGE
- HARMONIC CAM DESIGN – RADIAL ROLLER FOLLOWER
- HARMONIC CAM DESIGN – FLAT FACED FOLLOWER
- ROLLER FOLLOWER CAM FUNCTION GENERATOR
- FLAT FACED FOLLOWER CAM FUNCTION GENERATOR
- LINEAR CAM FUNCTION GENERATOR
- SPUR GEAR REDUCTION DRIVE
- STANDARD EXTERNAL INVOLUTE SPUR GEARS
- SPUR/HELICAL GEAR FORCES
- BEVEL GEAR FORCES
- WORM GEAR FORCES
- SPRING CONSTANT
- HELICAL SPRING DESIGN
- TORSION SPRING DESIGN
- FLAT SPRING DESIGN
- CONE AND PLATE CLUTCHES
- POWER SCREWS
- RPM/TORQUE/POWER
- LINE – LINE INTERSECTION/GRID POINTS
- CIRCLE – LINE INTERSECTION
- CIRCLE – CIRCLE INTERSECTION
- POINTS ON A CIRCLE
- BELT LENGTH

00065-67052 ..... **$45.00**

MEDICAL PAC 1

This Pac of 27 programs (38 pre-recorded cards) allows for the following types of medical calculations: unit conversions, ventilator set-up and calibration, analysis of cardio-pulmonary function, acid-base balance, blood gases, and respiratory status. The Pac contains:

- WEIGHT CONVERSIONS
- LENGTH CONVERSIONS
- VOLUME CONVERSIONS
- ENGLISH METRIC CONVERSIONS
- PATIENT IDENTIFICATION

Other programs are:

- MALE PULMONARY FUNCTIONS
- FEMALE PULMONARY FUNCTIONS
- LUNG DIFFUSION
- RESPIRATORY GAS CONVERSIONS
- VENTILATOR SETUP
- $PaCO_2$ NORMALIZATION
- BLOOD ACID-BASE STATUS
- VIRTUAL PO_2
- OXYGEN SATURATION AND CONTENT
- ANAEROBIC PCO_2 AND pH CHANGE
- ANAEROBIC PO_2 CHANGE
- DEAD SPACE FRACTION
- A-a O_2 DIFFERENCE
- PHYSIOLOGIC SHUNT AND FICK
- DUBOIS BODY SURFACE AREA
- BOYD BODY SURFACE AREA
- DYE CARDIAC OUTPUT
- FICK CARDIAC OUTPUT
- VALVE AREA
- ANATOMIC SHUNTS
- CONTRACTILITY
- STROKE WORK

00065-67004 ..... **$45.00**

AVIATION PAC 1

Here are 29 programs (31 cards) for flight and preflight calculations – primarily for the private and business pilot, but also being used by many airline pilots. Included are:

- AIRCRAFT FLIGHT PLAN WITH WIND
- FLIGHT MANAGEMENT
- PREDICTING FREEZING LEVELS
- GENERAL AIRCRAFT WEIGHT AND BALANCE
- CUSTOMIZED WEIGHT AND BALANCE
- TURN PERFORMANCE

Other programs are:

- RATE OF CLIMB AND DESCENT
- HEAD WINDS AND CROSSWINDS
- FLIGHT PLANNING AND FLIGHT VERIFICATION
- DETERMINING IN-FLIGHT WINDS
- STANDARD ATMOSPHERE (For altitudes 0-36089 and 36089-82000)
- MACH NUMBER AND TRUE AIRSPEED
- TRUE AIR TEMPERATURE AND DENSITY ALTITUDE
- LOWEST USABLE FLIGHT LEVEL
- GREAT CIRCLE PLOTTING
- RHUMBLINE NAVIGATION
- GREAT CIRCLE NAVIGATION
- POSITION, GIVEN HEADING, SPEED AND TIME
- LINE OF SIGHT DISTANCE
- POSITION BY TWO VORS
- NAVIGATION BY TWO VORS
- POSITION BY ONE VOR
- DME SPEED CORRECTION
- AVERAGE WIND VECTOR
- COURSE CORRECTION
- TIME OF SUNRISE AND SUNSET
- AZIMUTH OF SUNRISE AND SUNSET
- PILOT UNIT CONVERSIONS
- CUSTOMIZED UNIT CONVERSIONS

00065-67042 ..... **$45.00**

NAVIGATION PAC 1

Written for marine navigators but also useful to the land or air navigator, these 26 programs (40 cards) assist the navigator in piloting, dead reckoning, celestial navigation, and relative motion problems. The Pac includes:

- GREAT CIRCLE COMPUTATION
- LONG-TERM ARIES ALMANAC
- 1974-1975 SUN ALMANAC
- LONG-TERM STAR ALMANAC
- ALMANAC POSITIONS
- SIGHT REDUCTION TABLE
- MANEUVERING RELATIVE TO ANOTHER VESSEL

Other programs are:

- LENGTH CONVERSIONS
- SPEED, TIME, AND DISTANCE
- TIME-ARC CONVERSION
- PROPELLER SLIP
- FUEL CONSUMPTION
- DISTANCE TO OR BEYOND HORIZON
- DISTANCE BY HORIZON ANGLE AND DISTANCE SHORT OF HORIZON
- DEAD RECKONING
- RHUMBLINE NAVIGATION
- GREAT CIRCLE NAVIGATION
- COMPOSITE SAILING
- SEXTANT ALTITUDE CORRECTIONS
- SUNRISE, SUNSET, AND TWILIGHT
- MOST PROBABLE POSITION
- FIX BY TWO OBSERVATIONS
- FIX BY THREE OBSERVATIONS
- DISTANCE OF AN OBJECT BY TWO BEARINGS
- VECTOR ADDITION
- VELOCITY TO CHANGE RELATIVE POSITION

00065-67045 ..... **$45.00**

HEWLETT hp PACKARD

Or, you could save steps by calculating $A(x+y^2)$ in the stack and $A(x-y^2)$ in R_1, as follows:

```
001 LBL A                    007 RCL A
002 RCL 1                    008 STO×1   A(x−y²)in R1
003 RCL 2                    009 x       A(x+y²)in x
004 x²                       010 RCL 1   A(x−y²)in x
005 STO−1   (x−y²)in R1      011 RTN
006 +       (x+y²)in x
```

This is a code savings of 21%.

ARC TANGENT OF (x/y)

In many applications the arc tangent of the ratio of two quantities (x/y) must be calculated. This is a trivial problem unless the value of y is zero. In this case, the division of x by y would cause an **Error,** and program execution would halt.

One way to overcome this problem, in any angular mode, is to use the following subroutine instead of ÷, $\tan^{-1}$.

```
LBL 1
→P        Calculate θ(−180 ≤ θ ≤ 180).
R↓        Move θ to x.
cos       Test θ to determine if it is in 2nd or 3rd
x<0       quadrants.
GTO 0
CLx       If θ is in 1st or 4th quadrant, return final
LST x     value of θ.
RTN
LBL 0
CLx       Return 2nd or 3rd quadrant θ to x.
LST x
1         Compute and add 180°, π rad, or 200
CHS       grads, depending on angular mode, to
cos⁻¹     bring angle back to 1st or 4th quadrant.
+
1         Convert angles to standard arc tangent
→R        notation of (−90 ≤ θ ≤ 90) instead of
→P        (0 ≤ θ ≤ 90) and (270 ≤ θ ≤ 360).
R↓
RTN
```

THE PRINT/PAUSE OR STOP ROUTINE

The following routine (when called as a subroutine) automatically causes a print/pause of multiple results if the print flag is on, or it permits you to press R/S to obtain each result. See page L08-01 of the HP-67/97 *Standard Pac* for a description of setting and clearing the print flag.

```
LBL 9        RTN
F0?          LBL 1
GTO 1        PRINT x
R/S          RTN
```

When subroutine 9 is called (GSB 9), flag 0 is tested. If the flag is on, the calculator moves to LBL 1, prints/pauses the display, and then returns to the main program. If flag 0 is off, the calculator stops at R/S. When R/S is pressed from the keyboard, the calculator executes the RTN command, goes back to the main program, and continues execution.

Reversing The "Sense" Of Test-Cleared Flags F2 & F3

We received the following excellent idea and presentation from **Chris Johansen** of Auburndale, Massachusetts. If you are having trouble understanding or applying flags, here is an easy—and very clear—application you can study and perhaps use for your programs.

Occasionally, a user of the HP-67/97 would like his/her program to perform a single keystroke if a condition is false. While it is sometimes possible to design the program so that a true flag indicates the condition is false and a false flag indicates the true condition, it is more easily recalled and, for instance, in the case of numeric entry indicated by flag F3, it is sometimes demanded that the flag and the condition it indicates have the same logical sense.

As a contrived example, suppose a user wants to write an endless-loop program (or segment) that first presents a "cue" number (7, in this case) to request a possible input, then adds to register R_1 either the negative of the user's input or a zero, and then displays the current sum. Subroutines A and B, below, show two approaches. Shorter subroutine C takes advantage of the fact that the negative of zero is also zero. Subroutine D illustrates the main point of this letter: If there has been a data entry, F3 is true, and the first F3? clears F3 and performs the very next step, F3?, which, since F3 is clear (false) must skip over the following CLX; if there *wasn't* any data entry, F3 is already clear, and the first F3? skips a step to the CLX. The effect is to reverse the "DO if TRUE" rule, only clearing X if F3 is false. Finally, subroutine E proves that the shortest program may need to use a different approach.

```
002  *LBLA      018  *LBLB      034  *LBLC      048  *LBLD      061  *LBLE
003       7     019       7     035       7     049       7     062       7
004     PSE     020     PSE     036     PSE     050     PSE     063     PSE
005     F3?     021     F3?     037     F3?     051     F3?     064     F3?
006    GTO2     022    GTO2     038    GTO2     052     F3?     065    ST-1
007     CLX     023     CLX     039     CLX     053     CLX     066    RCL1
008  *LBL1      024    GTO1     040  *LBL2      054     CHS     067     PSE
009    ST+1     025  *LBL2      041     CHS     055    ST+1     068    GTOE
010    RCL1     026     CHS     042    ST+1     056    RCL1
011     PSE     027  *LBL1      043    RCL1     057     PSE
012    GTOA     028    ST+1     044     PSE     058    GTOD
013  *LBL2      029    RCL1     045    GTOC
014     CHS     030     PSE
015    GTO1     031    GTOE
```

The "Void" Maker

Here is a note from **Tak Y. Lee** of Wellesley, Massachusetts. Not everyone has an HP-97, so we added the tape printouts to clarify his idea. When you roll-down the entries in the stack registers, you see only one at a time. The HP-97's tape graphically (and convincingly) shows what happens to the stack registers when you use CLx and R↓ to clear the X-register.

CLx and R↓ seem to be two interchangeable keys for clearing the X-register to make way for further computations. In many instances it would seem that CLx is preferable to R↓, especially when you like to duplicate the contents in the T-register every time you drop the stack. But what you don't want is a "void" in your stack-loop. Don't jump to conclusions until you try the following programs (A & B) and see what key really is the "void" maker.

```
LBL A      LBL B      LBL 1
4          4          1
ENTER      ENTER      RTN
ENTER      ENTER
ENTER      ENTER
CLX        R↓
GSB 1      GSB 1
RTN        RTN
```

The results *look* all right. But, wait! Print out the stack and compare again.

So, CLx, after all, *is* the key that puts a "void" in your stack-loop! As you can see, CLx, if followed by such keys as LBL, GTO, GSB, P/S, etc., causes the stack to subsequently "lift" on data entry, and you get the result shown:

```
          GSBA                    GSBB
001     *LBLA           009     *LBLB
002          4          010          4
003      ENT↑           011      ENT↑
004      ENT↑           012      ENT↑
005      ENT↑           013      ENT↑
006       CLX           014        R↓
 0.00     ***            4.00     ***
007      GSB1           015      GSB1
017·    *LBL1           017     *LBL1
018          1          018          1
019       RTN           019       RTN
008       RTN           016       RTN

          PRST                    PRST

      4.00   T                4.00   T
      4.00   Z                4.00   Z
      0.00   Y                4.00   Y
      1.00   X                1.00   X
```

Application Pac Corrections

If you own some of our application pacs, check the following corrections and mark them in your copy—or mail in your old card and we will send you a revised card. If your copy is correct, you have a later, revised issue of the book and/or card.

HP-67/97 MATH PAC 1

The program on the magnetic card for *Optimal Scale, Plotting*, MA1-04A, contains four more steps than the program listing on pages L04-01 and L04-02; the prerecorded card, however, is correct. Change your book as follows:

On page 04-02, the first sentence of the first paragraph should start with 92, not 96. On the same page, change both "2. Press GTO • 1 2 8." steps to: "2. Press GTO • 1 3 2."

On page 04-03, change 128 in step 7 to 132.

On page 04-05, the keystrokes for Example 3 should be: GTO • 1 3 2.

The labels that have been changed are:

021	LBL 9	071	LBL D
.	ISZ I	.	x<0?
.	RCL E	.	GTO 0
.	RCL A	.	INT
.	÷	.	RTN
.	GSB D	.	LBL 0
.	RCL A	.	↑
.	x	.	INT
029	STO 9	.	x=y?
		.	RTN
		.	1
		.	−
		083	RTN

HP-67/97 E.E. PAC 1

The magnetic card for EE1-09A1, *Butterworth or Chebyshev Filter Design*, is recorded correctly, but the listing on page L09-01 is one step short. There should be a STO E at step 97; thus, everything from there to the end is pushed down one step.

HP-67/97 SURVEYING PAC 1

A few of the original prerecorded cards for program SU1-14A, *Predetermined Area*, and the corresponding listing are incorrect. To determine if you have an incorrect card, run Example 1 on page 14-04 (under the heading "Two Sides Parellel"). If running the example results in an **Error** display after the area 36000.0000 is displayed, you have an incorrect card. A corrected card can be obtained by sending your old card to *Customer Support* (U.S. address on back cover).

Meanwhile, mark the following changes in your book, on pages L14-01 and L14-02.

Line Number	Change
058	Delete SPC
115	Change R/S to GTO 3
Between 136 and 137	Insert LBL 3
196	Change STO 5 to STO C
201	Change STO 2 to STO B

To check for another possible error, load data card SU1-17A3 (both sides) and press f P≠S RCL 9. The number displayed should be: 1047.546710. (We have found some cards with: 1048.546710.) If your card is incorrect, send it back to us (see above) and we will mail back a correct card.

Well, **Bob Edelen** of Aurora, Colorado, has found much shorter routines than those previously published in KEY NOTE. If you use these conversions, study the routines carefully. They should do the job for you. And think about Mr. Edelen's final sentence in his letter to us: "Maybe some user has a better and shorter way."

TO D.MS (or H.MS)*			FROM D.MS (or H.MS)*		
LBL	23		LBL	23	
A	11		B	12	
ENTER	41		EEX	43	
f	31		4	04	
→D.MS	03		x	71	
STO 1	33	01	f^{-1}	32	
f^{-1}	32		INT	83	
→D.MS	03		g LSTx	35	00
−	51		f	31	
.	83		INT	83	
3	03		EEX	43	
6	06		4	04	
x	71		÷	81	
RCL 1	34	01	f^{-1}	32	
+	61		→D.MS	03	
RTN	24		g x↔y	35	07
*Must be in degree mode.			3	03	
			6	06	
			0	00	
			0	00	
			÷	81	
			+	61	
			RTN	24	
			*Must be in degree mode.		

If You Like Statistics You'll Love 00755A

Sometimes we receive a program that deserves to be highlighted in HP KEY NOTES. This one truly fits that category. Don't let the old number fool you; this is a complete revision of the original 00755. It is, in fact, a totally different program ... and *two programs* at that! So, if you are a statistically minded owner of the HP-65, you'll definitely want to order this contribution to the science of statistics.

The author is a professor of Management Science at the Tulane University Graduate School of Business Administration. And, we might add, a very astute HP-65 programmer. **Dr. Beckwith** has contributed 40 programs in the HP-65 Users' Library. Here's the abstract for #00755A.

Edgeworth Series: Frequency Function and Probability Integral (#00755A)*

Card 1 "fits" an Edgeworth Series curve (Edgeworth's form of the Gram-Charlier Series of Type A), based on the first four population or sample moments, and delivers the ordinate of the resulting frequency function. Card 2 delivers the ordinate of the corresponding distribution function, or probability integral. Provision is made for the automatic entry of (sample) parameter data following the use of the "Four Moments" program. (Catalog number 00754A, Four Moments, Skewness, Excess, Kurtosis—also one of Dr. Beckwith's programs.)

Author: **Dr. Richard E. Beckwith**
New Orleans, Lousiana

**In European areas, order by number 51519A.*

One More Time!

We have published many routines on the HP-65's firmware conversions, f→D.MS and f^{-1}→D.MS, because the HP-65 firmware many times does not give the angle to the nearest second in f→D.MS conversion. And, of course, it gives *no more* than seconds. But many people need to work to the nearest second and some to finer than that.

Machine Design On The HP-65

Here is the abstract of a program (actually, three programs in one) that was featured in KEY NOTE over a year ago. We present it again because the "B" revision makes it *enormously* better than it already was in the original version. If you are remotely interested in this subject, or in machine design in general, you'll want to investigate this program. And, as an added attraction, the documentation is among the very best in the Library.

Synchronous Belt Indexer (Order #03801B)*

These iterative programs compute the geometric parameters for incremental motion transmissions, using a constant angle driver such as a stepping motor or Geneva drive mechanism, synchronous (toothed) belt and pulleys, chain and sprockets, or gear and rack. Examples commonly used include: production-line work-positioners, punched-card/paper-tape indexers, and step-and-repeat mechanisms. Program 1 solves step-angle/pulley-size combinations with linear/step increment within user-defined limit-of-error. Prgrams 2 and 3 include an Error Warning for center distances less than the minimum center distance.

Author: **Thomas Hender**
Corvallis, Oregon

**In European areas, order by number 51520A.*

More COGO Comments

Several issues ago we printed an article about **Carl M. King's** "COGO-6500 Series of Coordinate Geometry Calculations for Surveyors." Some of you purchased these programs and made comments that the programs were written to accept *azimuth only* and not bearing and distance directly. So we asked Mr. King to write a reply and, so, for the benefit of our U.S. and Canadian readers, here is that letter.

I have endeavored to make the COGO programs as instructive and as easy to use as possible, within the limitations of a very small yet remarkably capable little computer. I call it a "computer" because it is programmable and is able to carry out relatively complicated instructions.

The COGO programs provide you with a virtually complete system of surveying calculations. The North-South, East-West system of coordinates provides the mapmaker with a precise method of plotting points on the flat drawing board. However, the measurements obtained by the surveyors in the field are obtained in a different form. Through the medium of the COGO programs we are able to take the raw data and convert it for the mapmaker. We are able to manipulate the data back and forth in a twinkling, and discover useful relationships, such as points of intersection, distances between intersections, and slopes of lines, all necessary and useful to the mapmaker.

In designing such a system the problem is twofold. We not only have to program the computer, but we have to "document" the program, which means we have to provide a training course for the User. The more complex a program is, the more extensive must be the documentation. In this particular case there is a communication gap in regards to the reading of angular directions or "headings." A "heading" is a general term for the direction in which you are proceeding. Headings can take several different forms depending on your habits and background. However, you need to communicate with a little handheld calculator, and it is much more economical and more convenient for you, in the long run, to learn to speak its language than it would be to program it to speak yours.

In the case of "bearings" VS "azimuths" we have several things going for us:

1. They are both expressed in the same units.
2. At least half of the time they both use North as the starting point.
3. The calculator interprets plus (+) and minus (−) signs in a significant and predictable fashion.

It is this item 3 that gives the clue and the cue for communicating with the calculator. A bearing actually consists of an angle and a distance. You may attach a (+) or a (−) sign to the angle, and you may attach a (+) or a (−) sign to the distance. This provides four combinations, and enables you to specify the quadrant while entering the *actual numerical bearings* into the calculator.

Using a negative distance may seem unnatural to you at first, but it actually works. Just keep in mind that CCW angles are negative; and, for the S'ly quadrants, oppositely facing distances are negative. (The calculator calculates *all* its angles from the NORTH.) The qualified surveyor will be quick to realize that going SW, for example, is just the opposite of going NE, and giving the calculator a negative distance is all that is required to designate the difference. I pointed this out in the COGO instructions in the form of a HINT. Maybe I should have enlarged on it a little more.

The other alternative of identifying the quadrant by number would have required the utilization of numerous program steps, and would have robbed the COGO programs of much of their convenience.

A Positive Error?

In the last KEY NOTE, on page 4, there was a small error in the article "Are Flags (+) or (−)?" In the second line of the table, in the third column, there's a notation: f⁻¹ TF2 (+). It was quite obvious that the (+) should have been a (−), and we feel sure that most people realized that when they read the article. We hope the error did not cause any confusion.

A Better Way To Do Tan^{-1}

This programming idea came from **Tak Y. Lee** of Wellesley, Massachusetts. If you haven't already discovered it by yourself, you'll find it very useful.

Dear Editor:

The HP-65 has no way to distinquish $\tan^{-1}(-y/x)$ from $\tan^{-1}(y/-x)$ if the arc tangent function is done with the f⁻¹ TAN keys. A better way to do it is to use the f R→P keys as follows:

(y including sign)
ENTER
(x including sign)
f
R→P
g R↓

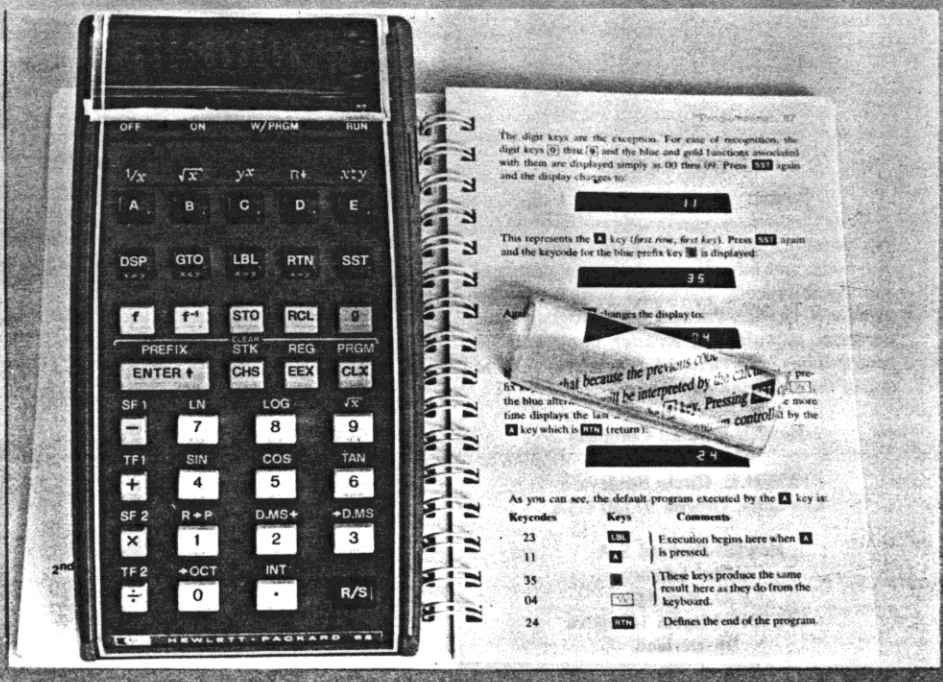
This way, for example, $\tan^{-1}(-1/1) = -45°$ and $\tan^{-1}(1/-1) = 135°$, but $\tan^{-1}(-1)$ is always −45° when you use the f⁻¹ TAN keys.

Bigger Than Life!

If special requirements or applications make it necessary for you to photograph the display on your calculator, you might have some difficulty recording (on black and white film) the red LED numbers. Particularly when you also want to include the keyboard or the entire calculator. When you move the camera back in order to frame the entire calculator, the display is reduced in size, and the display is less brilliant because of the increased distance.

Mr. **W.W. Trotti** of Cayce, South Carolina, has found one solution to the problem. As you can see in the accompanying photograph, his modification greatly magnifies the display and does not require altering the calculator. He used a Bausch & Lomb reading glass (which is made of clear plastic), cut it on a bandsaw to fit the HP-65, and mounted it over the display with double-backed (double-stick) adhesive tape.

Although Mr. Totti's "magnifier" does work and will double the size of the display, it does significantly cut down on the viewing angle at which you can easily read the displayed numbers. So, unless you need the increased size for photographic purposes or because of failing eyesight, you really don't *need* this modification. Also, another caution is that you cannot get the calculator in its case if you leave the magnifier on it.



(continued from page 2)

Bell-Fruit Slot Machine (00218D)*

A much-improved version of the HP-65 "Bell-Fruit" program, this program will simulate a Mills brand, 10-cent slot machine, both in standard payoffs as well as in precisely duplicating the same odds in which any particular combination will occur. It includes automatic recall of winnings by one key, a delayed action tumbler display, and a prestored seed for quick game start-up. (112 steps)

Author: **Craig A. Pearce**
Berwyn, Illinois

**In European areas, order by number 00202D.*

Now, here is a series of five "word-game" programs from the inimitable word-game mastermind, **John R. Rausch,** of Franklin, Ohio. Many of Mr. Rausch's HP-65 word-game programs were best sellers, and we are sure you will find these equally—probably even *more*–interesting. All of these programs utilize a keyboard overlay for alphabetic instead of numeric entries, and they are exceptionally well-documented and legible. And before you rush to order any *one* program, read the following abstracts carefully; some programs are dependent on others—as subroutines. In fact, you should order the "Word Game Subroutine" if you are interested in *any* of the programs.

Word Encoder (#00253D)*

This program is used to encode words into a string of up to 50 positions and to write this string onto a data card to be used by such word games as "Word Bagles" (program #00255D), "Probe" (#00256D), and "Hangman" (#00257D). If you intend to write your own word game using this program to encode the words, you should also order the "Word Game Subroutine" (#00254D) to decode them. (139 steps)

**In European areas, order by number 00196D.*

Word Game Subroutine (#00254D)*

The purpose of this subroutine is to interface word game programs with data-card words created by the program titled "Word Encoder" (program #00253D). Using this subroutine allows the programmer to concentrate on the mechanics of the game without having to program the entry of encoded words into his logic. One use of this subroutine may be found in the "Hangman Word Game" (#00257D). (90 steps)

**In European areas, order by number 00197D.*

Word Bagles (#00255D)*

"Word Bagles" is a game in which you try to guess a three- to five-letter word. When you enter your guess word, you are given a clue that tells the number of letters you have guessed in their correct position and the number of letters you have guessed but have in the wrong position. This program also uses cards created by the "Word Encoder" program (#00253D). *It will not function without the "Word Game Subroutine"* (#00254D), which is not included and must be purchased separately. (194 steps)

**In European areas, order by number 00198D.*

Probe Word Game (#00256D)*

"Probe" is a two-player game in which players compete against each other while trying to guess a word one letter at a time. Points are awarded for correct guesses. The word can have blanks on either end; however, a penalty is given for an incorrect blank guess. This program uses data cards created by the "Word Encoder" program (#00253D). *It will not function without the "Word Game Subroutine"* (#00254D), which is not included and must be purchased separately.

**In European areas, order by number 00199D.*

Hangman Word Game (#00257D)*

This program uses words on a data card created by the "Word Encoder" program (#00253D) to play "Hangman" with you. After being told the number of letters, you try to discover the word by guessing letters. After each guess you are told the positions in the word in which that letter appears, plus the number of wrong guesses made so far. *It will not function without the "Word Game Subroutine"* (#00254D), which is not included and must be purchased separately.

**In European areas, order by number 00200D.*

HP KEY NOTES
January 1977 Vol. 1 No. 1

Programming and operating tips, answers to questions, and information about new programs and developments. Published periodically for owners of Hewlett-Packard fully programmable personal calculators. *Reader comments or contributions are welcomed. Please send them to one of the following addresses.*

Hewlett-Packard Company
Users' Library
1000 N.E. Circle Boulevard
Corvallis, Oregon 97330 USA

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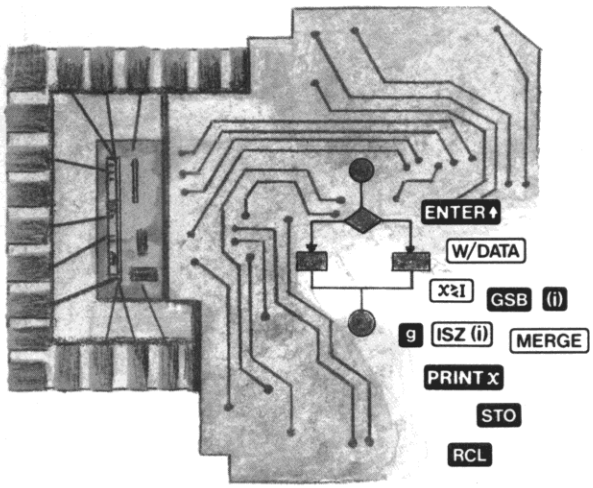


HEWLETT hp PACKARD

HP Key Notes

June 1977 Vol. 1 No. 2

To Know One Is To Want "01"

For over 38 years Hewlett-Packard has not assigned the model number "01". There it sat . . . waiting.*

Meanwhile, rumors, leaks, conjecture, and guesswork suggested that the magic #01 was to be a watch or wrist calculator.

Well, as you can see, the "01" is here. But at the risk of disappointing a few people, we made it more than a watch, more than a wrist calculator . . . we made it the one and only **HP-01**. Now what, you might ask, is that?

The **HP-01** *is personal information* . . . fast, accessible, reliable. Its six interrelated function groups, four types of data, and direct numerical entry provide a range of information limited only by its wearer. Because the **HP-01** is always there, the information is more timely, and thus more valuable.

The **HP-01** *is personal distinction*. Because it is worn on the wrist, it is designed to be boldly attractive. The result is a unique design, from the stylus in the clasp to the compound curvature of the case.

Finally, the **HP-01** *is Hewlett-Packard*. It steps beyond today's products to create a class of its own. It is made easy to use by "friendly" microprogramming and full literature support, including a 100-page *Owner's Guide*. And it includes the traditional HP commitment to quality and post-sale service.

One thing the **HP-01** is *not* is readily available . . . at least not yet. Because we believe that fine jewelers can best serve the **HP-01** customer, we are busy establishing a network of **HP-01** fine jeweler dealers. **The HP-01 will be available only through them. It will NOT be sold directly from the factory.** In the U.S., a dealer should be near you soon. Unfortunately, the rest of the world will have to wait a bit longer.

For more information, in the U.S. you may call, toll free, 800-648-4711 (702-323-2704 collect, in Nevada).

So, if you can't get an **HP-01** as soon as you'd like to, just remember one thing: at least HP KEY NOTES readers were among the first to know that HP has achieved another first, the **HP-01.**

*****When HP acquired the F.L. Moseley Company in 1958, Moseley had a "model 1" product, but it was not an "assigned" HP model number. HP started with model number 200A for its first product. Why 200A? Because "the number sounded important."*

Price Reduction

On April 1 we reduced the price of the HP-91 Scientific Printing Calculator. Originally $500 when it was introduced, it is now only $325.* This was the first battery-operated scientific calculator that delivered a printed record of all your calculations, no matter where you went.

At the new, lower price, this calculator could make a mighty fine companion to an HP-97. Or a fantastic gift for a June graduate headed for college this year.

*(*U.S. dollars. See notice on bottom edge of Cover.)*

Owes It All To HP-65 ...!

Many issues ago we ran an article about the HP-65 in *the* White House. It's owner was (and still is) **Dr. Gus W. Weiss, Jr.,** who at the time was an Economist on the Council on International Economic Policy and a Senior Staff Member at The White House.

Several weeks ago we discovered, in a telephone conversation with Dr. Weiss, that he had just been promoted to Director of the Council on International Economic Policy, and that his immediate supervisor is the President. So, all you folks who think the HP-65 is *passe,* just keep in mind that, although he said somewhat jokingly, "...and I owe it all to my HP-65...", there *is* some measure of truth in the statement.

Today, Dr. Weiss's venerable HP-65 has been supplanted by an HP-67 (and, on occasion, an HP-97), but his faithful HP-65 and hundreds of programs are still just as valuable for rapidly solving some of the country's vexing economic problems.

This story has a moral: There is an American saying that any child can become president of the United States. So pass your HP-65 down through your family and maybe you'll increase the odds in favor of your son or daughter. After all, look what one did for Dr. Weiss...!

All prices in this newsletter are suggested retail prices excluding applicable state and local taxes–Continental U.S.A., Alaska and Hawaii

Library Corner

Although the HP-65 is no longer in production, the HP-65 Users' Library continues to grow. As of June 16, there were 5,355 programs logged into the Library. But infinitely more important is the fact that new *applications* continue to be found for this marvelous machine that started the whole programmable pocket calculator phenomenon.

As of June 15, there were 994 programs logged into the HP-67/97 Users' Library, and new programs flow in almost faster than we are capable of reviewing them. Some of these new programs are highlighted under "NEW HP-67/97 PROGRAMS." We even included two from Europe, one from Canada, and one from Australia!

ORDERING PROGRAMS

Any program you see in HP KEY NOTES can be ordered from either the Users' Library in Corvallis, Oregon, or from the Users' Library in Geneva, Switzerland. (Both addresses are on the back cover.) For most of the world, use the program number listed next to the program's title, then order it from Corvallis. The only exception is if you live in the European areas; in that case, *use the number listed in italic type below the program abstract,* then order it from Geneva.

Payment for programs must conform with the instructions from *your* Library area. Always use order forms if possible, and be sure to include any state or local taxes.

SUBMITTING PROGRAMS

If you submit programs to the Library and use an HP-97 to list the program steps on tape, you know that it saves a lot of work and makes very legible copy. However, we would like to ask a favor of you. Please submit the tapes as soon as possible and try to keep them from direct exposure to fluorescent lights or sunlight. If left too long in an exposed state, the blue ink starts to fade. Then, when we try to photocopy the program to send it out on an order, the listing is barely legible, and we have a disconcerted customer.

For better service to all members, send in your programs as soon as possible after you have applied printout listings. Also, please do not put transparent adhesive tape directly on the blue ink symbols. A chemical reaction soon fades the ink. If you are sure the problem is not with the paper or from exposure to light, perhaps your calculator needs some repairs or adjustments.

FUTURE OF CORVALLIS HP-65 USERS' LIBRARY

The U.S. and Canadian HP-65 Users' Library continues, even though the last HP-65 has been built. The over 5000 programs in the Library will be available through 1981, in keeping with Hewlett-Packard's policy of supporting products that are no longer in production.

Responding to the sharp decrease in program submittals (many HP-65 programmers have graduated to the HP-67/97), we plan to publish the last Catalog Addendum later this year. To have your newest HP-65 program considered for inclusion in this final Corvallis Addendum, it should be postmarked no later than August 30, 1977. Submittals postmarked later than August 30 will be returned.

We will announce the availability of the addendum in the future HP KEY NOTES, which will also contain an *Addendum Request Form*. If you subscribed or resubscribed to the HP-65 Users' Library after July 31, 1976, you will be able to receive this Addendum without charge, simply by mailing this pre-addressed postage-paid *Addendum Request Form*. On the other hand, if you have not subscribed since July 31, 1976, and if you have a U.S. or Canadian mailing address, you will be able to use this *Addendum Request Form* to purchase this last Catalog Addendum (plus other abstracts you may not have received) for $8.00 (U.S.).

NEW HP-67/97 PROGRAMS

We've included in this issue a lot more abstracts than usual. That's because we have had an unusually fine bunch of programs submitted. You will also find a few more programs highlighted throughout this issue; they were considered to be either a level above the others or of such unusual value that we deemed it worthwhile to draw your attention to them.

If you would like to see *your* program in HP KEY NOTES, keep one thing in mind: We cannot highlight a program that, although accepted into the Library, is difficult to use, hard to understand, or not neatly and carefully documented. What we are after are the programs that have widespread use, solve unique problems, use clever and innovative programming tricks and routines, or merely appeal to the most people. As you can imagine, it is difficult to pick a few, because all of you do a pretty good job of programming your particular problems. So don't feel badly if we fail to choose *your* program.

We hope you enjoy the programs chosen for this issue. We are also happy to report that a large Catalog Addendum is being assembled and will soon be finalized so it can go to the printer. We are certain it will contain something for every HP-67/97 User.

NOTE: Because some of the following programs rely on "waveforms" or plotted curves that can be generated with the HP-97 printer they are not recommended for HP-67 owners. They are preceded by "(97)" in the program title. They *can be used* with an HP-67, but it will require some very tedious and lengthy pencil-sessions to arrive at the plotted data that the HP-97 so easily prints out on tape. (See program #00514D for an illustration of one of these tapes.) Programs that are equally usable on both calculators are marked by "(67/97)" preceding the program title.

67/97 Wind Chill Index and Equivalent Temperature (#00580D)*

How cold is "cold"? Temperature and wind both affect the heat loss from the surface of the body. The effect of these two factors is expressed as an "equivalent temperature" that approximates the still air temperature that would have the same cooling effect. This program accepts inputs of either miles per hour or meters per second, or degrees in Fahrenheit or Celsius, and calculates the equivalent temperature in either degrees Fahrenheit or Celsius. The Wind Chill Index (WCI) is expressed in kilocalories/meter^2/hour. (111 steps)

Author: **Fred A. Lummus**
Greenville, Texas

**In European areas, order by number 00217D.*

67/97 35mm Photomacrography (#00913D)*

This program (from Europe) quickly solves some vexing problems of photographing things at very close ranges. Input the lens *f*—number of your 35mm camera and the guide number of your flash, then choose one lens aperture and select the pertinent datum of your photomacrography problem; for example: a particular magnification rate, or the maximum size of your subject, or the length of your extension tube (or bellows), or the diopter strength of your close-up lens. Your HP-67/97 then calculates (or recalls): the magnification rate, the photographic range, the depth of field, the necessary bellows extension length, the equivalent necessary diopter strength of the close-up lens, the distance from subject to film-plane, the distance from subject to flash.

The program doesn't compute the distance from subject to film-plane when using a close-up lens. Also, the guide number of the flash must be the real guide number for ASA 50 and for the approximate distance from subject to flash. (161 steps)

Author: **Francis Parent**
Strasbourg, France

**In European areas, order by number 50097D.*

67/97 Biorhythm Critical Days (Complete) (#00549D)*

Biorhythmic critical days are days when a person is most susceptible to be accident-prone, error-prone, or emotionally unstable. This program allows a look into the future to identify these critical days in any of three modes: the next 30 calendar days, the next 10

GTO page 4

Card Storage Made Easy

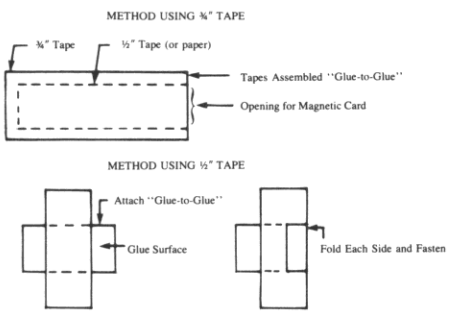
If you are looking for new ways to organize and store your collection of HP-65 magnetic cards, or if you want a method to keep your new HP-67/97 cards from becoming disorganized, here is a letter that will solve your problems or give you new ideas.

Dear Key Noters:

The HP magnetic cards can be conveniently located on rotary file cards, on 3 × 5 file cards, on pages of the application pac books, on program forms, on User Instructions forms,... on almost anything, by using two small pieces of tape. You simply bond ½-inch-wide transparent tape along the center of ¾-inch (or wider) transparent tape and attach 1- or 2-inch lengths where you wish to hold or store a magnetic card. The card will slide into the opening formed by the ½-inch tape under the wider tape.

If only ½-inch wide tape is available, wrap one short length around the middle of another to form a ½ × ½-inch opening when attached to a surface. Use two of these short openings, spaced 1 inch apart. Bend the page slightly to grasp the edges of one end of the card and flatten the page while withdrawing the card.

Happy filing and retrieving,
Richard A. Milroy
Annapolis, Maryland



394 Steps On 3 HP-65 Cards

Just before Christmas we received the following HP-65 program. It is, to say the least, a fine example of what can be accomplished with "only" 100 steps of program memory in a pocket calculator. And, although most of the material was available to the author, there is one formula that was developed by the author.

(65) Tournament Bridge: Major-Event Pairs-Games Awards (#05266A)*

A program that computes the master point awards for all major-event pairs-games. This includes overall and section awards for open, masters, nonmasters, novice, men's, women's, mixed and unmixed pairs, and regional consolations. It does not include sectional consolations, side games, team games, or individual events. (394 steps)

Author: **Robert L. Patton, Jr.**
Arlington, Texas

**In European areas, order by number 51608A.*

For Star Trek Fans

One of the phenomenons of American television was the program, *Star Trek*. It was especially popular because it occurred at a time when space exploration was a reality, not fiction. If dealt with the "starship" *Enterprise,* on various missions in outer space. And, although discontinued as a regular weekly program on prime time, its charisma lingers on with a following of fans known as "Trekkers."

As you get into the following program, you realize what an extraordinary accomplishment it represents. In 798 steps and 8 magnetic cards, the author has captured the same aura of the TV show. This program was also translated by us and included in the HP-67/97 Games Pac 1. (See page 9.) It is also available from the HP-67/97 Library (in Corvallis, only, as #00179D). This is truly a work of art and a treatise on multiple-card programming and implementation. Our very late—but sincere—congratulations to Mr. Gregory.

(65) Space War (#04200A)*

The mission of the *Enterprise* is to seek out (by use of long- and short-range sensors) and destroy (by use of photon torpedoes and phasers) the three Klingon ships in space, which consists of 5184 sectors divided into 64 quadrants, before 15 stardays elapse. There also exists a starbase to resupply energy and photon torpedoes to a docked *Enterprise*. Klingons can destroy an unshielded *Enterprise*. Similar to space war found on some minicomputer systems. (798 steps)

Author: **Walter Lee Gregory, Jr.**
Newport News, Virginia

**In European areas, order by number 51607A.*

"Must" Reading For Game Programmers

Whether or not you program games on your HP-65/67/97, you'll find it no waste of time to read an article in the March 1977 issue of *Scientific American* magazine. Starting on page 137, the article "Mathematical Games," by **Martin Gardner** (recreational mathematics wizzard) is of interest to all programmable calculator owners. It even mentions the new *HP-67/HP-97 Games Pac 1,* but the article is, primarily, about a simple two-person game. Also mentioned is Wythoff's "nim" (game). *(And I almost hesitate to tell you this, but there is quite a dissertation on the relationship of Fibonacci numbers and the golden ratio–as they apply to nim, etc. You see, I've been accused of "a protracted exchange" on Fibonacci numbers in KEY NOTES, so now I'm gun-shy about mentioning those utterly fascinating sequences. Ed.)*

Two Programs Of Rare Quality!

As our Applications Engineers look through dozens and dozens of programs submitted to the Users' Libraries, they sometimes send one or two directly to HP KEY NOTES. The reason could be that the program is unusually well documented, serves an unusual application, has very clever routines, or is on an altogether different subject. The first program, below, fits the last category. And, not only is it unique, it is topical, it works well, it is very well documented, and it has wide appeal. The second program, below, is for a rather specialized, technical application but it is in an area of chemistry that gets a lot of attention, and we get quite a few programs for calculations of this sort. However, the interesting thing about this one is that it will handle acids or bases with up to four different ionization constants; i.e., multiprotic acids. Most programs handle acids/bases with only one or two ionizable entities. Never have we seen one for four. The calculations get too complex for most people. But, in this case, the author has developed a very sophisticated looping arrangement to handle the calculation.

(67/97) Estimating Obesity, Body Fat, Surface Area, and Total Body Water (#00832D)*

Obesity may be defined as an excessive amount of body fat. A simple method of estimating the fat content in the living subject is based on measurements of body weight (W) and height (H), corrected for sex and frame size. This program calculates the W/H^2 Index, a crude measure of obesity. Body fat, body surface area, and total body water for men and women also can be calculated using either English or metric units of weight and height. (200 steps)

Author: **Andrew C.M. Coile**
Bethesda, Maryland

**In European areas, order by number 00226D.*

(67/97) Weak Acid/Base Titration Curve (#00831D)*

For a weak acid or base, the program accepts up to four dissociation constants, volume, and molarity; for strong base or acid titrant, it accepts normality. Then, for each titrant volume entered, the program computes the pH. the 3–, 4–, 5–, or 6–degree equation in H or OH (as needed) is solved by iteration to obtain pH, so the method is quite general and will work for a very wide range of concentrations. (223 steps)

Author: **Karl Marhenke**
Aptos, California

**In European areas, order by number 00225D.*

critical days, or the next 3 multiple critical days. Subsequent groups for each mode are available; however, the modes cannot be mixed and the ability to specify a different number of days is not available. This program is limited to only a 200-year calendar of March 1, 1900, through February 28, 2100. (221 steps)

Author: **Fred A. Lummus**
Greenville, Texas

**In European areas, order by number 00213D.*

(97) Biorhythm-Biological Cycles With 31-Day Printout (#00550D)*

This program is the companion printing version of program 00195D in the Corvallis Library. A given birthdate and a starting date are converted to Julian Day-Number display. A 31-day printed tape with the 23-day, 28-day, and 33-day cycles is output from the starting date. Any Julian or Gregorian data from January 1, 4713 B.C., may be input (209 steps)

Author: **Rex H. Shudde**
Carmel, California

**In European areas, order by number 00214D.*

67/97 Compass Deviation-Coefficients (#00912D)*

This program (from Switzerland) computes the coefficients of any compass deviation curve, from deviation at compass courses N, NE, E, SE, S, SW, W, and NW, and stores the coefficients in registers A thru E. Function B computes the compass deviation (d) at any compass course from the compass deviation coefficients stored in R_A to R_E by: d = A + B sin Cc + C cos Cc + D sin 2 Cc + E cos 2 Cc. (This is Archibald Smith's formula.) (120 steps)

Author: **Robert F. Menzi**
Geneva, Switzerland

**In European areas, order by number 50081D.*

(67/97) Pinball Wizzard (#00321D)

(Here he is again, the inimitable wizzard of scintillating calculator games. And this time he's nearly outdone himself! Incredibly well documented. Ed.)

For either HP-67 or HP-97 use, this program simulates an actual pinball machine, including two flippers, out hole bonus, thumper bumpers, slingshots kickers, special star roll-overs, bonus advance star roll-overs, top roll-overs, kickout holes, free ball drop targets, free game scoring, spinner gate, optional tilting possibility, and either conservative (standard) or liberal (easy) scoring options. The calculator keeps track of games, amount spent, number of balls to play, total score, etc. (222 steps)

Author: **Craig A. Pearce**
Berwyn, Illinois

**In European areas, order by number 00204D.*

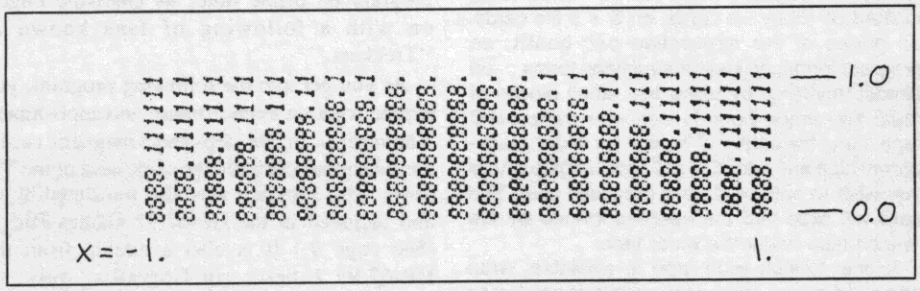
(97) Plot Subroutine (#00785D)*

This program (actually, a subroutine) uses two registers (8 and 9) and two labels (8 and 9). It operates on the value in the display, produces a normalized function, and prints a formatted display in which a decimal point represents the function value. The area "under" the curve is represented by 8's, "over" the curve by 1's.

(As you can see in the drawing, this clever subroutine has all sorts of possibilities for many applications–but read on...! Ed.)

Author: **James A. Weber**
Renton, Washington

**In European areas, order by number 00228D.*



(97) Curve Plotting Routine (#00732D)

Given (1) the function to be plotted, (2) the plotting interval, and (3) the number of points to be plotted, this routine plots the function using the HP-97 printer. Two unique features were incorporated: (1) the values are pre-scanned for maximum and minimum (and printed), and (2) if the output interval contains zero, the zero level is indicated and points are plotted with respect to it. Ten print positions (across) are used. (184 steps)

(Terrific program! We are impressed. Ed.)

Author: **Arthur E. Anderson III**
Mountain View, California

**In European areas, order by number 00223D.*

67/97 Dog Races (#00370D)*

A program that gives all 36 win and quiniella odds on 8 dogs, then stops on handicapping tips. If shows the race in progress in a maximum of seven steps then stops on the finish order. If gives all win, place, show, quiniella, perfecta, and trifecta payoffs, plus the Daily Double and Big Q if a previous race has been run. All payoffs vary with the popularity of the dogs. Payoffs can be with or without a percent taken out. A random-number "seed" is the only entry that must be made before the first race. (335 steps)

Author: **Donald L. Miller**
Tampa, Florida

**In European areas, order by number 00206D.*

67/97 Flag Test Routine (#00233D)*

This routine may be used in the process of program editing and debugging to indicate the status of the four flags in the calculator. It uses only one label and the Z and T registers of the stack. Even the use of the label can be avoided by placing the routine at the top of the program and initiating it by pressing RTN R/S. The X and Y stack registers and all storage registers, as well as flag status, are undisturbed by the test. (27 steps)

Author: **Howard B. Kutner**
New York, New York

**In European areas, order by number 00203D.*

67/97 Star Trek-Advanced (#00369D)*

Here are 1113 steps of decision-making that puts the pressure on you, the captain. You fly the *U.S.S. Enterprise* on a triaxial coordinate system, tracking down Klingon, Romulan, and Vallician war vessels, in addition to a stranded Nubian freighter. Functions include advanced sensor system, course controls, shields, phasers, photon torpedoes, transporter, tractor beam, Romulan cloaking device, self-destruct, and even a practice "firing range."

(For all the thousands (millions?) of Star Trek fans, here is a tour de force of HP-67/97 programming. After 29 pages of documentation and 6 cards, you'll notice you've been up half the night mastering this "game" program ...or going into orbit! A truly monumental job. However, I must admit that Walter Lee Gregory did it a year ago–and on the HP-65, no less–with 798 steps, 8 cards, and a truly astounding 46 pages of beautiful documention; it must be the all-time record for programmable pocket calculator programming. See page 3. My congratulations to both of you! Ed.)

Author: **Larry G. Schneider**
Wilkes-Barre, Pennsylvania

**In European areas, order by number 00205D.*

(97) Colinear Antenna Gain and Pattern (#00514D)*

The program calculates the gain of center-fed dipole antennas and colinear arrays of center-fed dipoles. It also calculates relative gain at selectable angles (elevation angle for vertical antenna), or uses the HP-97 printer to plot relative gain in selectable decibel steps. Also included is provision for progressive phase shift to evaluate beam tilt. (220 steps)

(Here's a printout (below) that we ran on an HP-97. Very clever and neat, right? Ed.)

```
-1111118111.  ***
-1111111181.  ***
-1111111118.  ***
-1111111118.  ***
-1111111118.  ***
-1111111181.  ***
-1111111181.  ***
-1111118111.  ***
-1118111111.  ***
-8111111111.  ***
-1111811111.  ***
-1111811111.  ***
-1111811111.  ***
-1118111111.  ***
-8111111111.  ***
-8111111111.  ***
-1181111111.  ***
-1118111111.  ***
-1118111111.  ***
-1181111111.  ***
-1811111111.  ***
-8111111111.  ***
-8111111111.  ***
-8111111111.  ***
-8111111111.  ***
-1811111111.  ***
-1811111111.  ***
```

Author: **Kenneth R. Wetzel**
Ridgecrest, California

**In European areas, order by number 00211D.*

67/97 Jack of Eagles (#00727D)*

A guessing game! (From Australia!) On each move, the human enters a positive or a negative number; the machine has already analyzed the human's previous moves and anticipates his/her choice. If correct, the machine's score goes up; if wrong, the human's score goes up. The human can cheat if so desired. (208 steps)

(Jack of Eagles, a science fiction novel by James Blish, is concerned with psychic abilities; the program converts the machine into a mind-reader. Ed.)

Author: **Dick Jenssen**
Parkville, Victoria, Australia

**In European areas, order by number 00222D.*

(97) Graph of a Function (#00764D)*

This program was written primarily for the HP-97 and is not very usable on an HP-67 because the real value is in the printout. Given a function F(χ) (and you have 112 steps available to define F!), the calculator (printer) will draw the graph of F from two given end-points. Very accurate graphs can be obtained simply by gluing together more printout strips. (112 steps)

(The possible applications for this program are nearly unlimited. Nice work! Ed.)

Author: **Moshe M. Breiner**
Cambridge, Massachusetts

**In European areas, order by number 00224D.*

67/97 Ballistics Trajectory Computations (#00371D)*

The program computes remaining velocities, energies, flight times, and maximum rise and drops of bullets at user-specified intervals. (210 steps)

(This program required considerable theoretical development–approximately two years of spare time. It allows full trajectory calculations. The author uses the program to compute trajectories as a service for a small fee. Ed.)

Author: **David M. Ivey**
Macon, Georgia

**In European areas, order by number 00207D.*

67/97 Phase of Moon Dates (#00702D)*

Given a month and year during the 200-year period from March 1900 through February 2100, this program will determine the date for each phase of the moon within plus or minus one day. Also, a correction factor may be optioned for different time zones. (214 steps)

Author: **Fred A. Lummus**
Greenville, Texas

**In European areas, order by number 00221D.*

67/97 Fixed-Time Traffic Signals 1 (00575D)*

This program (from Canada) calculates the optimum setting of fixed-time traffic-control signals and the characteristics of any flow, at any cycle length on any phase. (224 steps)

(A remarkably well-researched and well-documented program. Too bad it isn't a de rigueur requirement for traffic-control-managers in all the large congested cities throughout the world. But even then, you still couldn't find a place to park ... . Ed.)

Author: **Paul O. Roer**
Vancouver, B.C., Canada

**In European areas, order by number 00216D.*

(67/97) Game of "Life" (9 × 9) (#00463D)*

The game of life was originally described in *Scientific American* magazine, October 1970, in an article by **Martin Gardner.** The game was originated by **John Conway.** In the game, organisms exist as cells on a grid (9 × 9 in this version) and die or reproduce according to a simple genetic rule. The symmetry generated is very interesting. A generation takes less than 3 minutes to run, compared to 50 minutes for a previous program. In fact, it takes 1 minute and 50 seconds to run on an HP-67 and 2 minutes and 10 seconds on an HP-97 ... that is, to compute the generation. It then takes 1 additional minute to display on the HP-67 or 13 seconds to print on the HP-97. (210 steps)

Author: **John R. Rausch**
Franklin, Ohio

**In European areas, order by number 00210D.*

(97) Linear Life (#00462D)*

"Linear Life" implements two distinct transformation principles, *static* and *dynamic*, that act upon linear digital arrays of variable length to evolve patterns of great depth and beauty. The generative principles are logically simple but operationally deep and offer many challenges to the user. (224 steps)

(The author of this program is well-known to HP-65 Library Users. But let's let him tell it in his words. Ed.)

"The three HP-65 Library programs, *(Life-Line* (03695A), *Life-Line 9* (04933A), and *Cyclic Life-Line 5* (04934A), utilize a unique transformation principle acting on linear digital arrays to generate deep and unusual 'Life' patterns. Each program was limited to specific linear dimensions, and only the smaller arrays were able to generate cyclic groups automatically or incorporate pause controls. My program for the HP-97, *Linear Life,* represents a considerable expansion in capacity—to linear arrays of length 2-10 for moduli of range 2-10, with incorporation of full cyclic control and print formatting. In addition, an alternative 'static' transformation principle is available, more clearly analagous to Conway's *Life* concept of neighborhood effects and instantaneous next-generation evaluation. Both static and dynamic transformations yield extraordinary numerical and spatial patterns. I've spent many hours with these transformations, have gotten some remarkable results, yet have barely scratched the surface. I think HP-97 Users will enjoy this program."

Author: **Dr. Mordecai Schwartz**
Woodmere (L.I.), New York

**In European areas, order by number 00209D.*

(67/97) Telephone Directory (#00442D)*

This program will store 19 name codes and phone numbers, allowing you to change them, delete them, or review them. The capacity is limited only by the number of data cards used.

GTO page 6

Significantly, the program will check and let you know if another data card is needed. (185 steps)

(A clever program. An alphabetic overlay is used on the calculator so you can "dial" the name and recall the person's phone number. No area codes can be stored, and the program is based on phone numbers of seven numbers or less. Good work! Ed.)

Author: **Ruben J. Carril**
Glendora, California

**In European areas, order by number 00208D.*

(67/97) Bubble Sort Routine (#00619D)*

This program sorts any combination of data registers 0 through 20, in ascending or descending order, as defined by the user. It is primarily designed to be "called" as a subroutine of a main program. A sketch is included to pictorially display the comparison mechanics and indexing of a bubble sort routine. (69 steps)

Author: **Lee M. LaMunyon**
Picayune, Mississippi

**In European areas, order by number 00219D.*

(67/97) Synchronous (Belt) Indexer, 2 Pulleys (#00573D)*

This program computes geometric parameters for incremental motion systems that use a constant-angle driver such as a stepping motor or Geneva drive mechanism, and synchronous (toothed) belt and pulleys, chain and sprockets, or gear and rack. Common examples are production-line work positioners and punched-card/tape indexers. The program yields step-angle/pulley-size combinations having a linear cumulative error within such user-defined limits as belt length, center distance, and number of belt teeth engaged (on the smaller pulley). (224 steps)

(If this looks familiar, it should! The author also wrote a similar program for the HP-65. Both versions of the program provide flexibility of starting point input: stepper angle 0°, number of steps per driver revolution, or number of driver pulley teeth are accepted. Lengthy combination searches may be manually halted at random, reviewed, and resumed from the point of interruption by pressing R/S, the desired review key(s), and A ENTER↑ A. *The programs may also be used to calculate geometries of two-pulley, non-indexing synchronous belt transmissions. All in all, a tremendously good program for machine designers, for mechanical engineers, or even for college students. Documentation rates with the very best. Ed.)*

Author: **Thomas A. Hender**
Corvallis, Oregon

**In European areas, order by number 00215D.*

(67/97) Duplicate Backgammon (#00628D)*

The program generates 25,000 backgammon dice throws from each seed and compiles match score. It also stores any number of games up to 21 per card, including each game score, then duplicates throws for each game, with players exchanged and the games in random order. The program also compares each replayed game score with the original score and compiles the overall score. Unlimited interruptions are allowed. And the combined score of each game is reviewed after completion of the rematch. If the HP-97 is used, the scores are printed on tape. And, as a bonus, the program includes a flowchart. (224 steps)

Author: **Donovan E. Smith**
El Cerrito, California

**In European areas, order by number 00220D.*

67/97 Chicago Bridge Scorekeeper (#00615D)*

Program accepts points scored above and below the line for each of four hands of so-called Chicago Bridge. Partnership data are initially input. Above- and below-line scores are entered and totals are printed after each hand is scored. *WE* scores left of the decimal point; *THEY* scores to the right. Vulnerability is indicated in the display according to the rules of Chicago Bridge. The initial team to deal is always *WE*. Game and part score bonuses are automatically awarded. At the completion of four hands, the HP-97 automatically totals, converts net score to ± 100's *WE*, and sums and prints net scores by player. (The program is written so that 4 or 5 individuals' scores can be accumulated.) Team make-up can be changed after each session of four hands. (188 steps)

Author: **Jack E. Kahoun**
Millbrae, California

**In European areas, order by number 00218D.*

67/97 Discounted Cash Flow/Present Value Analysis (#00528D)*

This is a program to solve the general equation for investment analysis: $PV = F0 + F1/(1 + i) + F2/(1 + i)^2 + \ldots + FN/(1 + i)^2N$. When the internal rate of return (i) or the present value (PV) is the unknown variable, up to 22 cash flows (F0, F1, ... F21) can be given. When N or $F1 = F2 = .. = FN =$ PMT is the unknown, values of F0, i, and the third variable known (PMT or N) must be given. After the unknown value is calculated, the program can flash, year by year, the discounted and accumulated cash flow. (224 steps)

Author: **Hernan Anzola**
Stanford, California

**In European areas, order by number 00212D.*

Some True Believers!

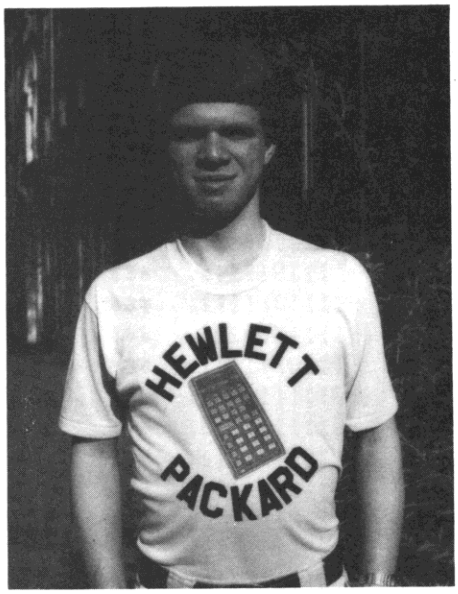
A lot of people were amused by the "calculator cake" photo in the last issue. So, here are two more photos you'll probably enjoy. They came with the following letter.

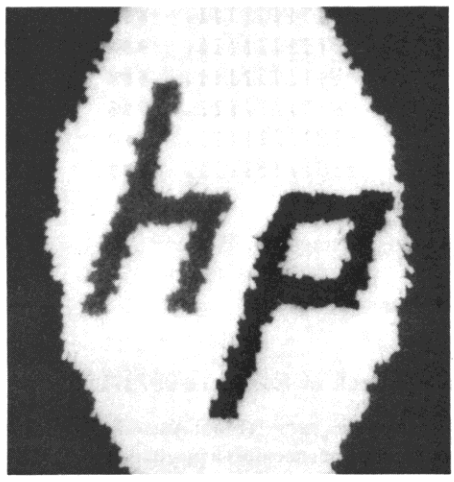
Dear Sirs:

I thought you might enjoy seeing the enclosed picture of my boyfriend, **Larry Schneider.** His HP-67 shirt was given to him as a twenty-first birthday present this past February by his roommates at Harvard. It matches very well the gift I gave him—a latch-hooked wall-hanging of your symbol, a picture of which I have also enclosed.

Sincerely,

Sally Seeherman, Waltham, Massachusetts





(It would be a fair assumption that Mr. Schneider is an avid HP fan. It also would seem a fair assumption that Ms. Seeherman is an HP fan. However, I'll bet that she is a more avid Schneider fan than HP fan! Anyway, thanks for sharing the photos with all the other KEY NOTES readers. Too bad we couldn't print the logo photo in color. The "h" is blue, the "p" is black, the center is white, and the "surround" is bright red. Thanks again. Ed.)

Smart Card Reader Is Outsmarted

As you all know, software can be a very trying thing to make completely devoid of errors. And in the last issue of HP KEY NOTES, we inadvertently added history to the above observation. In the article "Outsmarting the HP-67 'Smart' Card Reader" (page 6), we gave you some good information. However, there is a small problem that can crop up when you use that information. But let's let **Craig Pearce** of Chicago, Illinois, tell it his way.

Dear Editor:

My main reason for writing is the article on "Outsmarting the HP-67 'Smart' Card Reader" on page 6. While the solution given in the article will produce the desired results (that is, placing a **Crd** prompt on a card which has data on one side and a program on the other), there is an error-trap that one can fall into, as follows:

By storing the 112-step program on side one and placing the 113th step in the machine, the **Crd** prompt *will* be placed on side one and, then, the data *can* be stored on side two. However, reading in side one, with the **Crd** prompt pulse on it, will not clear the previous 113 through 224 steps, if a program was already in the machine.

At first glance, this may not seem like much of a problem, but when one thinks about it, the dangers become visible. Suppose your current 112-step program (the one just loaded over an old one in the machine) calls for a jump to, say, LBL 8, the label being located somewhere earlier in the machine's memory. Also, suppose the previous program residing in memory had a LBL 8 somewhere in its bottom half of program space (steps 113 through 224). The jump will cause the pointer to search down in memory from the GTO 8 command and encounter the LBL 8 of the previous program, *starting program execution there instead!*

Also, one of my programs requires, actually, 113 steps, the 113th being some halt command (a RTN or R/S). By allowing the second half of program space to be cleared to all R/S's allows this program to be stored on one side of the program card. This will not happen if the article is followed.

There is a solution to this dilemma, however. Simply reverse the situation. The program should be placed on side two of the card. Side one will contain the data. The **Crd** prompt is placed on the card by simply pressing the sigma + (summation) key, which will put data in the secondary registers.

Now, all one has to do is record the program on side *two* of the card and, then, in the RUN mode, press W/DATA. Side *one* of the card is fed through and the display will show the word: **Crd.** The user then just presses any key (usually a CLX) and the card is recorded.

Now, when the card is read into the machine, the data is stored in the primary registers and the HP-67/97 sees the code that tells it to display the **Crd** command on the readout, expecting more data. However, side two contains the program and *that* is loaded in the program memory. Since the program side contains no **Crd** prompting code, the steps from 113 to 224 are cleared to R/S as they should be, and all is well. A step-by-step summary of these rules follows:

TO RECORD A DATA/PROGRAM CARD

1. Load program into memory.
2. Fill the necessary data registers.
3. Switch to the W/PRGM mode.
4. Write (feed in) side *TWO* of the program card, placing the program on that side.
5. Switch to the RUN mode.
6. Press the sigma + (summation) key. This stores data in the secondary registers.
7. Press f, WRITE DATA (or, on the 67,f, W/DATA).
8. Feed in side *ONE* of the program card. Display should show **Crd.**
9. Press CLX to clear the prompt word. *DO NOT* feed the card through again until this step is performed!
10. The card is now recorded with the data on side one, the program on side two and, when read into the machine, it will show the necessary **Crd** prompt when side one is read, telling the user that side two is also needed.

I hope that this will be of some help to your readers. I found this out the hard way on my "Bell Fruit" program, which uses the clearing of step 113 as an important HALT in that particular program.

Yours sincerely,
Craig A. Pearce

HP-67 Alarm Clock?

We get all kinds of letters. Some are highly technical. Some are complimentary. Some are indignant. Some are bizarre. Some are amusing. Some are highly interesting or unusual. We suppose the following letter could be classified as being in the last category, and it could also fall into several others. But, all that aside, the program works, and it could give rise to similar applications, but for other solutions.

Dear Editor:

Just recently I became aware of a rather unusual use for my HP-67 that may be of interest to some of your readers.

I've been a practitioner of TM (transcendental meditation) for a number of years. One of the problems with the technique, as any of your readers who practice TM will know, is that of *timing* your meditations. you must either interrupt yourself to glance at your watch, or depend on a loud commercial alarm that jangles the nerves enough to cancel half the good effects of the meditation.

Anyway, while working on an EE program with my HP-67, it suddenly occurred to me that the soft buzzing noise made whenever the HP-67 reads a card would be an absolutely *perfect* "alarm" for my meditations! The program below is the result of that discovery.

f LBL E	CHS
2	h ST I
7	g DSZ (i)
4	GTO (i)
×	h PAUSE
STO 1	h RTN
1	

Using the program is easy. Simply enter the number of minutes that you want the timer to run, press E, and place any program or data card into the card-reader slot. When the time is up, the HP-67 will read the card, and the "alarm" will go off!

Obviously, this is not a timer with split-second accuracy, but for the use mentioned above, it is more than adequate.

Yours truly,
Dave Rose, Forest Park, Georgia

Application Pac Corrections

If you own some of our application pacs, check the following corrections and mark them in your copy—or mail in your old card and we will send you a revised card. If your copy is correct, you have a later, revised issue of the book and/or card.

HP-67/97 BUSINESS DECISIONS PAC 1

Programs BD1-01A *(Internal Rate of Return)* and BD1-02A *(IRR-Groups of Cash Flows)* have been rewritten to correct some cases where the iteration routine did not converge. The documentation and User Instructions remain the same. To receive new magnetic cards BD1-01B and BD1-02B, send your old cards to: *Service Department* (U.S. address on back cover).

HP-67/97 MATH PAC 1

It is possible that you may have an error on the card for *Base Conversions,* MA1-03A (page 03-01). To find out, convert the following base 10 number to base 8.

$$65535_{10} \rightarrow 177777_8$$

If you do not get this answer, send your old magnetic card to: *Service Department* (U.S. address on back cover), and they will send you a corrected card (MA1-03A) and program listing.

HP-67/97 SURVEYING PAC 1

Several corrections and changes have been made in Surveying Pac 1. An article in the January 1977 HP KEY NOTES called attention to corrections in programs SU1-14A, *Predetermined Area* and SU1-17A3, *Lambert Data.* Corrections or improvements have also been made to the following programs.

SU1-01A, *Traverse, Inverse, and Sideshots.* On page L01-02, at line number 191, change STO 5 to STO +5. This change allows traverses with more than one curved side to be run, with proper calculation of the total area of the traverse. To obtain a new magnetic card, send your old card to: *Service Department* (U.S. address on back cover).

SU1-03A, *Intersections.* On page L03-01, between line numbers 083 and 084, insert two steps: F2? and GTO 4; and between line numbers 094 and 095, insert: LBL 5. On page

GTO *page 8*

L03-02, after line number 193, add three steps: LBL 4, SF2, and GTO 5. This change improves the accuracy of the "offset" portion of the program and eliminates **Error** displays that formerly occurred with some inputs. To obtain a new magnetic card, send your old card to: *Service Department* (U.S. address on back cover).

SU1-13A, *Azimuth of the Sun*. On page L13-02, line number 144, change − (minus) to + (plus). This change corrects an error in the refraction correction. In addition, Users should take care to input the "hour difference" using the proper sign. If the sun's declination is *increasing*, as between the winter and summer solstices, the hour difference is *negative*. (Unfortunately, some almanacs or ephemerides do not mention this distinction.) Specifically, the example on page 13-01 should be run with a negative hour difference input (i.e., –0′.76).

These changes are covered in a forthcoming Addendum Card that will accompany a revised magnetic card. If you work through the examples in the current handbook (on pages 13-01 and 13-02) using these changes, you will get considerably different values than those in the handbook. The correct values are shown on the Addendum Card. To obtain a new magnetic card, send your old card to: *Service Department* (U.S. address on back cover).

SU1-15A *Earthwork*. The program as recorded and listed in the current edition of the Surveying Pac does not allow freedom of input of elevation and offset distances in the calculation of volume by average end area. The following changes allow you to input the data, starting at any station.

On page L15-01, after line number 009, add:

STx1	RCL 0	STO 0
RCL 1	ST+2	RCL 2
STO−2	R↓	2
R↓	STO 1	÷
x⇄y	R↓	STO 3
STx0		

Then, delete all steps for line numbers 010 through 023. Finally, insert STO 1 and STO 0 between line numbers 053 and 054. To obtain a new magnetic card, send your old card to: *Service Department* (U.S. address on back cover).

SU1-18A2, *Mercator to Geographic*. On page L18-02, insert CHS between line numbers 160 and 161. Also, delete the GSB1 at line number 164. This change improves the accuracy of the program. For example, in the problem on pages 18-02 and 18-03, in which geographic coordinates are calculated from state plane coordinates and then converted back to geographic coordinates, you will now obtain the results:

C ⟶ 349231.2940 *** x
2357247.272 *** y

in very close agreement with the original geographic coordinates shown on page 18-02.

The above changes to Surveying Pac 1 are incorporated in all new magnetic cards and current editions of the pac handbook. If you have older cards with incorrect listings, send your old cards to: *Service Department* (U.S. address on back cover), and we will send you corrected cards.

Surveying Pac users will also be interested in two other notes about using their programs.

In SU1-07A, *Vertical Curves and Grades*, a PC, or beginning station, of 0 (zero) cannot be used. The PC input must be a number greater than zero, otherwise the program thinks you are inputting PI, the intersection of the tangents.

Here is another correction to SU1-07A. We suggest that you input a very small positive number, say 10^{-6}, or a "pseudo" station number, say 10 + 00, to obtain the proper outputs when the beginning station is 0 + 00.

In SU1-14A, *Predetermined Area*, using the "two sides parallel" method does not work for rectangles or parallelograms. The program is designed for trapezoids. Of course, the rectangular case is easily solved by keyboard arithmetic. The parallelogram may be resolved into two congruent triangles and solved by the "triangle" portion of the program.

We wish to express our appreciation to sharp-eyed, concerned Users who suggested some of the above changes. Thank you.

HP-67/97 STANDARD PAC

For those of you who have had some problems with SD-13A, *Arithmetic Teacher*, after entering an optional seed, we apologize. There should have been a note in the program description referring to the pseudorandom number generator description on page L13-01. In particular, an optional seed should be chosen such that the quotient of (seed × 10^7) divided by 2 or 5 must not be an integer. Because of the method used in this generator, a seed of 0.25, or any multiple, always generates itself and sends this program into an infinite loop trying to come up with a problem that is different from the preceding one. If you want to modify your program so that this will not occur, make the following changes on page L13-03.

Line Number	Change
Between 20 and 21	Add: STO 6
Between 21 and 22	Add: RCL 6
	Add: x

It would still be wise to statistically test seeds before using them, to make sure that the resulting sequence is random and does not repeat itself quickly.

SD-07A, *Triangle Solutions*. Here's a very easy change. On page L07-03, at the bottom of the page, add the word "used" in the block for register 7. Somehow, it "dropped out" on the printing run.

SD-12A, *English–SI Conversions*. In order to agree with the "Remark" at the bottom of page 12-01 that the LAST X register contains the input value for all conversions except temperature, three steps need to be inserted in the program. A corrected card can be obtained by mailing your old card to: *Service Department* (U.S. address on back cover). Meanwhile, make the following insertions in the listing on page L12-02.

Line Number	Insert
Between 51 and 52	x⇄y
Between 67 and 68	x⇄y
Between 84 and 85	x⇄y

SD-15A *Diagnostic Program*. To ensure that the correct code is displayed from this program, two steps must be inserted in the program. As stated above, a corrected card can be obtained by sending in the old one. To correct your handbook, on page L15-02, insert a "RCL I" step between line numbers 154 and 155 and again between 161 and 162.

Surveying Pac Bonus

Many users of our *Surveying Pac 1* have requested a traverse program with bearing-quadrant outputs, rather than azimuths. So we now have a Users' Library program that does just that.

(67/97) Traverse, Inverse, and Sideshots With Bearing/Quadrant Outputs (#00866D)*

This program is a revision of pac program SU1-01A, *Traverse, Inverse, and Sideshots*. All angle outputs are in bearing-quadrant form. Inputs in the form of either bearings or azimuths are accepted by the program. It offers four major routines: (1) Bearing/Azimuth Traverse, (2) Field Angle Traverse, (3) Inverse, and (4) Sideshots. In addition, Slope Distance Reduction may be performed and Curved Sides may be included in the traverse. Because of program space limitations, the routine for Closure of Traverse was not included. You may obtain closure data by using the routine in SU1-01A after use of this traverse program. (217 steps)

Author: **Hewlett-Packard Co.**
Corvallis, Oregon

**In European areas, order by number 00227D.*

A Programming Aid

If you still have trouble programming problems for your own applications, perhaps you should try a new direction. The March 10, 1977, issue of *Machine Design* magazine presents an article on page 62 that might be what you are looking for. The article, "How To Make Your Calculator Think Like a Computer," was written by **Leon S. Levy,** Associate Professor in the Department of Statistics and Computer Science at the University of Deleware.

The article describes a new approach called "structured programming." In the five pages of text, flowcharts, and sample problems, the author has done a very good job of presenting a new approach to what is often considered a complex mess, and he shows how such

complex problems can be orderly and systematically solved.

If you have avoided programming because you thought it too complex, here is an article that could change your mind.

Are Calculators Computers?

Although the following magazine is very likely more available in the U.S. than in other parts of the world, if you can possibly get one (check your local public library), you won't be wasting your time. In the March 1977 issue of *Popular Computing* (Vol. 5 No. 3), there is an article on page 14 entitled, "Schwartz on Calculators." (Yes, he is the same **Dr. Mordecai Schwartz** whose program is featured on page 5 .

In the article, Dr. Schwartz adds some very interesting comments and facts about the often-asked question: Where is the dividing line between calculators and computers? Among the more interesting comments are those on the comparisons of the HP-65, HP-67, and the T.I. SR-52.

Quite a few people who own both an HP-65 *and* an HP-67 have written to us about the article. Mostly, they stated that they were sure that other HP-65/67 owners should be informed about the article, because it more or less discussed calculator/computer considerations that had not been published before. They also described it as "fascinating." We agree. Don't miss it.

HP Inspires Users' Group In Utah

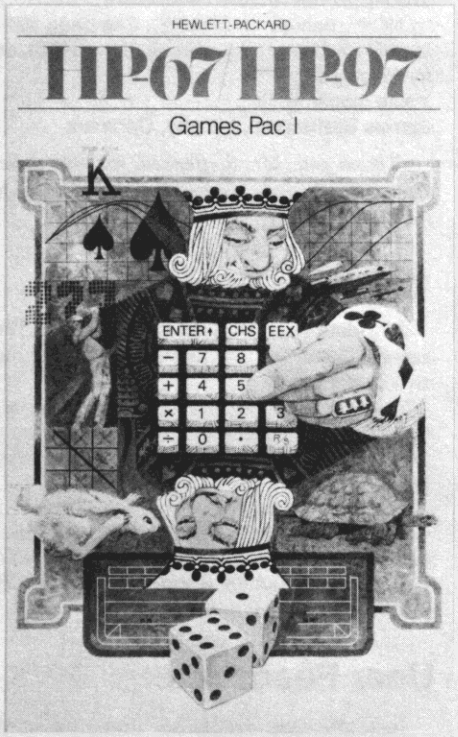
Brigham Young University, Provo, Utah, is the site of *Alpha Kappa Pi,* an association of calculator programmers who also turn out to be a small but devoted band of HP-67 owners. Essentially, the club is a mutual benefit society whose major efforts go into (1) sharing programs, (2) attracting new members, (3) stimulating original programming aimed at filling members' needs (including entertainment by calculator games!), and (4) providing a public service. Club President **Don Colton,** a graduate student in management, and Faculty Advisor **Eben Visher,** a member of the Mathematics Department, note that "A student considering the purchase of any calculator has available to himself a large number of calculator description sheets provided by manufacturers. Most students try not to buy in ignorance, but seeing beyond the confusing variety in calculator offerings is an awesome task. We use the influence of personal experience in aiding interested students and others in making the best purchase decision." Of course, for advanced calculators, *Alpha Kappi Pi* thinks that HP offers the best available.

Two New Accessories

Here are two accessories that were recently released. Although the games pac is primarily for the newer HP-67/97 calculators, the dc rechargers cover all of the *pocket* calculators produced by Hewlett-Packard to date.

A PAC OF GAMES!

If you *like* calculator games you'll *love* the new *Games Pac 1*. Consisting of 19 programs on 20 magnetic cards, the new pac has a little of everything for everyone. You can go from "Tic-Tac-Toe" to "Hexpawn" to "Super Bagels" in one evening. And, for once, your entire family can participate and learn why you bought a programmable calculator in the first place!



Get the whole family interested in "Racetrack"; up to five players can race. Then, to top off an evening—and challenge your mind—try a game of "Wari" (also known as "Man-Kalah").

All of the games are designed primarily to provide fun—to take you away from the tedium of everyday business—but they are also helpful in teaching principles of mathematics, physics, and logic.

The new 00097-13185 *Games Pac 1* is available now and is priced at only $35.*

FOR CARS, AIRPLANES, BOATS, OR ANYWHERE

As the Spring and Summer months get people out of the house and into boats, airplanes, recreational vehicles, and what-have-you, perhaps they will want to take along their calculators for navigation, surveying, business away from home, record-keeping, or just plain fun. But now they won't have to rely solely on the batteries in the calculator and, even better, they can charge the batteries in remote locations.

The new HP 82054A and 82055A DC Rechargers were released on April 1. Price is $35* for either model. The 82054A (pictured here) is for the calculators: HP-35/45/55/65/67/70/80. The model 82055A is for the calculators: HP-21/22/25/25C/27.

The dc recharger includes two power cables. One cable (pictured here) plugs into a conventional automobile cigarette lighter receptacle. The other cable is equipped with two lugs for fastening directly to 12-volt battery terminals. The input is not polarity dependent; either lug may be connected to either terminal of the battery.

The input voltage range is 10 to 16 volts dc (the typical 12-volt battery range), with transient protection from 125-volt, non-repetitive, 300-microsecond spikes (typical of automobile engines).

The dc recharger has a thermal protection circuit whose operation is indicated by a small red lamp. If the lamp is on, the dc recharger is charging the calculator battery. If it's off, the battery is *not* being charged and, hence, is being protected from possible high-temperature damage. The maximum ambient charging temperature with the calculator on is 35°C (95°F); maximum with the calculator off is 39°C (102°F). Whether the red lamp is on or off, the dc recharger supplies all power to the calculator without discharging the calculator battery.

This accessory has long been wanted by many of our calculator Users. Now it is a reality, and you can get one at your local HP dealer.

ORDERING INFORMATION

Always check *first* with your local HP dealer for accessories, or check with your local HP Sales Office. If you cannot find an accessory that way, as a last resort, order directly from the factory in Oregon (U.S. address on back cover).

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There are, however, a few things you must do to make sure that a factory order is accepted. You must: (1) order by product name and accessory number; (2) pay for your order with a negotiable check, in U.S. dollars, and drawn on a U.S. bank; and (3) allow 4 to 6 weeks for shipment. Also, *we cannot accept orders from European Bloc nations, and import regulations make it impractical to accept orders from Brazil and Mexico.*
*(*U.S. dollars. See notice on bottom edge of Cover.)*

Attention Attención Achtung Attenzione

Because of cost and time restrictions, all documentation associated with the Users Libraries *is in English only*. That includes this newsletter, all library programs, all library catalogs, and all library documentation. Therefore, all correspondence to the Library or newsletter should also be in English.

Some Users have written to the libraries to ask why no keycodes are on the program listings of the library programs. The answer is simple to explain: The keycodes for the HP-67 and HP-97 are not the same, because the keyboards are not the same. That is why the codes are not listed. Anyway, it is easier to key in a program from the keystroke listing than from the keycode listing.

Programming Tip Corrected

At least one sharp-eyed reader caught an error in the last issue. Here is a letter from **Dave Sheehan** of San Francisco, California.

I would like to comment on a programming tip that I read in the January 1977 HP KEY NOTES. It was submitted by **Art Leyenberger** of Ridgewood, New Jersey. (See page 5, column 3.) The article was titled "Testing Register Contents of HP-67".

In testing his subroutine I found that if a register held the same value as its register number (e.g., the number 4 stored in register 4), the program would halt at that register and not continue. This occurs because of the condition in step 12 (g x=y) and in step 13 (R/S). I have what I consider an improved subroutine to test register contents.

f LBL A	DSP 0
RCL (i)	h PAUSE
f x≠0	RCL (i)
GTO B	DSP 2
f ISZ	h PAUSE
GTO A	f ISZ
f LBL B	GTO A
h RC I	

This modified subroutine will automatically stop with an **Error** display after 25 = 25 because (i) will be incremented to 26, and there is no storage register 26. Changing the f -x- display to h PAUSE cuts the display time in half.

Pardon Our NOP!

In the last issue of HP KEY NOTES, we published an article "Converting HP-65 Programs To The HP-67/97." Instruction 9 stated: "The HP-67/97 does not have a NOP (no operation) statement. If it is necessary to have a 'filler' step, you may insert a label (e.g., LBL 9), which is never called."

The above statement is true; it works. However, it took a sharp-eyed and alert HP-67 owner in Denmark to point out a very simple and more logical key to use. Here's his letter.

Gentlemen:

Although you have doubtless received the same comment from many other quarters already *(nope, you were the first one! Ed.)*, may I point out an error in paragraph 9 of your remarks on converting HP-65 programs to the HP-67/97? The HP-67 has an exact equivalent of the HP-65 "g NOP", namely "h SPACE". See page 304 of the *HP-67 Owner's Handbook* (June 1976), and try for yourselves!

Yours sincerely,
James Steffensen, Lyngby, Denmark

(Thank you, Mr. Steffensen, for your letter. However, the rule we printed still is valid for the HP-97. Ed.)

Two Tips From A User

In a note from **Donald B. Rowley** of Torrance, California, we received the following two suggestions.

The operation N!, where n is a non-integer or n <0, should be added to the list of improper operations in appendix C of the owner's handbooks for the HP-67 and HP-97.

In a long program, you can conserve labels by using the same label repeatedly for forward references. Label 0 is used in this way in the Standard Pac programs, but the technique is not pointed out in the text.

User Feedback

Just after we caught an omission in the HP-67/97 handbooks, we received the following letter from **Terry Mickelson** of Duncan, B.C., Canada.

Dear Editor:

Flag 3: Consider the following short program and you will correctly come to the conclusion that it will operate once and stop at step 005.

LBL A, 1, F?3, GTO A

To prove the point, key in the program and run it by pressing [A]. Now switch to W/PRGM and it may be seen that step 005, R/S, has been done and the program has stopped. So what's the problem? Well, it's deceptively simple. Try to get the same result by stepping through the program; i.e., switch back to RUN, press [GTO] [A] and single-step through the program. This time flag 3 is always set and the program continues in a never-ending loop. The reason appears to be that the numerical entry appears in the display under SST conditions, and the calculator cannot tell the difference between a program-generated and keyboard-generated number, so flag 3 is set whenever any number appears in the display in SST mode. If the number is deleted from the program it will operate in the same way *in either mode*, so the problem is isolated to any number (except pi).

The point to be made is obvious and may explain the difference in SST vs RUN modes. The cure is to clear flag 3 after a program-generated number appears so that the operation becomes the same as if the RUN mode was in use.

When this omission was caught, we initiated a change in the handbooks and sent the change to our printer so that future copies will be correct. You can correct your handbook by adding the following statement in your handbook. HP-67 owners can add the statement at the bottom of page 257 and show it as an insert after the second paragraph under "Test-Cleared Flags" on page 256. HP-97 owners can add the statement at the bottom of page 235 and show it as an insert after the first paragraph on that page. The statement is:

"Note that flag F3 is also set if the SST key is used in RUN mode to single step through a program that contains digit entry, and it is set *as soon as the step containing the digit is reached.*"

Shorter And Faster

It is not unusual for someone to eliminate a few steps from a program or routine—even one of ours. It is *very* unusual for *anyone* to eliminate half—or more—of the steps in a subroutine! But **Gustave Kutzko** of Cincinnati Ohio, has done just that, as follows.

Dear Sir,

I could not resist the urge to modify the subroutine, shown on page 9 of the Vol. 1 No. 1 HP KEY NOTES, which avoids the problem of division by zero when computing the tangent (y/x) and returns arctangent (y/x) in "conventional" notation ($-90° \leq \theta \leq 90°$). The following routine will accomplish the same result with 11 fewer HP-67/97 program steps and (at least) one less trigonometry function evaluation.

LBL 1	RTN
x = 0	LBL 0
GTO 0	→P
÷	R↓
TAN^{-1}	RTN

In marine navigation problems, one defines the sense of East longitude and East meridian angle ("t") as negative. Deriving equations for longitude and azimuth (heading) in the form

$$\theta = \arctan(y/x),$$

with y and x being independently derived, lets one use R→P to compute the numerical value of the angle with the proper sense and with $|\theta|$ less than 180°. For example, in the HP-65 Navigation Pac 1 program, NAV 1-10A, *Great Circle Navigation,* the computation of H_i (initial heading) can be shortened by 9 HP-65 steps.

Incidentally, several days after we received the above letter, we received another one from **G.D. Van der Starre** of Nootdorp, Holland. He also arrived at the shorter subroutine shown above. *(P.S. Mr. Van der Starre, we will answer your Math Pac question in a letter. Ed.)*

Last Chance For Bargain HP-65 Pacs*

We still have some leftover "used" HP-65 application pacs. By "used" we mean that they have been on dealers' shelves and were traded back to us for the new HP-67/97 pacs, or they are some pacs returned to us on our 15-day free trial offer. Although these are all officially "used" items, *they will be covered by our same Full One-Year Warranty that covers any new calculator or software pac.* (Warranty available on request.)

In fairly good supply are:

00065-67001 Math Pac 1
00065-67002 Math Pac 2
00065-67003 Surveying Pac 1
00065-67004 Medical Pac 1
00065-67005 Statistics Pac 1
00065-67007 E.E. Pac 1

In fairly limited supply are:

00065-67042 Aviation Pac 1
00065-67045 Navigation Pac 1
00065-67050 Chem. Engrg. Pac 1
00065-67051 Stress Analysis Pac 1
00065-67052 Machine Design Pac 1

All other "used" pacs have been sold and are no longer available. You can, of course, still buy *new* HP-65 application pacs, and these will be available for quite a while.

ORDERING INFORMATION

All the "used" pacs listed above are priced at $19.95 each. To order them, use the product name and accessory number and send your order to *Order Processing* (U.S. address on back cover). Make your check or money order payable to *Hewlett-Packard,* and be sure to include your state or local taxes.

**This offer is good only in the United States (including Hawaii and Alaska).*

A Note About "Key Notes"

Because there was a 6-month gap in the changeover from HP-65 KEY NOTE to HP KEY NOTES, a lot of people write to ask us if they missed an issue. Specifically, we get many requests for the "November 1976" issue.

To save you the trouble of writing and to save us much time, here is a listing of all newsletters released to date. *None, except the last one, are available.* All back issues have been depleted, and it is not economically feasible to reprint them.

HP KEY NOTES, January 1977, Vol.1, No.1
HP-65 KEY NOTE, July 1976, Vol.2, No.3
HP-65 KEY NOTE, Winter 1976, Vol.2, No.2
HP-65 KEY NOTE, Autumn 1975, Vol.2, No.1
HP-65 KEY NOTE, Summer 1975, Vol.1, No.5
HP-65 KEY NOTE, Spring 1975, Vol.1, No.4
HP-65 KEY NOTE, Winter 1975, Vol.1, No.3
HP-65 KEY NOTE, Autumn 1974, Vol.1, No.2
HP-65 KEY NOTE, Summer 1974, Vol.1, No.1

Another thing we want to clarify is that HP KEY NOTES does *not* have a fixed schedule. It is our desire to print it quarterly, but many factors can influence that schedule. For example, if we print 12 pages per issue, three times a year, we give you 36 pages of information and save one-fourth on postage (not a small factor today). If we print quarterly, in 8-page issues, you get only 32 pages per year, and our postage costs skyrocket. Considering that we have printed *well over* 2.5 million *pages* of the newsletter since its beginning, the cost is something that cannot be easily overlooked.

We know that you enjoy HP KEY NOTES, so we make every effort to send it to you as often as possible. After all, it also helps us to remind you that HP cares about you—even *after* you've bought our products.

HP-65 "Digs Up" A New Field

Ever on the alert for new or unique applications for our calculators, we traced down this one submitted by our sales office in Albuquerque, New Mexico. It seems that the HP-65 has entered the field of archeology.

If you—or a colleague—are at all interested in archeological research, you will want to read an article, "Programmable Pocket Calculators: Some Archeological Applications," in the March 1977 issue of *Newsletter of Computer Archaeology*. The author of the article is **Landon D. Smith,** who is with the USDA Forest Service.

The article discusses the use of programmable calculators/computers in the field of archeology. The context of the discussion centers around the use of the HP-65, describes its characteristics, and includes some programs written for specific tasks that would be of particular interest to the archeological profession. Also stated is the fact that the HP-65 was found to be a very versatile instrument and that it is recommended for use in the archeological profession. *(However, anyone considering a programmable calculator, today, for this application should first investigate the HP-67 or HP-97. They are much more "powerful" than the HP-65 and therefore capable of being more easily utilized for archeological work. Ed.)* The newsletter mentioned above is edited by **Sylvia W. Gaines** and is published by:

Department of Anthology
Arizona State University
Tempe, Arizona 85281

The newsletter is published quarterly. Back issues can be obtained at cost.

99 Is Really 59

Some people wrote to us about **Bob Edelen's** HP-65 f→D.MS and f^{-1}→D.MS routines on page 10 of the January 1977 HP KEY NOTES. Here is one letter, from **John Ball** of Harvard, Massachusetts.

Try converting 1°99989 to D.MS using the routine in HP KEY NOTES. The correct answer is not 1°99'99."6, but rather 1°59'59."6. This difficulty occurs with a borrow across the second-minute or minute-degree boundary. I don't know of any short fix.

So we checked with Mr. Edelen, and he sent the following letter to us. It clears up the mystery.

Dear Editor:

I checked the routine on many values and did not ever use a value that caused dd.9999nnnn to appear. I see now how it occurs. Also, John Ball missed the other times that this anomaly will occur. It does so not only on angles less than ½ second below an integral number of degrees but also on angles less than ½ second below an integral number of minutes. For example; 4.216583 degrees goes to 4 degrees 12 minutes 99.6988 seconds. Thus it can be seen that the routine is okay to use as long as one realizes that 99 minutes or 99 seconds means 59 of either one. Obviously, one uses the routine for output only, and the result of the conversion will not be used as input to a computation. I think the routine is a good one, because it is short and fast. All we need do is tell the Users about the 99 to 59 interpretation.

Thank you, Mr. Edelen, for clearing up this problem. We, too, think the routines are good, and we hope this puts this subject to rest.

"Equation Keystrokes" Follow-On

The people who commented on **C. Ray Kolker's** "Equation Keystrokes ONLY!" article in the last issue certainly did enjoy reading it. And we can assure you that Mr. Kolker enjoyed working with us on the project, and that he received a lot of personal satisfaction from seeing his idea in print. Here is a letter about the article.

Dear Sir:

I was fascinated with the "Equation Keystrokes Only" concept in January *KEY NOTES*. As a 65 owner, I found a few parallels that wouldn't surprise any other member of the HP-65 Users Club. Let me add a suggestion that, in the hands of a 67 programmer, might make the "logical skeleton" even more compact.

Using the multi-level subroutine capability along with the index I, one might have one subroutine serve programs A, B, C, . . . With a little more squeezing and index I, one might even manage to get all the LBL1, LBL2, LBL3 segments in a single sequence. Though this might cost steps, it might also allow merging of the skeleton program with a variety of separate equation keystroke sets kept on different cards.

Yours very truly,
Dr. Jack Schwartz, Nashua, New Hampshire

Conversion Caution

Here is another consideration to keep in mind if you convert HP-65 programs for use on the HP-67/97.

In the January HP KEY NOTES, we ran an article on page 3: "Converting HP-65 Programs To The HP-67/97." An additional cau-

GTO page 12

tion, *A GSB command will enable the stack lift,* should be added to the use of item 4, regarding conditional branching.

Many HP-65 programs, lacking a conditional to compare x with zero, used a CLX, followed by an x–y conditional test. On the HP-67/97, if such a conditional has a GSB command as one or both of its alternatives, the stack lift will be enabled. Subsequent number entry in the subroutine will preserve in the stack the (unwanted) zero that resolved from CLX. The example shown is from the *HP-65 Surveying Pac 1* (see pages 104, 105).

HP-65

```
CLX
g    x>y
3 ⎫  Adds 360
6 ⎬  if test met;
0 ⎬  adds 0 if
+ ⎭  test not met.
```

ORIGINAL CONVERSION	MODIFIED CONVERSION
HP-67/97	HP-67/97
CLX	x<0?
x>y	GSB 0
GSB 0	.
.	.
.	.
.	.
LBL 0	LBL 0
3 ⎫ Number entry	3
6 ⎬ after stack-	6
0 ⎬ enabling GSB	0
+ ⎬ will carry un-	+
⎬ wanted 0 from	
⎭ CLX into stack	
RTN	RTN

Remember: When converting programs from the HP-65, making full use of the power of the HP-67/97 will prevent this problem.

One-Step Program Runs Forever

For an HP-67/97, what is the shortest, longest-running program possible? Well, since you asked the question, here is the answer. However, be prepared to watch your HP-67/97 display blinking . . . forever!

The program is, simply: GSB (i), or GTO (i), and store –224 (or –224 × n, where n is a positive integer, n < 4) in the I-register, for execution. The keystroke sequence is: switch to W/PRGM and press f CLPRGM GSB (i). Then switch to RUN and press: 224 CHS STO I RTN R/S.

Rounding The HP-67/97 Display

Here is a 26-step routine that most HP-67/97 Users can apply to their programs if they have trouble in rounding the display.

Dear Editor:

There are many times when, while writing a program, I want to change the rounding of the display to display the exact number of decimal places necessary to show the whole number, without trailing zeros or truncating and rounding off the display. I find this subroutine very useful, and I believe that many HP-67/97 Users will find it just as beneficial.

```
f LBL 1      x          GTO 4
DSP 0        f ISZ      f LBL 3
f FIX        g FRAC     9
0            f x ≠ 0    h ST I
h ST I       GTO 2      f LBL 4
RCL 1        9          DSP (i)
f LBL 2      h RC I     RCL 1
1            g x > y    h RTN
0            GTO 3
```

It is important to note that this subroutine assumes that there is a value stored previously in register 1.

Sincerely,
Gary M. Tenzer,
Pacific Palisades, California

On Marking Cards

It is not our policy to promote pen, pencil, or marking products that can be used to annotate information on blank magnetic cards. However, over the past three years, some products seem to have emerged as the most popular ones with HP-65/67/97 owners.

After many letters about one product, a telephone call from **Stanton Perry** of Riviera Beach, Florida, prompted us to bring you the following summation.

Most people are satisfied with pencil markings for everyday use. Some use pencil and then spray their cards with a clear "fixative" to keep the pencil marks from smudging. The next choice is a wide variety of soft-tipped ink pens. Some are better than others. We have not found one better than the No. 3000 Sanford's *Sharpie** soft-tipped pen.

Another favorite, especially for small, virtually permanent lettering, is the capillary type of pen used by artists and for drafting, etc. The point is a small tube, and the ink is a virtually permanent, water-soluble type that is usually black. There are several brands of capillary pens and several brands of ink. Stanton Perry uses this method and finds it superior to all other markers.

Finally, some people use "rub-on" lettering. It comes in a nearly endless number of sizes, type faces, and even colors. These letters, however, *can* come off, but many people use them and have no trouble with them.

It is also interesting to note that quite a lot of people write to us and tell us they have no trouble at all marking their cards. But they don't mention how they do it or what they use. And, inevitably, the last question is: what do *we* use to mark *our* cards? Well, three methods prevail. Mostly we use pencils. Often-used cards get the soft-tip pen treatment, and for neat, small lettering, the capillary pens are favorites.

**Sharpie is the registered trademark of the Sanford Corporation, Bellwood, Illinois.*

HP KEY NOTES

June 1977 Vol. 1 No. 2

Programming and operating tips, answers to questions, and information about new programs and developments. Published periodically for owners of Hewlett-Packard fully programmable personal calculators. *Reader comments or contributions are welcomed. Please send them to one of the following addresses.*

Hewlett-Packard Company
Users' Library
1000 N.E. Circle Boulevard
Corvallis, Oregon 97330 USA

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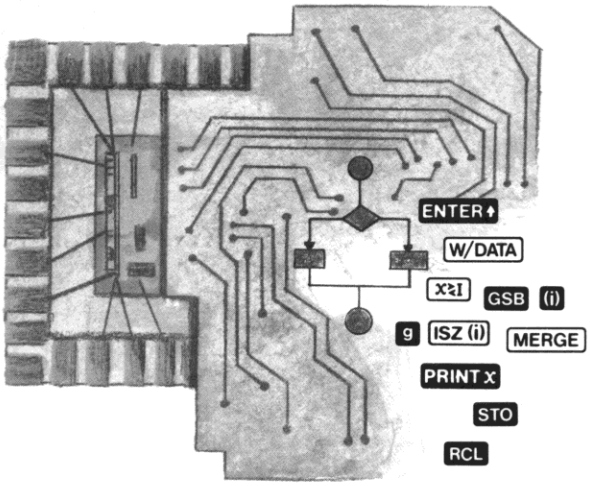


HEWLETT hp PACKARD

HP Key Notes

October 1977 Vol. 1 No. 3

Here Come the Solutions!

For some time now, some of you have been asking us, "Why don't you put together, from the many Users' Library programs, small booklets that would contain several programs on one subject, so you could offer your calculator owners a substantial savings over *separately* buying each program?" As you can see, we did it.

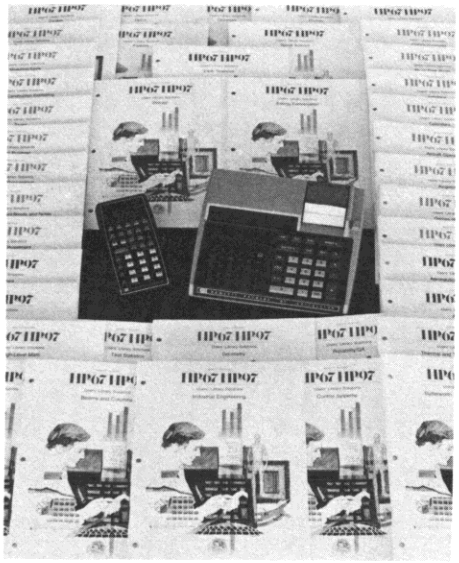
Out of the seemingly inexhaustible files of the HP-65 and HP-67/97 Users' Libraries, we have put together an impressive array of over 450 programs in a series of 40 books of programs for the HP-67/97. And, with the benefits to the calculator User in mind, these books have been named *Users' Library Solutions*.

Each book has between 60 and 70 pages and a number of programs ranging from 10 to 15, which would cost $30 to $45* if bought separately from the Users' Library. The books measure 8½ by 11 inches, and they are staple-bound and three-hole punched to facilitate collection in loose-leaf binders. Regardless of size or content, each book has a retail price of only $10*. They do NOT include any pre-recorded or blank magnetic cards.

Elsewhere in this issue you will find a complete listing of the books and the programs in each book. As you will see, the books cover a large number of specialized fields—from Real Estate to Space Sciences, to Portfolio Management to Taxes to Chemistry ...and much more. There is something for everyone—even Home Management, Astrology, and the usual Engineering and Mathematics. The list—as you will see—is unbelievably complete.

Most HP dealers are stocking these new products. If your dealer is out of stock, use the order form that you will find in this issue of KEY NOTES. Now you won't have an excuse to *not* order copies for your spouse, for your college-bound children, for your early Christmas shopping list. (However, the order blank is good only in the Continental U.S.A., Alaska, and Hawaii. In all other areas, you can get these books from your local HP dealer.)

(*U.S. dollars. See note on bottom edge of Cover.)



Let's face it; these books are one of the few bargains available in our inflation-ridden world. For instance, take a look at *Taxes* (00097-14004). How much do you pay someone to do your Federal Income Tax form each year? It's a snap to do it yourself with the aid of this book and an HP-67 or HP-97. Then buy 00097-14009 or -14010 or -14012 and build into a fortune the money you saved on your taxes. (Well, it's a *start*, anyway!)

Do you like challenging calculator games? Or—are you contemplating starting a photographic darkroom? Going into a small business? Learning more about Forestry? You'll find programs for all those—and more—in the listing.

But the biggest bargain is the *time* you will save by not having to write, edit, check, and recheck your own programs. Think about it: Would you write 15 complex programs on a difficult subject for the sum of $10?? We both know the answer.

And, finally, we extend our congratulations to those authors whose programs were selected for the *Users' Library Solutions* books. In particular, the following authors deserve special recognition for their many programs:

Eric Isaacson
Howard B. Kutner
Chet Langin
Bruce Murdock
Dr. Richard C. Rodgers
Rex H. Shudde
Dave Stedman

But special congratulations are due for one author because only one *Users' Library Solutions* book (COGO-Surveying) was compiled *entirely* from the programs of one author. He has appeared before in HP-65 KEY NOTES, and we are pleased to present him again: **Carl M. King** of Sarasota, Florida.

Library Corner

You have already seen on the cover the big news from the Users' Library. But, for HP-67/97 owners, there is even more good news *below* about the Addendum to the HP-67/97 Library Catalog. And, as we told you in the last issue, there is news here about the final Addendum to the HP-65 Users' Library Catalog.

HP-65 LIBRARY NEWS

Bound in this issue (except European version) you will find an *Addendum Request Form* for the final Catalog Addendum for the HP-65 Users' Catalog. If you are an HP-65 owner and want the latest listing of programs, be sure to carefully read the form and order only the addendum you need.

As of September 6, 1977, there were 5,451 programs logged into the HP-65 Users' Library in Corvallis, Oregon.

HP-67/97 LIBRARY NEWS

By the time you read this, *Addendum No. 1* to the HP-67/97 Users' Library *Catalog of Contributed Programs* will be in the mail to you *if you are a subscriber to the Library in Corvallis, Oregon*. This new Addendum contains 723 new HP-67/97 programs that have been accepted into the Library. The programs are numbered from 00195D through 00917D. These programs cover an absolutely staggering variety of applications and can be invaluable to any HP-67/97 owner. If you haven't as yet subscribed to the HP-67/97 Library, now is a good time to join. Remember: The subscription fee entitles you to three free programs of your choice, and now you have some fantastically good programs from which to choose.

ORDERING PROGRAMS

Any program you see in HP KEY NOTES can be ordered from either the Users' Library in Corvallis, Oregon, or from the Users' Library in Geneva, Switzerland. (Both addresses are on the back cover.) For most of the world, use the program number listed next to the program's title, then order it from Corvallis. The only exception is if you live in the European areas; in that case, *use the number listed in italic type below the program abstract,* then order it from Geneva.

Payment for programs must conform with the instructions from *your* Library area. **Always use order forms if possible** and be sure to include any state or local taxes.

SUBMITTING PROGRAMS

If you submit programs to the Library and use an HP-97 to list the program steps on tape, you know that it saves a lot of work and makes very legible copy. However, we would like to ask a favor of you. Please submit the tapes *as soon as possible* and try to keep them from direct exposure to fluorescent lights or sunlight. If left too long in an exposed state, the blue markings start to fade. Then, when we try to photocopy the program to send it out on an order, the listing is barely legible, and we have a disconcerted customer.

NEW HP-65 PROGRAMS

Here are two new HP-65 programs that have long been requested but never written. If you own the HP-65 *Navigation Pac 1,* you will want to add these programs to your pac. The programs referenced in the following abstract (00510A, 00512A, 00514A) correspond to programs NAV1-14A, NAV1-16A, and NAV1-18A in *Navigation Pac 1.*

We owe a note of thanks to the author for programming and documenting something that fills a void felt by many people.

1977-1978 Sun Almanac (#05453A)*

A program that computes the sidereal hour angle and declination of the sun and stores them for use by the "Almanac Positions" program (NAV1-18A). This program also computes the equation of time, which is used by the "Sunrise, Sunset, and Twilight" program (NAV1-16A). This program is intended to be used with programs 00510A, 00512A, and 00514A. (198 steps)

Author: **John F. Belsher, III**
San Jose, California

**In European areas, order by number 51643A.*

1978-1979 Sun Almanac (#05452A)*

This program is the same as the previous one except that it is for the year 1978-1979.

Author: **John F. Belsher, III**
San Jose, California

**In European areas, order by number 51644A.*

NEW HP-67/97 PROGRAMS

Here are some of the latest programs submitted to the Library. If you are not a subscriber, just think of all the good things you are missing in the other 723 programs in the new Catalog Addendum!

Before you order any of these programs, be sure you read the paragraph (above) on Ordering Programs.

67/97 Area Navigation (RNAV) by VOR or ADF (#01151D)*

This program provides area navigation (RNAV) capability to the general aviation pilot equipped with as little as a single very high frequency omnirange (VOR) [or automatic direction finder (ADF)] receiver and a stopwatch. Map planning (Card 1) done prior to flight using enroute Low (or High) altitude aeronautical charts permits use of up to 10 VOR's and pilot-selected way points. Navigation (Card 2) is performed by making position reports (radials from two VOR's and time); by updating winds aloft; and by estimating ground speed, heading, and ETA (estimated time of arrival) to any of the 10 VOR's and way points. The pilot may add or change way points during flight. Inflight recovery of the program following a mistake or a calculator battery change requires reading only 1½ cards. (358 steps)

(If you are a pilot and do not have a program such as this, here's a chance to acquire a superb program and, at the same time, save yourself a whole lot of time and effort. Why? Because, in 14 pages, the author has done an outstanding job of documenting/programming on the HP-67/97 a complex navigation application. A fine job! Ed.)

Author: **James S. Hayden**
Edwards, California

In European areas, order by number 00229D.

67/97 Telephone Cost Timer (#01204D)*

The Telephone Cost Timer will turn any HP-67 or HP-97 into a telephone timer that will, when started at the instant the called party answers the phone, alternately give a pause readout in dollars and cents (with tax included or not included), and a pause readout displaying the remaining seconds of talking time at that cost. These two alternately shown outputs will continue until the phone conversation is completed, at which time, the R/S key must be pressed to stop the timer. The Telephone Cost Timer may be used at a pay phone or at home or the office, and with the operator's assistance or when dialing direct. (251 steps)

(Don't hang up! There's more! This is a clever program. And if you spend a lot of time on the telephone, this program could save you a considerable amount of money in one year. It will even accept calls over $99.99 and calls that exceed 99 minutes. The second card is a Clock Adjuster so you can "adjust" your calculator to be an accurate timer to time your calls. In fact, there is very little about a phone call that this program will NOT tell you... except, the telephone number to dial. And we had that *program in the last issue! Kudos to the author for 13 pages of superior documentation/programming. Ed.)*

Author: **Malcolm T. Herbert**
San Diego, California

**In European areas, order by number 00230D.*

67/97 Sunrise/Sunset (#01144D)*

Given the latitude, longitude, and date, this program computes the standard time of sunrise, sunset, local apparent noon, and astronomical, nautical, and civil twilight. (411 steps)

(Here is another terrific program. The author has even included two typewritten pages of documentation to make sure the program can be thoroughly understood and successfully

used. Accuracy is excellent: In 75% of the cases computed by the author, times are only either 0 or 1 minute in error. Only at high latitudes (over 50°) are errors of 2 or 3 minutes common. Ed.)

Author: **Jim Fremont**
Detroit, Michigan

**In European areas, order by number 00231D.*

67/97 Hohmann Transfer Orbit with Plane Changes (#01230D)*

This program is used to compute orbital velocities, angles, and periods using a Hohmann transfer orbit from a parking orbit (which may be elliptical) to a final orbit (which also may be elliptical). Plane changes may be made at perogee and apogee. In addition, the vis-viva and orbital period equations are directly accessible. (200 steps)

(Very well done! While not of universal interest (no pun intended), here is a program on a subject that has fascinated many people in many walks of life. And, although all units are in feet per second etc., metric units can easily be used by modifying three steps. Ed.)

Author: **George J. Andrews**
Los Angles, California

**In European areas, order by number 00232D.*

More About Converting HP-65 Programs

Most of you who have HP-65 programs have already converted them if you own an HP-67/97. But a few people—probably those who were not familiar with the HP-65—still have problems while converting programs. So here are two more things to keep in mind, based on questions we have gotten on the telephone and in the mail.

1. If digit entry occurs immediately after a programmed [R/S], the number displayed on the HP-65 is overwritten and stack lift does not occur. This is not true for the HP-67/97.
2. The function, ⇌H.MS, does not operate the same as ⇌D.MS. The HP-65 converted D.MS inputs to decimal equivalents of the angle in the trigonometry mode to which the calculator was set (i.e., 30° 30′ was automatically converted to 0.5323 radians upon pressing [f] [→D.MS] when the HP-65 was set in RAD mode). The HP-67/97 does not operate exactly this way. Pressing [f] [H→] (67) or [f] [H.MS→] (97) converts the angle to the decimal *degree* equivalent regardless of the angular mode setting. Therefore, if the angular mode setting is other than DEG, you must subsequently convert the decimal degree to the proper equivalent ([D→R] for RAD, multiply by $\frac{400}{360}$ for GRAD). Of course, the inverse operations also behave in the same manner, so outputs must be converted back to degrees before pressing [→H.MS].

Stock Control With An HP-97

If you have even a remote responsibility for stocking parts, inventory control, and so forth, you will be interested in the application presented here. It was brought to our attention by an HP Field Engineer in one of our sales offices. The article appeared in the July 15, 1977, issue of Sandia Laboratories' *LAB NEWS* newsletter. The article is printed here for the benefit of our HP KEY NOTES readers; it is not an endorsement of HP products by Sandia Laboratories.

FANCY CALCULATOR EASES STOCK CONTROL

Stock control is a problem that can strike terror into the hearts of grown persons. The usual solution is an elaborate computerized system. But **Paul Benson** of Satellite Systems Tests and Operations Division 1247, thinking small, adopted a Hewlett-Packard Model 97 fully programmable printing calculator to handle his division's stock control.

The division maintains a stock of a thousand different types of high reliability, flight-qualified parts with a value approaching a million dollars. The parts are used in fabricating and modifying as many as 10 satellite (or satellite-related) projects simultaneously. Most of the projects are on short time scales. The division works with other labs, such as LASL on the Venus Orbiter program, and with the services: for example, the Air Force on the Vela and Radec programs and the Army on the Nuclear Burst Detector System.

If a part fails on any project, it's necessary to trace the part from system back to manufacturing lot. That's where the problems arose: many parts many lots, and several people pulling what they needed from the parts bins and *usually* writing down how many they'd pulled from which lot for which project.

While watching his son Howard, a pocket calculator fanatic attending UNM, manipulate the small (1 × 7 cm) magnetic data cards on his HP-67 programmable pocket calculator, Paul conceived the idea of using the magnetic cards as "bin" cards to keep records of each type of part. An HP-97, which has a print-out capability, seemed the best choice for the task. Howard, who is highly skilled in programming these calculators, made it an efficient working system.

Now, when a new parts lot arrives for testing, a data card is prepared by keying in the information on the HP-97's keyboard. The card contains part identification, date code, and the current balance-on-hand (the number of parts in the arriving lot).

Whenever parts are withdrawn, Paul keys in the quantity and the project code (if different from the last withdrawal). The program then records automatically the entire transaction on the data card: identification of the part, date code, project it will be used on, current date, and the new balance-on-hand. "Accurate and up-to-date totals of stock on hand is one of the system's advantages," says Paul. "Another is the speed with which transactions can be recorded—it's much faster than the old hand-written lists."

"Still another is the ease with which summary information can be secured. It's a simple matter to have the calculator print out a listing from the cards of the parts used on any of the several active projects."

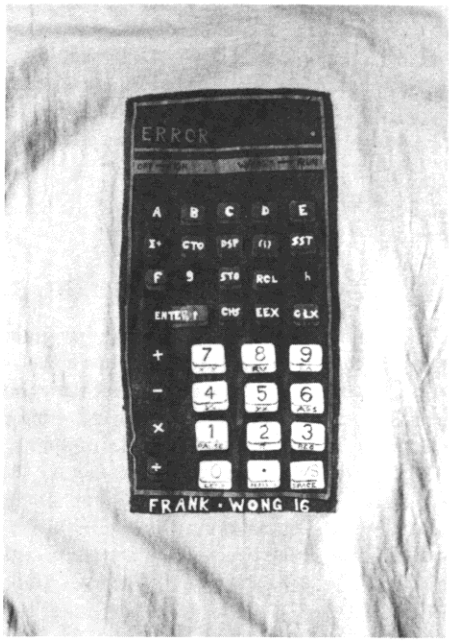
"Finally, the system is completely self-contained and portable—it's battery powered. And it's cheap compared to a remote computer terminal and its associated software."

8-Hour T-Shirt!

Anyone who reads the newspapers, watches TV, reads magazines, or even looks around today, knows that we are going through a T-shirt craze. Here's a letter and photo from Hawaii to prove it!

Dear Sir:

I think you will find this story and the enclosed photograph quite amusing. First of all, I own an HP-67 and, just recently, I had my sixteenth birthday. For my birthday, my friend, **Leslie P. Luke,** created an HP-67 T-shirt! He created this marvelous design by first coloring the shirt with india ink to make a dark body. Then, all of the calculator keys, **Error** display, functions on the keys (i.e., GTO, CHS, EEX, etc.), and trimming were hand-cut out of "iron-on" patches. Leslie then "ironed" them onto the shirt. This took him a total of 8 hours of hard work!



Although it may not be too clear, he has all of the "h" functions in their proper places. However, Leslie did not put in the "f" and "g" functions, simply because there was no room for them.

It should be noted that Leslie did not know about the HP-25C "cake" that was shown in a previous issue of KEY NOTES.

I hope you have enjoyed this story and photograph and will share it with other "HP" owners in a future issue of KEY NOTES.

Sincerely,
Frank A. Wong

We certainly did enjoy it, Frank. But did Leslie *have* to pick **Error** for the display? He could have used something more "positive!" Anyway, thank Leslie for us and...Happy Birthday!

Two More Pacs Released

Since the last issue of KEY NOTES, two more HP-67/97 Application Pacs have been completed and released for sale. They are *Navigation Pac* 00097-13205 and *CE PAC* 00097-13195.

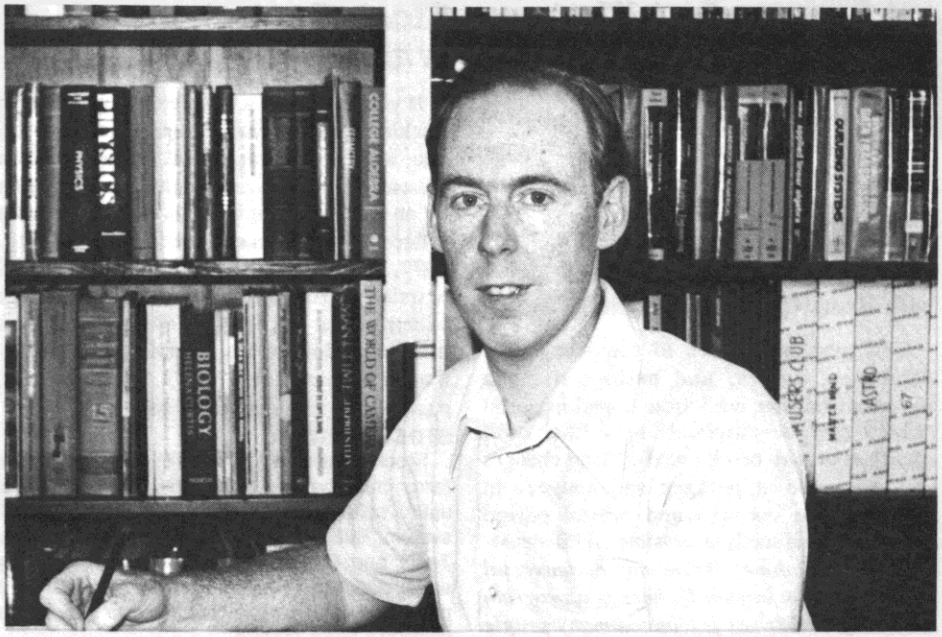
The Navigation Pac contains 14 programs ranging from "Estimated Time of Arrival" to "Dead Reckoning" to the unique self-contained "Sun Line of Position," which includes a perpetual almanac and sextant corrections *all on one card*. A special set of well-integrated position-fixing programs allow you to use both celestial navigation and piloting techniques to determine your position. If you own a boat—or a ship—you won't want to miss this excellent pac.

The Civil Engineering Pac contains 18 programs ranging from "Section Properties" to "Bending or Torsional Stress" to programs for all types of beams, including "Reinforced Concrete Beams." And it ends up with "Bolt Torque." All in all, a *tour de force* in sections, stress, deflection, moments, shear, deformation, and lots more.

As do the others, these two new pacs come complete with a detailed manual, prerecorded magnetic cards, and a handy magnetic card holder. The pacs are priced at $35* each.

Now you have two more ideas for back-to-college presents—or for those hard-to-buy-for people on your early Christmas shopping list.

*(*U.S. dollars. See note at bottom edge of Cover.)*



William M. Kolb

On Understanding Flags

For many thousands of people, programming a personal calculator has become a way of life—or at least an everyday part of their job/position/profession/hobby. Of all the things that must be learned to be able to program a programmable calculator, it seems that the use of "flags" is the toughest stumbling block. The Owner's Handbooks for the HP-67/97 explain **how** to use flags, but it is not possible to cover every application in the handbook. Therefore, we bring the following letter and article to your attention.

Dear Editor:

As pointed out by **Chris Johansen** in the January 1977 HP KEY NOTES, flags may be used in not-so-obvious ways to improve your programs. As a start toward eliminating some of the mystique that surrounds programming with flags, I prepared the enclosed article for the *HP-65 Users Club*. Feel free to use whatever you think is of value to KEY NOTES readers.

It should be pointed out that the logic table described is to be used only after the programmer has determined that he/she wants to skip or not-skip, depending on the test to be applied. It does not, for example, solve the problem of adding the negative value of x to register R_1 if the flag is set or of adding zero to R_1 if the flag is not set. The programmer must work out this part of the code first. Should the programmer try CLX, CHS, STO + 1, then he/she will require flag logic that skips one step when the flag is set. The table provides the following solutions:

F3?
F3?
CLX
CHS
STO + 1

Had the programmer tried STO − 1, the flag logic would skip one step if the flag were not set. Referring to the table for this simplest of cases, the code would be:

F3?
STO − 1

Please continue with the high quality material published in KEY NOTES; it has come a long way since the HP-65 was first introduced.

Sincerely,
William M. Kolb, Annapolis, Maryland

FLAG LOGIC FOR HP-67/97

Flags are often very useful and powerful tools for programming. This is especially true of the test-cleared flags found on the HP-67/97. All too often, however, the programmer is uncertain of how these can be used to advantage without wasting a lot of time checking for an unwanted branch condition. The following discussion is intended to illustrate some of the many ways flags can be used to shorten a program and to help you choose the best code on the first try.

A basic problem that is sure to be encountered when converting an HP-65 program to run on the HP-67, is how to skip two steps instead of one when a flag is not set. Compare the following solutions:

HP-65	HP-67 (good)		HP-67 (better)
TF1	F1?	LBL 0	F1?
1	GSB 0	1	1
+	.	+	F1?
.	.	RTN	+
.	.		
.	.		.
.	.		.
.	.		.
(3 steps)		(6 steps)	(4 steps)

The procedure used here was to test twice with the same flag to obtain the extra step required. Extending this concept, you could test three times to obtain three steps, or four times to obtain four steps. No steps are saved, however, by testing four or more times in lieu of using a label.

In some cases, the same idea can be applied to relational tests. The following examples illustrate several ways a test on the HP-65 might be coded on an HP-67:

HP-65	HP-67 Using Labels		HP-67 Using Flags	HP-67 Special Case
x>y	x>y	LBL 0	x>y	x>y
1	GSB 0	1	SF0	1
+	.	+	F0?	x>y
.	.	RTN	1	+
.	.		F0?	.
.	.		+	.
.	.		.	.
.	.		.	.

Note that the special case is used only if x is always less than one. This limitation can be avoided by using flags but results in the same number of steps as using a label. This could be important if you cannot spare a label or you have an iterative loop where the extra time required to execute a label can add up.

Another useful technique involves the use of complementary functions. Suppose you must subtract x from y if F0 is set and add x to y if F0 is not set. The simplest way to do this is:

F0?
CHS
+
.
.
.

The same technique can usually be extended to relational tests as well, by substituting the appropriate relational test for F0. If, for example, you want to divide by x when x is greater than y and multiply otherwise:

x>y
1/x
x
.
.

Whenever this process leaves x unchanged, the following approach using complementary functions will usually shorten the program without resorting to labels. In the first example, x is added to R1 when F0 is set and to R2 when F0 is not set. In the second example, x is added to R1 when F0 is set and multiplied by R1 when F0 is not set.

F0?	F0?
STO + 1	STO + 1
STO + 2	STO × 1
F0?	F0?
STO − 2	STO ÷ 1
.	.
.	.
.	.

The procedure used here is to perform both operations if F0 is set and then reverse or complement the second operation. Note also that different registers can be used for the two operations. A further refinement of this technique uses LSTx rather than the complementary function whenever the operation involves only one argument. Suppose we need the SIN if F0 is set and the COS otherwise:

SIN	F0?	F0?
F0?	SIN	SIN
LSTx	COS	COS
F0?	F0?	F0?
COS	LSTx	COS^{-1}
.	.	.
.	.	.

The first routine takes somewhat longer to execute than the second routine, given an even chance of F0 being set. The first two routines both have the slight disadvantage of using LSTx, which returns the wrong argument for −1 when inverse trigonometric functions are used.

The third routine avoids this problem but takes longer to execute than the other two since it involves an average of 2½ transcendental computations per iteration as opposed to 1½. Note that the two operations in this case need not be "complementary"—as the following examples illustrate:

F0?	F0?	F0?	F0?
LN	P⇌S	RCL 0	RCL 0
SIN	Σ+	%	RCL 1
F0?	F0?	F0?	F0?
LSTx	Σ−	LSTx	RCL 0

When using flags in this fashion, it is wise to make sure that the first test is actually necessary. By paying close attention, the first two steps in one of these examples can be eliminated. The tip-off is usually the appearance of repetitive code.

Thus far we have only looked at logic trees involving a single test. In many programs it is necessary to check two or more conditions before the next program step to be executed can be determined. Because of the large number of ways flags can be combined, a programmer may spend considerable time looking for the most satisfactory code. In order to facilitate this search, a table has been prepared listing all of the possible ways two conditions can be tested. The appropriate codes are listed under each of these conditions. The symbols A and B are shorthand for the particular conditions that are to be tested. They might, for example, represent situations such as: x greater than zero, x is within the limit specified, the fact that subroutine three has been called, an illegal move in a computer game, or the game has ended in a draw.

A bar over the letter A($\bar{A}$) means it is not the case that A is true. Now suppose it is necessary to skip a step on A rather than $\bar{A}$, as is normal for the HP-67. Find the non-skip case for condition $\bar{A}$ and use any of the routines listed. When more than one routine is listed, the programmer must exercise some judgement. For the case just described, the second routine will produce a skip on F0, which is not a test-cleared flag. Thus you might choose this implementation if it is necessary to test F0 again elsewhere in the program.

Testing two conditions is somewhat more complicated. If, for example, an iterative process is used to determine where a curve crosses the x-axis, the following logic might be used: Increment x until the value of y changes sign. At this point, divide the increment by four and decrement x until the sign changes again. The procedure is repeated over and over until the result is sufficiently close to zero. The easiest way to determine the logic required for this process, is to state the problem in the simplest terms possible. In this example, the problem can be stated as follows: Whenever the computed value of y changes sign, we have crossed the x-axis and must therefore change both the sign and magnitude of the increment; otherwise we continue to increment or decrement, as the case may be. The two conditions under which we must branch to the routine that changes the sign and magnitude of the increment are (1) when the current value of y is positive and the previous value of y was negative, and (2) when the present value of y is negative and the previous value was positive. Letting A mean that the current value of y is positive and B mean that the previous value was positive, we can symbolize the branch condition as:

(A and $\bar{B}$) or ($\bar{A}$ and B).

That is, we want to branch out of the loop if A is positive and B is not, or if B is positive and A is not.

(Continued)

FLAG LOGIC

Non-Skip Case / Skip Case	**A / $\bar{A}$**	**$\bar{A}$ / A**	**$\bar{A}$ or B / A & $\bar{B}$**	**A & $\bar{B}$ / $\bar{A}$ or B**	**$\bar{A}$ & B / A or $\bar{B}$**	**A or $\bar{B}$ / $\bar{A}$ & B**	**A & $\bar{B}$ / $\bar{A}$ or $\bar{B}$**	**$\bar{A}$ or $\bar{B}$ / A & B**	**$\bar{A}$ & $\bar{B}$ / A or B**	**A or B / $\bar{A}$ & $\bar{B}$**	**(A & $\bar{B}$) or ($\bar{A}$ & B) / (A & B) or ($\bar{A}$ & $\bar{B}$)**	**(A & B) or ($\bar{A}$ & $\bar{B}$) / (A & $\bar{B}$) or ($\bar{A}$ & B)**
	F0 (A) F0 (A) F3 F0	F3 (A) F3 F0 (A) F3 F0 F3 CF0 F1 (A) F0	F0 (A) F1 (B) F3 (A) F0 (B) F3 F0 F3 (A) F3 F0 (B) F0 F2 (A) F3 (B) F2 F3 F0 (A) F3 (B) SF3 F3	F0 (A) F1 (B) CF0 F0 F3 (A) F0 (B) F3 CF3 F0 (A) F1 (B) F3	F3 (A) SF3 F2 (B) F3 F2 F0 (A) CF1 F1 (B)	F0 (A) F3 (B) F3 F0 F0 (A) F1 (B) F1 F0 F0 (A) CF1 F1 (B) F0	F3 (A) F3 CF0 F0 (B)	F3 (A) F3 SF3 F0 (B) F3	F3 (A) F0 (B) F0 F3 F3 (A) F3 F0 (B) F3 CF3 F0 (A) F1 (B) F1 F3 F0 (A) SF3 F3 (B) F3	F3 (A) F3 F0 (B) F0 (A) SF1 F1 (B) F0 (A) F1 (B) F1 F0 F0 F0 (A) F1 (B) F0 F1 F1 F1 (A) F0 (B) F0 F1 F1	F0 (A) F3 (B) F3	F2 (A) F2 F3 (B) F3 F2 (A) F3 (B) F3 F2 F0 (A) F3 (B) F3 F3
	Normal	**Inverse**					**And**	**Nand**	**Nor**	**Or**	**Exclusive Or**	**Equivalence**

Note: F2 and F3 are Test Cleared Flags.

In some instances it may be easier to program or state the conditions under which you do not want to branch out of the loop. In this example, we would not want to branch to the routine which changes the sign and magnitude of the increment as long as:

(A and B) or ($\bar{A}$ and $\bar{B}$).

When you can translate this last expression into the equivalent English sentence, you will be well on the way toward using the table efficiently. Both of these expressions fit the form F0, F3, F3 in the table, where F0 means the current value of y is positive and F3 means the previous value of y was positive. It is necessary only to add the code that assures these flags are properly set. Note that, in this case, it is superfluous to set F0 when y is positive, since, "X>0" accomplishes the same thing with fewer steps:

```
X>0     A (in lieu of F0?)
F3?     B
F3?
GSB 1   Change sign and magnitude of
        increment, return current value of y.
X>0     If current y is positive, set F3 for next
SF3     iteration.
```

In trying to verbalize a given problem, you may find two seemingly different ways to express the relationship between A and B. The expression (A) or ($\bar{A}$ and $\bar{B}$), for example, is equivalent to saying ($\bar{B}$) or (A and B). Similarly, (A) or ($\bar{A}$ and B) is identical to (B) or (A and B). By keeping these two identities in mind, it will be easier to translate some problems to the symbolic form used in the table. Also note that it is not necessary to always let A and B express the logically true condition. A and B may better express the negative or false condition. In the last example, B could just as well have meant that the previous value of y was less than zero. We would now want to branch out of the loop whenever:

(A and B) or ($\bar{A}$ and $\bar{B}$).

Now it will be necessary to set F3 when the current value of y is less than zero. If the programmer chose to implement the test in this fashion, the program could be written from the table as:

```
X>0
F3?
F3?
F3?
GSB1
X<0
SF3
```

This approach required one more step than the previous routine. In other cases, however, negating one of the conditions can make the problem easier. Suppose, for example, you want to test the value of y to see if it is either positive or zero. Since the calculator does not have a branch when x is greater than or equal to zero, you might let A be the condition that x is less than zero and use $\bar{A}$ for your logic expression. Begin by stating the problem normally:

(1) A means the current value of y is greater than or equal to zero. B means the previous value of y was greater than or equal to zero.
(2) Branch out of the loop whenever (A and $\bar{B}$) or ($\bar{A}$ and B).

Since we are going to test A and B with $X < 0$ rather than x greater than or equal to zero as stated, simply change the sense of A and B wherever they appear in the logic expression:

(3) Branch out of the loop whenever ($\bar{A}$ and B) or (A and $\bar{B}$). Use $X < 0$ to set conditions A and B.

The program can be written directly from the table using $X < 0$ in lieu of F0?.

```
X<0
F3?
F3?
GSB1
X<0
SF3
```

This program is just as short as the original program and now includes zero as a positive number.

A quick look at the table shows that any set of conditions can be tested for either the skip or non-skip option. Alternative tests are listed to give additional programming flexibility. Another point to remember is that ($\bar{A}$ or B) can be exchanged with (A or $\bar{B}$) in the table if conditions A and B are switched with each other in going from one expression to the other. The table can also be used to solve more complex problems involving three or more flags by testing two of the conditions, setting a new flag, and then testing the new flag and the third condition. With a little practice, the table and the techniques described here will allow you to make the most of flag logic in your programs.

Can You Calculate Enthalpy?

Not long ago we received a reprint of an article, "Calculate Enthalpy With a Pocket Calculator," that appeared in the May 23, 1977, issue of *Chemical Engineering* magazine. Because a lot of HP-65/67/97 Users are in the Chemistry business, we felt it important to bring this fine article to their attention.

The article was written by **Raymond T. Schneider,** who wrote the programs in the article. These programs develop a data-base library of component cards from the polynomial heat-capacity data in the general form $Cp = a + bT + cT^2 + dT^3 + e/T^2$, and the standard heat of formation of the compound. Programs are presented for the HP-65 and HP-67/97.

The data-base library is then used, under simple program control, to synthesize a polynomial expression of enthalpy versus temperature for any multicomponent mixture of any proportions in which the physical heat of mixing is negligible.

Additional programs for each calculator solve the resulting polynomial expressions for either temperature or enthalpy, given one or the other. The programs that are presented apply to gases, liquids, or solids, or combinations of any of these, as long as the heat of mixing and the effect of pressure are negligible in the specific application.

But—don't stop reading yet! Mr. Schneider has a limited supply of reprints of the article, and he will send them *to interested chemists who could use the information.* If you request a reprint from a U.S. address, please send a self-addressed business-size envelope with a 13¢ stamp. Outside the U.S., send an envelope at least 22 cm long and include postage to cover 20 grams.

Mr. Schneider has already received inquiries from such places as England, Argentina, and Mexico—not to mention many from the U.S. For a copy of the article, send your request to:

Mr. Raymond T. Schneider
Pridgen Engineering Co.
P.O. Box 2008
Lakeland, Florida 33803

Thank you, Mr. Schneider, for sharing your article with HP KEY NOTES readers.

Check Your Timer

In the HP-65 Users' Library, the all-time best-selling programs were those that converted the calculator into a timer or stopwatch. But not everyone owns a stopwatch or chronograph to accurately check the accuracy of his or her calculator in a timer mode.

Bill Peterson of Chanute, Kansas called us one day to talk about the clever "HP-67 Alarm Clock?" program in the June 1977 KEY NOTES and suggested we tell everyone about the super-accurate time signals (WWV) broadcast by the U.S. Government on short-wave radio broadcasts. *(Good idea, Bill! Ed).* So here is a list of frequencies on which you can hear these time broadcasts. Of course, you need a short-wave radio receiver, but ... maybe you have one and *not* a stopwatch.

Anyway, if all else fails, check the front pages of your telephone directory (at least, in the U.S.). There is usually a number listed to call for the time of day—to the second. And it's nearly as precise as the WWV time signals.

The National Bureau of Standards broadcasts continuous signals from its radio stations WWV, near Fort Collins, Colorado, and WWVH, Kauai, Hawaii. The radio frequencies used are 2.5, 5, 10, 15, and 20 MHz, and also 25 MHz from Fort Collins only. Beside time announcements, services include storm warnings, standard musical pitch, standard radio and audio frequencies, and so on. Voice announcements are made from WWV and WWVH once every minute. The two stations are distinguished from each other by a female voice from WWVH and a male voice from WWV. The WWVH announcement occurs first—at 15 seconds before the minute—while the WWV announcement occurs at 7½ seconds before the minute. Coordinated Universal Time (UTC) (sometimes refered to as GMT) is used in these announcements.

You can obtain more information from:
Time and Frequency Services Section
National Bureau of Standards
Boulder, Colorado 80302

HEWLETT hp PACKARD

LIST OF *USERS' LIBRARY SOLUTIONS* BOOKS

Business

- **Options/Technical Stock Analysis (00097-14009)**
  - Put & Call Option Fair Values (Black-Scholes)
  - Call Option Evaluation
  - Routines for Option Writers
  - Empirical CBOE Call Pricing
  - Warrant & Option Hedging
  - Bull Spread Option Strategy
  - Butterfly Options
  - Stock Price 30-Week Moving Average with Data Storage
  - Exponential Smoothing
  - Multiple Linear Regression
  - Curve Fitting, Selecting Best Function
- **Portfolio Management/Bonds & Notes (00097-14010)**
  - Stock Portfolio Valuation
  - Portfolio Data Card
  - Stock Portfolio Beta Coefficient Analysis
  - True Annual Growth Rate of an Investment Portfolio
  - Convertible Bond Portfolio Premium Evaluation
  - Yield on Call Option Sales
  - Bond Price and Yield
  - Days between Dates
  - Bond Yield to Maturity
  - Interest at Maturity/Discounted Securities
  - U.S. Treasury Bill Valuation
  - Convertible Security Analysis
- **Real Estate Investments (00097-14012)**
  - 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
- **Taxes (00097-14004)**
  - Hourly Payroll
  - Tax Planning I
  - Tax Planning II
  - Federal Income Tax—Joint, Married Filing Separate and Estates or Trust
  - Federal Income Tax—Single (Unmarried) Taxpayers
  - Maximum Tax on Earned Income—1977 & Later
  - Income Averaging Tax
  - Federal Estate/Gift Tax—1977 & Later
  - Federal Estate Tax Credit for State Taxes Paid
  - Estate/Gift Tax Portfolio Valuation
- **Home Construction Estimating (00097-14033)**
  - Concrete Volume
  - Linear to Board Feet Conversion & Costing
  - Framing Board Feet
  - Lumber Estimate
  - Shingle Estimate
  - Wall & Ceiling Estimate
  - Wallpaper Estimate
  - Drywall & Insulation Estimate
  - Sheathing & Subfloor Estimate
  - Painting Estimate
  - Wood Floor Estimate
- **Marketing/Sales (00097-14032)**
  - Forecasting using Exponential Smoothing
  - Financial Trend Analysis
  - Seasonal Variation Factors (SEVAR)
  - Price Elasticity of Demand
  - Experience (Learning) Curve for Manufacturing Cost
  - Breakeven Analysis
  - Income Statement (P & L) Analysis
  - Internal Rate of Return-Groups of Cash Flows
  - Sales Force Requirements
  - Cost & Price Computations
- **Home Management (00097-14031)**
  - Income Tax Planning
  - True Cost of Insurance Policy
  - Automobile Cost/Tire Cost Comparison
  - Comparison Shopping
  - Time & Charges Running Total
  - Reconcile Checking Account
  - Savings Account Compounded Daily
  - Accumulated Interest/Remaining Balance
  - Stock Portfolio Valuation & Data Card
  - True Annual Growth Rate of an Investment Portfolio
  - Diet Planning
- **Small Business (00097-14039)**
  - Hourly Payroll
  - Accounts Receivable
  - Invoicing
  - Account Posting
  - Tabulation
  - Retail Inventory Monitor
  - Estimating Inventory using Cost or Profit Method
  - Inventory Ordering
  - Order Point Calculation
  - Depreciation
  - Amortization
  - Federal Tax
  - Working Capital Needs-Bardahl Formula

Engineering

- **Antennas (00097-14021)**
  - Loaded Vertical Antennas
  - Loaded Dipole Antennas
  - Gain of a Horizontal Rhombic Antenna at Zero Azimuth
  - Azimuth Pattern of Cylindrical Array of Antennas
  - Colinear Antenna Gain & Pattern
  - Beam Pattern for Uniform Array
  - Radar Antenna Beamwidth & Gain
  - Antennas
  - Parabolic Antenna Calculations
  - RF Path Loss, DB
  - Antenna Gain or Power of a Remote Transmitter
  - Planar Phased Array Radar Beam Positions
  - Radar Parameter Unit Conversions
  - (Television) Antenna Length & Channel Frequency
- **Butterworth & Chebyshev Filters (00097-14003)**
  - Butterworth Active Filter Design, Lowpass
  - Butterworth & Chebyshev Filter Response
  - Butterworth & Chebyshev Filter Group Delay
  - Butterworth & Chebyshev Filter Order Calculation
  - Butterworth & Chebyshev Lowpass Normalized Coefficients
  - Normalized Lowpass to Bandpass Filter Transformation for Types 1, 2, 6, & 7
  - Normalized Lowpass to Bandpass Filter Transformation for Types 8, 9, 10, 11
  - Normalized Lowpass to Bandstop, Lowpass, or Highpass
  - Y-Delta Transform for L, R, or C
  - Chebyshev Active Lowpass Filter Design & Pole Locations
- **Thermal & Transport Sciences (00097-14023)**
  - Psychrometric Properties
  - Psychrometric Calculations for Water in Air
  - Equations of State
  - Isentropic Flow for Ideal Gases
  - Saturated Steam Properties
  - Conduit Flow
  - Parallel & Counter Flow Heat Exchangers
  - Energy Equation for Steady Flow
  - Flow with a Free Surface
  - Pipe Slide-Rule
  - Force at Bends & Fittings
- **EE (Lab) (00097-14025)**
  - Wire Table
  - OHM'S Law
  - Reactance Chart (Nine Equations)
  - Coil Calculations
  - Complex Impedance Calculator—AC Circuit Calculator
  - Wye-Delta Transformations
  - RC Timing
  - Series R-L-C Circuit Analysis Program
  - Passive High & Lowpass Composite Filter Design
  - "L" Attenuator (Generator Impedance Greater than Load Impedance)
  - 1% Resistor Value Subroutine
  - Wheatstone Bridge
- **Industrial Engineering (00097-14035)**
  - Discounted Cash Flow/Present Value Analysis
  - Depreciation Schedules
  - Invoicing & Inventory Control
  - Production Monitor & Record
  - Learning Curve
  - x & R Control Chart
  - Single- & Multi-Server Queues
  - Two Way Analysis of Variance with Replications Fixed Effects Model
  - Multiple Linear Regression for 3 Independent Variables
  - Simultaneous Equations in Six Unknowns
- **Aeronautical Engineering (00097-14036)**
  - Properties of Air
  - Theoretical U.S. Standard Atmosphere Temp. & Pressure below 35,332 Ft.
  - Aircraft Flyover Acoustic Tone Doppler Shift
  - Isentropic Flow for Ideal Gases
  - Normal & Oblique Shock Parameters for Compressible Flow
  - Oblique Shock Angle for Wedge
  - Mach Number & True Airspeed
  - Take-Off Run vs. Density Altitude
  - True Air Temperature & Density Altitude
  - Aircraft Climb
- **Beams & Columns (00097-14027)**
  - Compressive Buckling
  - Eccentrically Loaded Columns
  - Reinforced Concrete Beams
  - Concrete Beam Deflection
  - Torsion-Concentrated Load-Steel Beams-(Wind Flange)
  - Torsion-Uniform Load-Steel Beams (Wide Flange)
  - A.I.S.C. Steel Column Formula
  - Concrete Columns Ultimate Strength Design
  - Column Strength
  - Beam on Elastic Foundation with Point Load-Any Location
- **Control Systems (00097-14026)**
  - Frequency Response of a Transfer Function
  - Bode of Transfer Function that has each Pole & Zero Given
  - Bode of Second-Order over Third-Order Transfer Function
  - Bode of Second-Order over Second-Order Times s* *n Transfer Function
  - Pole-Zero to Group Delay
  - Routh Test for Continuous & Discrete Time System Analysis
  - Convert Frequency Response—Open Loop Closed Loop
  - Aid to Root Locus Plots I—Real Poles
  - Aid to Root Locus Plots II—Complex Poles
  - Classical Control Gains
  - First Order Regulator
  - Second Order Regulator

Computation

- **High-Level Math (00097-14011)**
  - Eigenvalues for 3rd Order System
  - Eigenvalues/Vectors of 3rd Order Systems
  - Matrix Algebra
  - Characteristic Equation of a 4 × 4 Matrix
  - One Card Determinant & Inverse of a 5 × 5 Matrix
  - Simultaneous Equations in Six Unknowns
  - Roots of Polynomials
  - Miscellaneous Special Functions A
  - Miscellaneous Special Functions B
  - Incomplete Gamma Function
  - Incomplete Beta Function
  - Incomplete Elliptic Integrals
- **Test Statistics (00097-14008)**
  - One Sample Test Statistics for the Mean
  - Test Statistics for the Correlation Coefficient
  - Differences Among Proportions
  - Behrens-Fisher Statistic
  - Kruskal-Wallis Statistic
  - Mean-Square Successive
  - The Run Test for Randomness
  - Intraclass Correlation Coefficient
  - Fisher's Exact Test for a 2 × 2 Contingency Table
  - Bartlett's Chi-Square Statistic
  - Mann-Whitney Statistic
  - Kendall's Coefficient of Concordance
- **Geometry (00097-14007)**
  - Sine Plate Solutions
  - V Notches & Long Radii
  - Internal & External Tapers
  - Points of Tangency with Circles & Arcs
  - Line-Line Intersection/Grid Points
  - Points on a Straight Line
  - Grid of Points: Calculates All Points
  - Grid of Points: Calculate Discrete Points
  - Tangent Circle to Two Straight Lines with a Given Radius
  - Distance between Lines in Space
- **Reliability/Quality Assurance (00097-14030)**
  - Reliability: Intra-Class Correlation
  - Specification Compliance from Limits & Regression Analysis
  - Parameter Estimation (Exponential Distribution)
  - Lower Limit of Reliability—Binomial Distribution
  - Reliability & Probability of Failure of Series & Parallel Systems
  - Mil-Std-883 Calculates Leak Rate
  - MLE: θ from Hazard Rate
  - MLE: θ by Least Square Method
  - Systems Reliability-Series & Parallel with Same λ
  - Systems Reliability-Series & Parallel with Different λ

(Continued)

Physical/Life Sciences

- **Chemistry (00097-14006)**
  - pH of Weak Acid/Base Solutions
  - Acid-Base Equilibrium (Diprotic)
  - Weak Acid/Base Titration Curve
  - Equations of State
  - Van Der Waals Gas Law
  - Beer's Law & Absorbtivity Calculations
  - Activity Coefficients from Potentiometric Data
  - Crystallographic to Cartesian Coordinate Transformations
  - Kinetics using Lineweaver-Burk or Hofstee Plots
  - Mixture Viscosities
  - Vapor Pressure, Bubble & Dew Point Calculation
  - Single-Stage Equilibrium Calculation
- **Optics (00097-14016)**
  - Optical Design I
  - Optical Design II
  - Lens Calculations-Sag, Angle, Min/Max
  - Ray Tracer—Spherical, Paraboliodal & Flat Surfaces
  - General Lens Tracer
  - Ray Tracer
  - First Order Ray Tracing by Matrix Methods
  - Fraunhofer Diffraction of Light by Spherical Particles
  - Kubelka-Munk Diffuse Layer Reflectance & Transmittance
  - Ray Trace Parabola
  - Paraxial Ray Tracing Part 1: Tracing
  - Paraxial Ray Tracing Part 2: Storing
- **Physics (00097-14015)**
  - Black Body Thermal Radiation
  - Black Hole Characteristics
  - Special Relativity Conversions
  - Three Dimensional Special Relativity
  - Einstein's Twin Paradox
  - Delta-V—Orbit Simulator
  - Equations of Particle Motion
  - Ballistics Trajectory Computations
  - Isotope Overlap Corrections
  - Critical Reactor Code
  - Semi-Empirical Nuclear Mass Formula
  - Clebsch-Gordon Coefficients & 3J Symbols Evaluation
  - 32-P Remaining on MM.DDYYYY Given MCI on Earlier MM.DDYYYY
- **Earth Sciences (00097-14017)**
  - Earthquake Magnitude—Energy Conversion
  - P & S Seismic Wave Velocity Determination
  - Electromagnetic Seismograph Frequency Response
  - Earthquake Seismic Wave Radiation Pattern: Shear Fault
  - Plate—Tectonic Velocities
  - Plunge & Rake of Faults
  - Depth of Strata
  - Strata Thickness
  - True & Apparent Dips
  - Bouguer Anomaly Gravity Reduction
  - Geocentric Distance—Azimuth—Back Azimuth
  - Heat Flow
  - Physical Properties of Seawater
  - Sigma-T & AOU
  - Atmospheric Thermodynamics
- **Enegry Conservation (00097-14029)**
  - Air Cooling System Design
  - Black Body Thermal Radiation
  - Economic Insulation Thickness
  - Heat Transfer through Composite Cylinders & Walls
  - Steady State Cond. Heat Trans., Heat Load & Logarithmic Mean Temp. Diff.
  - Sun Altitude, Azimuth, Solar Pond Absorption
  - Total Daily Amount of Solar Radiation
  - Temperature or Concentration Profile for a Semi-Infinite Solid
  - Transient Temp. Distribution in a Semi-Infinite Solid Conservation of Energy
- **Space Science (00097-14028)**
  - Precession of Right Ascension & Declination
  - Local Sidereal Time & Obliquity from Local Standard Time
  - Space Science & Technology No. 1 Horizon Distance, Great Circle Distance
  - Space Science & Technology No. 2 Vis Viva & Path Angle Relations
  - Space Science & Technology No. 4 Ballistic Missle Range
  - Celestial Position
  - Binary Star Ephemeris
  - Precession/Galactic Coordinates
  - Space Science & Technology, No. 5 Kepler's Equation
  - Orbit Determination by the Method of Gauss
- **Forestry (00097-14034)**
  - Log Volume in Cubic Feet, Cubic Meters, or Board Feet
  - Lumber Scale Board Feet Recoverable from a Log
  - Logging Calculations—Doyle's Method
  - True Productivity of a Natural Coniferous Forest
  - Mean Annual Increment of Various Forests
  - Standing & Running Skyline Loadcarrying Capability
  - Cruiser's Stick for Forest Mensuration
  - Latitude & Longitude from Geological Survey Map
  - Mean Annual Increment of Douglas-Fir & Certain Pine Forests
  - Traverse, Inverse & Sideshots
- **Biology (00097-14040)**
  - Demography I: Estimates of Parameters/Rates of Increase
  - Demography II: Expectation of Life & Reproductive Value
  - Diversity & Equitability Indices
  - Niche Breadth & Overlap/Shannon's H & Horn's R0
  - Population Size Estimate (Jolly's Estimate)
  - Cell Phase & Cycle Times
  - Crossover: Location/Products
  - Chromosome Cleavage
  - Recessive Gene Frequency after Selection, Mutation, Inbreeding
  - Selection & Frequency
  - Genetic Inference from Truncate Data
  - Positive Assortative Mating for a Recessive Phenotype

Medical

- **Medical Practitioner (00097-14005)**
  - Blood Pressure Averages & Mean Arterial Pressure
  - Pacemaker Rate & Interval Averager
  - Blood Alcohol
  - Human Post-Trauma Epilepsy Seizure Prediction
  - Bedside Blood-Gas Interpreter
  - Body Density, Fat & Lean Mass from Skinfolds
  - Estimating Obesity, Body Fat Surface Area & Total Body Water
  - Fluid & Electrolytes/Body Burn Area
  - Fluid & Electrolytes/Potassium Balance (Scribner)
  - Anesthesiology Parameters
  - Discounted Cash Flow Analysis-Net Present Value*
  - Income Property Analysis*
  - Income Tax Planning-I*
  - Income Tax Planning-II*
- **Anesthesia (00097-14019)**
  - Anesthesia Parameters I
  - Anesthesia Parameters II
  - Pulmonary Medicine: Respiratory Set Up & Deadspace Adjustment
  - Copper Kettle Anesthetic Regulation
  - Anesthesia: Antoine Values from Experimental Data
  - Anesthesia: Vapor Pressure of Water
  - Anesthesia: Vapor Pressure of Halothane
  - Anesthesia: Vapor Pressure of Diethyl Ether
  - Anesthesia: Vapor Pressure of Methoxyflurane
  - Anesthesia: Vapor Pressure of Enflurane
  - Anesthesia: Vapor pressure of Fluroxene
  - Anesthesia: Vapor Pressure of Cyclopropane
  - Anesthesia: Vapor Pressure of Trichlorethylene
  - Anesthesia: Vapor Pressure of Ethylchloride
- **Cardiac (00097-14018)**
  - Virtual PO_2 & O_2 Saturation & Content
  - Body Surface Area for Cardio Pulmonary Programs
  - Dye Curve Cardiac Output
  - Fick Cardiac Output
  - Valve Area
  - Anatomic Shunts
  - Contractility
  - Stroke Work
  - Ejection-Fraction Ejected-Volume Cardiac Output
  - Calculation of Left Ventricular Functions from Angiographs
  - Impedance Cardiac Output, Systemic & Pulmonary Resistance
  - Basic EKG Determinations
- **Pulmonary (00097-14037)**
  - Pulmonary Medicine/Male Spirometry Standards
  - Lung Diffusion
  - Water Vapor Pressure & Respiratory Gas Conversions
  - Ventilator Setup & Corrections (Radford)
  - Arterial CO_2 Normalization
  - Blood Acid-Base Status
  - Virtual PO_2 & O_2 Saturation & Content
  - Anaerobic PCO_2 & pH Change
  - Anaerobic PO_2 Change
  - Dead Space Fraction
  - Alveolar-Arterial Oxygen Tension Difference
  - Phsiologic Shunt & Fick
  - Body Surface Area for Cardio Pulmonary Programs

Other

- **Games (00097-14013)**
  - Risk
  - Blackjack with a Permanent Bank
  - Bell-Fruit (Mills Standard)
  - Turn the Die
  - Word Encoder
  - Word Game Subroutine
  - Hangman Word Game
  - Pro Football Simulation
  - Electronic Contract Bridge Score Pad
  - Duplicate Bridge Score with Running Totals
  - Battleship
- **Games of Chance (00097-14038)**
  - Craps
  - Twenty-Six & Thirty-Six
  - Chuck-A-Luck Dice Game
  - Parapar
  - Pig
  - Big Six
  - Roulette
  - Dog Races
  - Horse Race
  - Blackjack Betting
- **Aircraft Operation (00097-14001)**
  - Aircraft Flight Plan with Wind
  - Flight Management
  - Predicting Freezing Levels
  - General Aircraft Weight & Balance
  - Pilot Unit Conversions
  - Turn Performance
  - Rate of Climb & Descent
  - Head Winds & Cross Winds
  - Flight Planning & Flight Verification
  - Determining In-Flight Winds
  - Standard Atmosphere
  - Mach Number & True Airspeed
  - True Air Temperature & Density Altitude
  - Lowest Usable Flight Level
- **Avigation (00097-14002)**
  - Great Circle Plotting
  - Rhumb Line Navigation
  - Great Circle Navigation
  - Position given Heading, Speed & Time
  - Line of Sight Distance
  - Position &/or Navigation by Two VOR's
  - Position by One VOR
  - DME Speed Correction
  - Average Wind Vector
  - Course Correction
  - Time of Sunrise & Sunset
  - Azimuth of Sunrise & Sunset
- **Calendars (00097-14024)**
  - Calendar Date/Julian Date Conversion
  - Days to Dates & Dates to Days; Day of Week
  - Day of Year—Day of Week
  - Number of Weekdays between Two Dates
  - In What Year is a given Date an M-Day?
  - Number of M-Days between Two Dates & N^{th} M-Day of the Month
  - Holidays
  - Easter-Ash Wednesday-Religious Holidays
  - Complete Maya Calendar
  - Mohammedan (Islam)—Gregorian Calendar Conversion
  - Chinese Years to/from Gregorian Years
  - Biorhythm—Biological Cycles
  - New Moon & Full Moon Day of Month
- **Photo Dark Room (00097-14022)**
  - Macro-Photography & Enlarging
  - Time, F-Stop, Magnification, Paper Speed, Enlarging Factors
  - Color Printing Factors
  - Color Printing Factors; New Paper
  - Subtractive Color-Printing Filters; Density Correction
  - Tri-Color Print Exposure (Photo)
  - Color Print Processing in Drum
  - Cibachrome Reciprocity Correction
  - Print Viewing Distance
  - Photo/Image Display Parameters
  - Image Projection Data
- **COGO/Surveying (00097-14020)**
  - Basic Traverse, Inverse, Deflection Angle
  - Bearing-Bearing Intersection, Traverse, Etc.
  - Bearing-Distance Intersection, Traverse, Etc.
  - Distance-Distance Intersection, Bearing, Deflection Angle, Etc.
  - Traverse of Curve, Bearing and Deflection Angle, Etc.
  - Curve Inverse; Bearing & Deflection Angle, Etc.
  - Compass Rule Adjustment, & Deflection Angle, Etc.
  - Rotation of Axes, & Deflection Angle, Etc.
  - To Inscribe Curve, Bearing Traverse
  - Slope Shot Traverses & Inverse Traverse
  - Crandall's Rule Adjustment, Bearing Traverse, Etc.
  - Transit Rule Adjustment, Bearing Traverse, Etc.
- **Astrology (00097-14014)**
  - Astro 1—Mean Obliquity of the Ecliptic & Greenwich Sidereal Time
  - Astro 2—Moon's Ascending Node, Nutation, & SVP
  - Astro 3—Local Sidereal Time, Geocentric Latitude, MC & Ascendant
  - Mundoscope, Regionmontanus
  - Mundoscope, Campanus
  - House Cusps—Placidus Method (Exact)
  - House Cusps—Regiomontanus Method
  - House Cusps—Campanus Method
  - House Cusps—Topocentric Method
  - House Cusps—Koch (GOH) Method
  - Astrological Horoscope Construction

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Can HP-67's Beat Computers?

Surprisingly ... yes! Here's a letter that was forwarded to us from the Users' Library in Geneva, Switzerland. It proves that you should never underestimate the power of these tiny calculators.

Dear Sir:

A team from Garringtons Limited Management Services Department recently completed a business game organized by the Midlands Operational Research Society (MORS) in England, and run on the Birmingham University Computer.

The game required decisions in the areas of marketing, production, personnel, and finance and ran for 20 simulated months. We were in competition with teams both from other industrial concerns and from universities, who no doubt had access to powerful optimisation packages on large mainframe computers. We, on the other hand, used only the Department's two HP-67's for all our computation for the competition—and won! Whilst we think we deserve some credit for our success, there is no doubt that it is also a triumph for the power and versatility of the HP-67!

We developed a suite of programs that enabled us to

- forecast total market size for the various products in the game;
- evaluate the effects of our actions on our market shares;
- convert projected sales into raw material requirements;
- optimise our raw material purchasing to take best advantage of quantity discounts without incurring excessive storage costs;
- schedule raw material purchases effectively;
- optimise plant loading;
- do marginal costing; and
- produce budgets and cash-flow forecasts.

Some of the programs—particularly the optimisation routines—were quite large, and one of them took 15 minutes to come up with the answer!

Although two members of the team—Management Services Manager **Tom Biss** and myself—have had programs accepted by both the HP-65 and HP-67 Users' Libraries, we have no plans to submit any of the programs developed for this game. Firstly, they are too specific; they are really only of any use to people playing this particular game. Secondly, much of the fun and benefit from games of this sort comes from "doing your own thing," and we wouldn't want to spoil that.

Yours faithfully,
Martin Humphries
O.R. Manager

Device Aids Calculator Educators

Although some educational institutions have been reluctant to accept personal calculators in the classroom, most are tolerant of them today—some even welcome them. One case in point is the University of Tennessee. Beginning in 1978, each student in its courses on trigonometry and mathematics of finance will be required to have a handheld calculator.

If you were the instructor, how would you cope with a whole classroom full of calculators—probably of many types and brands? Not a small problem, right? Well, someone has built a device—shaped like a lecturn and capable of accepting several types of calculators—that will display on its front surface whatever appears in the display of the calculator.

The device is similar in size to a portable typewriter. The master calculator is permanently mounted on top for operation by the instructor. On the other side, facing the audience, are large neon digits that repeat the calculator's display with a wide viewing angle and 60-foot legibility.

Aside from those that use other brands, models are now available for the HP-25, HP-25C, HP-27, HP-29C, and HP-67. Others may be available. If you are interested in such a device, contact the manufacturer:

Educational Calculator Devices, Inc.
P.O. Box 974
Laguna Beach, CA 92652

We have brought this to your attention solely as a service to our readers. This article is in no way meant to be an endorsement for the above-mentioned device.

Application Pac Corrections

As irritating as program errors can be, we are sure that it is satisfying to know that, when errors do occur, program corrections are published in KEY NOTES as we learn of them. Furthermore, just one of the advantages of the magnetic card program storage/input system used in the HP-67/97 is the ability to correct errors on magnetic cards efficiently and at relatively low cost. We are glad to be providing this continuing customer service to you.

If you own some of our application pacs, check the following corrections and mark them in your copy. If the correction includes a revised card, **you must mail in your old card to get a new one.** Be sure to include your name and address. If your copy is correct, you have a later, revised issue of the book and/or card.

HP-67/97 E.E. PAC 1

Program EE1-07A, "Fourier Series," may not correctly compute the angle when data are output in polar form because a *few* cards were recorded incorrectly. To check your card, read both sides of the card, then press GTO ⊡ 108, and switch to PRGM (or W/PRGM). Your display should show the keycode: "to polar." If your display shows the keycode for x⇆y, you have an incorrectly recorded card. In that case, delete step 108 on page L07-01 of your book, and **send your old card to:** *HP Service Department, P.O. Box 999, Corvallis, Oregon 97330,* and we will send you a new one.

Program EE1-09A, "Butterworth or Chebyshev Filter Design," documentation should be changed to state that, for Chebyshev filters, only odd-order filters are meaningful between equal terminations. For even-order Chebyshev filters the load resistance should be:

$$R_L = R_s\,(2E^2 - 2E\sqrt{E^2 - 1} - 1)$$

where $E = \sqrt{\epsilon^2 + 1}$

In addition, the symbol ΔdB was used with two different meanings. It means "ripple" in the formula for ϵ and it means "attenuation" in the equations used for n. **No new card is needed for this change.**

HP-67/97 STAT PAC 1

Two changes have been made to improve programs in this pac. To receive a revised card, **you must send your old card to:** *HP Service Department, P.O. Box 999, Corvallis, Oregon 97330.* Correct your book as follows.

Program ST1-11A, "t Distribution." On page L11-02, make these corrections:

Step 119	Delete: 1
Step 120	Delete: −
After step 123	Add: DSZI
	GTO3
	GTOc
After step 139	Add: LBLc
Step 158	Delete: ST−0

Program ST1-15A. "t Statistics." On pages L15-01 and L15-02, make these corrections:

After step 002	Add: CF1
After step 090	Add: GSB0
	GSB1
	F1?
	R/S
Step 102	Delete: GSB0
Step 103	Delete: GSB1
After step 103	Add: SF1

HP-67/97 GAMES PAC

Four games in this pac have been changed or revised to correct or improve the game. To receive a revised card for any of these programs, **you must send your old card to:** *HP Service Department, P.O. Box 999, Corvallis, Oregon 97330.* Meanwhile, correct your book as follows.

Program GA1-03A, "Slot Machine," has been changed to correct for a wrong payoff for one combination. On page L03-01, delete step 080 (0).

Program GA1-05A, "Artillery," was changed because it flashed "500.00" once even if you didn't lose. On page L05-02, insert a step x>y? after step 143.

Program GA1-13A, "Racetrack," was changed because it printed *twice* if you ran off the track on the inside. On page L13-02, delete step 155 (GSB5) and add in its place: GTO 5.

(Continued)

Program GA1-16A, "The Dealer," was changed because the card-review feature did not work correctly. It reviewed too many cards. On page L16-01 and L16-02, delete all steps from 109 through 115 and add in their place: 7, 4, ENT↑, 2, 3, F1?, CLX, − (minus).

HP-67/97 SURVEYING PAC 1

Program SU1-08A, "Resection," has been changed to eliminate negative outputs that resulted under some conditions. To correct your book (page L08-01):

Between steps 107 and 108 insert:

STO 9, 180, x⇆y, x<0?, +

Change old step 112 to:

RCL 9

Between old steps 115 and 116 insert:

180, x⇆y, x<0?, +

To receive a revised card, **you must send your old card to:** *HP Service Department, P.O. Box 999, Corvallis, Oregon 97330.*

Program SU1-14B, "Predetermined Area," has been corrected to make it run as described in the book. With the uncorrected program, error displays will occur on the triangle (line through a point) portion of the program when using distance and adjacent angle inputs. To correct your book (Revision C, only, page L14-01):

Delete step 003 (SPC)

Between old steps 195 and 196:

Insert STO 5

To receive a revised card, **you must send your old card to:** *HP Service Department, P.O. Box 999, Corvallis, Oregon 97330.*

HP-67/97 CLINICAL LAB AND NUCLEAR MEDICINE PAC

Program CL1-05A, "Urea Clearance," has an incorrectly recorded magnetic card. Step 045 is recorded as +; it should be ×. The program listing in the book is correct, as are the sample problems. To receive a revised card, **you must send your old card to:** *HP Service Deaprtment, P.O. Box 999, Corvallis, Oregon 97330.*

Program CL1-19A, "t Distribution," has been changed to correct an error that occurred with certain inputs. The correction is (page L19-01):

Delete steps 111, 112, and 148.

Between old steps 115 and 116 insert:

DSZI, GTO3, GTOd

Between old steps 131 and 132 insert:

LBLd

This avoids the incorrect answers that were obtained when ν (degrees of freedom) = 3. To receive a revised card, **you must send your old card to:** *HP Service Department, P.O. Box 999, Corvallis, Oregon 97330.*

A Unique Data Storage Idea

This fine article started with a telephone conversation with one of our Applications Engineers. The author, **Donal B. Botkin,** works for a large investment management group in New York. He needed some time-saving computations for his work in the financial world, so he put his HP-97 and his thought-processes to work and came up with the following idea. He even wrote the article for us so we could share it with other people who could use the idea.

Have you ever keyed in 100 data points for one program only to have to repeat those same keystrokes for another type of program? Wouldn't it be nice if there were a simple way of storing and accessing data for multiple problems? Well now there is! By using a serial storage technique (which uses no internal storage registers), one can build a data file of over 50 three-digit numbers on a single card that can be accessed with only four program steps.

Of course, the HP-67 and HP-97 are capable of writing data onto a card for storage and merging data into registers for use, but if your program requires that results of computations be stored, the number of available registers becomes too small for efficient usage. Also, a complex sequence of indirect recall instructions is required to operate on the data, thus diminishing the space available for the operating program. Furthermore, different programs may use different registers for storage of intermediate results and constants.

Serial data storage solves many of these problems. Quite simply, data is stored *as steps of a program,* which is then merged into the operating program at the appropriate time. This, of course, is nothing new to HP-65 users—that was the only way they had to store data. The new twist is that the data points are separated by GSB instructions that perform the required data manipulation—no STO or RCL instructions are required. This technique takes advantage of the automatic GSB instructions on the calculator's user-definable keys and the powerful merge instruction. The subroutine called by the serial data storage will be the one that would handle data entry under the standard method; e.g., LBL B on the basic statistics programs.

To store data, one switches the calculator to W/PRGM and keys in data just as though the switch were in RUN. After the last entry, a card is passed through to create a permanent record.

There are, however, some operational considerations. Only 224 steps are available for use, which means that the operating program should be limited to the first 112 steps. This should not be critical in practice, however, as the operating program will be concerned only with tabulation or summation during the data input phase. The computational part of the operating program (e.g., computing a, b, R^2 in a regression) can be loaded after the data has been "massaged."

The program sequence that calls the serial data consists of the following steps:

001	LBLe
002	MRG
003	PSE
004	GTOe
005	R/S

Of course, GTOe will be lost when the serial data is merged. If multiple cards are to be inputted, a GTOe instruction should follow the last GSB on the serial data card, otherwise R/S will suffice. Special programming techniques may utilize a PSE instruction at the end to allow another program card to read without changing display or flag status. If the first instruction on that card is a GTO, (to the computation subroutine), calculation will continue without interruption.

Another negative aspect is that some rearrangement of subroutine sequences may be required to insure that all subroutines that might be called during data entry are in the first 112 steps.

All things considered, serial data storage overcomes far more problems than it creates. It requires a minimum of operator attention and, in some cases, is actually easier and faster to use than the standard entry method. It also offers the programmer a far better data error-detection and recovery system as the data may be listed (either directly by program listing or by defining the GSB as PRT X), and then corrected simply by deleting the incorrect digit.

Some of the programs on which I have used this system are:

Basic Statistics for Two Variables	ST1-01A
Moments, Skewness, and Kurtosis	ST1-03A
Curve fitting lin, exp, log, pwr Polynomial Fit	
Histogram (with plotter)	ST1-05A
Multiple Regression	
Tabulator	SD-03A
Ranking	
Row/Column Sorting	
Data Listing	

It is even possible to store x and y data on separate cards and merge the variables to compute a regression. The uses are limited only by the ingenuity of *homo programmus!*

(Note: There is a consideration the author didn't mention. This idea works only for routines that call 2–or less–subroutines. Ed.)

Another "Unique Idea"

Although this technique is in the HP-67/97 handbooks (67: page 294, 97: page 267), no one has applied it in this unique fashion. And now, within a week of receiving **Don Botkin's** letter (see page 8), we received this letter, with material adding to and improving his "unique idea."

This idea was submitted by **Robert L. Neal, Jr.,** who is a Research Forester for the U.S. Department of Agriculture Forest Service in California. Thank you, Mr. Neal, for sharing this with KEY NOTES readers.

Gentlemen:

The following notes on the HP-67/97 may be of interest to other users of the machines.

1. The *HP-67/97 Owner's Handbooks* describe how looped merge, pause instructions can be used to merge data, but they do not mention that the same technique can be used to merge programs. Looping the merge instruction provides unlimited time to load the new program. No flag or other test is necessary to resume operation unless

successive programs are to be merged at the same point, in which case flags 0 and 1 can be used alternately to get the program out of the loop to resume program operation. For example:

Program 1	Program 2	Program 3	Etc.
:	F0?	F1?	
GTO 8	GTO 9	GTO 9	
LBL 9	LBL 8	LBL 8	
Merge	:	:	
Pause	:	:	
GTO 9	SF 0		
LBL 8	CF 1	SF 1	
:	GTO 9	CF 0	
CF 0		GTO 9	
GTO 9			

2. "Set status" conditions at the start of program operation are determined by the conditions recorded on the *last* program-card side read into the calculator. Therefore, two different sets of status conditions can be recorded with any program requiring two card sides. The conditions can be selected by the sequence of loading the card sides; i.e., one set would be selected by loading side 1 followed by side 2, and the other by loading side 2 followed by side 1.

As examples of applications, the technique might be used to select angular input in decimal degrees or degrees, minutes and seconds, or to select degree or radian mode. In the first case, the program could be written so that →H would be executed if flag 1 is set, and not executed if flag 1 is clear; side 1 could be recorded with the flag clear and side 2 with the flag set, or vice versa. In the second case side 1 could be recorded in degree mode and side 2 in radian mode, or vice versa.

To record the two sets of status conditions: (1) Enter the program, (2) establish status conditions desired when *side 2* is read *last,* (3) record both side 1 and side 2, (4) establish status conditions desired when side 1 is read last, (5) re-record side 1.

Is This A Record?

We've heard about many people who have written *hundreds* of programs for our personal programmable calculators. And some people have, over the years, amassed an astonishing number of programs for *several* calculators. However, you'll find the following statistics rather hard to believe, but they are totally true.

We recently received a copy of the book *Hydrologic and Hydraulic Computations on Small Programmable Calculators*. It contains over 870 programs with easy-to-understand user instructions for programmable calculators, including six HP machines (HP-25, HP-25C, HP-55, HP-65, HP-67 and HP-97). The book is the work of **Dr. Thomas E. Croley II,** Associate Professor and Research Engineer at the University of Iowa's Institute of Hydraulic Research.

The book has over 850 pages (8½ by 11 inches) containing all necessary background information on problems and programs for complete program understanding, with over 130 worked examples in 40 areas of hydrology and hydraulics.

Partial contents include: unit hydrograph derivation, construction, convolution, and transformation to other durations; three hydrologic and one hydraulic routing methods; well hydraulics for unsteady and steady radial flow; Log-Pearson type III distribution and fit; uniform and critical flow in four prismatic channel types and conduits; open channel momentum and specific energy functions for all channel types; water surface profile computations (including direct step, integration, and standard step methods); turbulent pipe flow; and pipe network analyses.

The manual is self-contained; there are no requirements for outside textbooks for use and understanding of the programs. All programs have been triple-checked from the final manuscript.

The wide range of program and machine capabilities enables easy adaptation to other machines, especially the new HP-19C and HP-29C.

The book is clothbound and obtainable for $15.95* per copy from the Iowa Institute of Hydraulic Research, The University of Iowa, Iowa City, Iowa 52242.

A special note of thanks goes to **John F. Kennedy,** Director of the Iowa Institute of Hydraulic Research, for bringing this book to our attention so we could share the knowledge of it with HP KEY NOTES readers. And, we cannot overlook our congratulations to Dr. Croley for an incredible and well-done job.

**U.S. dollars. See note on bottom edge of Cover.*

A Final Offer For Bargain HP-65 Pacs*

In the last issue we gave you a "last chance" to buy "used" application pacs. However, since then, a limited number have turned up in our warehouse, so we are making *one more offer* for those who missed out or changed their minds.

By "used" we mean that they have been on dealers' shelves and were traded back to us for the new HP-67/97 pacs, or they are some pacs returned to us on our 15-day free trial offer. Although all of these are officially "used" items, *they will be covered by our same Full One-Year Warranty that covers any new calculator or software pac.* (Warranty statement available on request.)

In fairly good supply are:
00065-67001 Math Pac 1
00065-67002 Math Pac 2
00065-67003 Surveying Pac 1
00065-67052 Machine Design Pac 1
00065-67056 E.E. Pac 2 (Microwave)

In fairly limited supply are:
00065-67004 Medical Pac 1
00065-67005 Statistics Pac 1
00065-67007 E.E. Pac 1

All other "used" pacs have been sold and are no longer available. You can, of course, still buy *new* HP-65 applications pacs, and these will be available for quite a while.

ORDERING INFORMATION

All the "used" pacs listed above are priced at $19.95* each. To order them, use the product name and accessory number and send your order to *Order Processing, Hewlett-Packard Co., 1000 N.E. Circle Blvd., Corvallis Oregon 97330.* Make your check or money order payable to *Hewlett-Packard,* and be sure to include your state or local taxes.

**This offer is good only in the United States (including Hawaii and Alaska).*

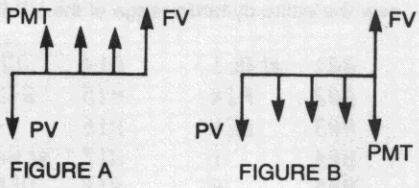
HP-67/97 Standard Pac Error?

Here's an interesting problem to try on your *Standard Pac* program, "Annuities and Compound Amounts."

You have an investment opportunity that requires a $10,000 initial payment and four subsequent yearly payments of $1,000 apiece. How much should the investment return at the end of 4 years in order to provide you with a minimum yield of 10% a year?

What answer do you get? $10,000??? It takes only a moment to realize that the answer can't be right, but what went wrong? Actually, the resolution of the dilemma is both interesting and relatively simple.

There are actually two classes of five-variable problems (n, i, PMT, PV, and FV), one in which the stream of payments (PMT) moves in the opposite direction from the initial investment (PV) (figure A) and another in which they move in the same direction as the initial investment (figure B).



The problem we presented to you was of the second class (figure B), but the program was solving it as if it was of the first class (figure A). If one used positive values for all of the variables, as the documentation implies, all answers will be calculated as if they were class 1, five-variable problems, regardless of what your intent was.

The new HP-92 Investor acknowledges this potential ambiguity by using a system we've called the *cash flow sign convention.* All cash flows in a compound interest problem have signs that reflect the direction and the flow of cash. Positive is used for cash received and negative for cash paid out. Once you establish your point of perspective, the sign convention clears up the ambiguities and becomes a powerful tool in understanding investment problems.

(Continued)

Cash flow diagrams such as the figures above and the sign convention will, we hope, be a major contribution in the world of finance by providing a universal language in which to communicate financial problems between industries and countries; a situation that is difficult now because of the lack of standardized terminology.

Returning to our *Standard Pac* program, is there anything we can do to get the answer to our original problem? The answer is YES, if you follow this rule for compound interest problems with four knowns:

If the cash flow of the payments is in the same direction as the initial transaction (PV), enter the payment as negative. Otherwise, enter all values as positive, as the user's instructions imply.

As you can see, our original problem would fall under the jurisidiction of this rule and, hence, −1,000 should be used for PMT. The correct answer is $19,282.

The rule is not as straightforward as the new HP-92 sign convention, but it does do the trick. Happy Investing!

"Rounding" Article Squared Off!

On page 12 of the last issue, we had an article on "Rounding the HP-67/97 Display." It elicited a rash of responses because the subroutine was longer than necessary, and it gave other people other ideas. Here are a few responses.

Dear Editor:

Gary M. Tenzer's floating point subroutine in the June 1977 KEY NOTES works within a certain range, but for numbers that underflow or overflow the FIX mode, the program may not give the desired results. The enclosed subroutine uses fewer registers and labels but works over the entire dynamic range of the HP-67/97.

001	*LBL 1	014	CLX
002	FIX	015	STO 1
003	EEX	016	+
004	1	017	*LBL 2
005	0	018	DSP i
006	X≤Y?	019	ENT↑
007	SCI	020	RND
008	X≷Y	021	X=Y?
009	DSP 9	022	RTN
010	ENT↑	023	ISZ I
011	RND	024	X≷Y
012	X≠Y?	025	GTO 0
013	SCI	026	R/S

The value to be "floated" should be in the display when LBL 1 is called.

Sincerely,

Duane Chapman, Rancho Palos Verdes, Cal.

Dear Sirs:

In using the subroutine to round the HP-67/97 display, if a whole number is entered, the display will have one trailing zero. Thus, the number 123 is displayed as 123.0. I have revised the subroutine to:

1. Eliminate all trailing zeros, including those for whole numbers.
2. Use 22 rather than 26 steps; and if the program is in FIX display mode at all times, step 1 could be eliminated.
3. Require only three (not four) labels.
4. Eliminate the need for DSP 0.

001	f LBL 1	012	x
002	f FIX	013	f ISZ
003	0	014	GTO 2
004	h ST I	015	f LBL 3
005	RCL 1	016	h RCI
006	f LBL 2	017	9
007	g FRAC	018	g x≤y
008	f x=0	019	h ST I
009	GTO 3	020	DSP (i)
010	1	021	RCL 1
011	0	022	h RTN

Sincerely yours,

Thomas R. Welch, Paw Paw, Michigan

And this suggestion was made by **Bruce Schlobohm** (Mill Valley, California) and **Bob Smiley** (Columbia, Maryland).

Gary Tenzer's subroutine could be shortened by two steps by eliminating LBL 3 and GTO 3 and changing g x>y to g x≤y.

Many other readers sent in these program-shortening tips. Therefore, to keep from being partial, we printed only the first letters received. Nonetheless, we thank everyone who wrote to us about this subroutine.

Users' Library Solutions Book Correction

If you have purchased the *Users' Library Solutions* book, "Options/Technical Stock Analysis," you will want to mark the following corrections to the program: "Routines for Option Writers."

There are two corrections. One involves some mixed-up keycodes/mnemonics and the other is actually an improvement the author made after we published the book.

In some steps, the keycodes do not agree with the mnemonics. The keycodes are correct, so only the mnemonics have to be changed. First, change all the mnemonics that appear to be % (percent) to ÷ (divide). Then change:

023	f GTO 5	to	f GSB 5
032	h x⇆y	to	g e^x
060	h x⇆y	to	f LN
157	CHS	to	EEX

Next, replace the second paragraph on page 11 (starting: Cash Flow return =) with the following:

"Cash Flow return = Premium* divided by stock price. MYOI = Premium + (Strike-Stock prices) + dividends, all divided by dividends. Annualized return = (days in year/days to expiry) x lesser of C/F or MYOI return. #options to write = 1/hedge ratio. Downside protection (break even) point = Strike price − premium. Maximum profit point = Strike price. Upside protection point = ((premium + Strike − Stock prices)/#options that are uncovered) + Strike price. If options are fully covered, upside protection = Strike price + premium."

The effect on the program is to change all of the steps starting with 178 (f LBL A) to the end of the program. Replace these steps as follows:

f LBL A	g LBL f b	f LBL 7
STO 1	RCL 7	RCL 2
h R↓	RCL 2	+
STO 2	RCL 1	f −x−
DSP 2	−	RCL 2
1	+	f −x−
2	RCL 6	RCL 1
CHS	1	RCL 7
h ST I	−	−
h R↓	f x=0	f −x−
h RTN	GTO 6	h RTN
	÷	f LBL 6
		RCL 7
		GTO (i)

These corrections will clear up the problems that people have had with this program. It will be revised in future printings.

Expand Your Computing Capabilities

We often are questioned about multiple card programs and how to do this easily. Here is an article we received in the mail. It answers this question for us.

Dear Sir:

Below is a small article titled "Expand Your Computing Capabilities." Many HP-67/97 owners may not realize they have this expansion capability and may hesitate to write programs beyond 224 steps. I am sure many "computer-like" programs, using "computer-like" algorithms, could be written.

EXPAND YOUR COMPUTING CAPABILITIES by **Charles I. Dinsmore**

The HP-67/97 are, in reality, miniature computers and have the built-in capability to perform like their bigger relatives. One way to do this is by using pause merge loops and pause loops to input additional program cards. For example:

Merge Loop	Pause Loop
LBL #9	LBL #8
Merge	Pause
Pause	GTO #8
GTO 9	

Any convenient value at any display format may be used for prompting; i.e., (0.0000000). By careful programming and the use of these loops you can expand your program execution beyond 224 steps to 448 or 672 continuous-step execution. This also would allow you to use 224 steps alone as one routine, say, an iterative process, let the machine prompt you with a pause loop to identify the end of the iterative routine, read an additional card, and continue execution, automatically.

There are a few important things to remember.

1. When using the automatic merge loop, everything below the pause instruction in program memory is replaced by the new instructions, therefore careful study is required.

2. Any subroutines that were necessary in the first set of instructions that are also necessary in the second set of instructions, must be included in that second set. Also, careful attention to labels is required, especially if part of the first set of instructions remains.
3. When using the automatic pause loop without merge to read a card, all previous instructions are replaced, so to continue execution, automatically, the first step of the next set of instructions should not be a RTN or R/S instruction. With this condition the operation will, automatically, pass thru a label if used as a first step, which then can be used in this new set of instructions.

With this in mind, stop thinking that you are limited to just 224 steps. Now you don't need to hesitate to write an extremely valuable program—for yourself, for others, or both.

Blank Cards Unscrambled

There have been some questions about blank magnetic card packs. So we'll list the availability again for those who missed it or misunderstood it in the last issue.

HP has developed "universal" packs, as follows, that can be used on the HP-65, HP-67, and HP-97 calculators.

- #00097-13141. One pack of 40 Blank Magnetic Cards, plus one Program Card Holder: $20.*
- #00097-13143. Three packs of 40 Blank Magnetic Cards, plus three Program Card Holders: $45.*

You also can buy the Program Card Holders separately, as follows:

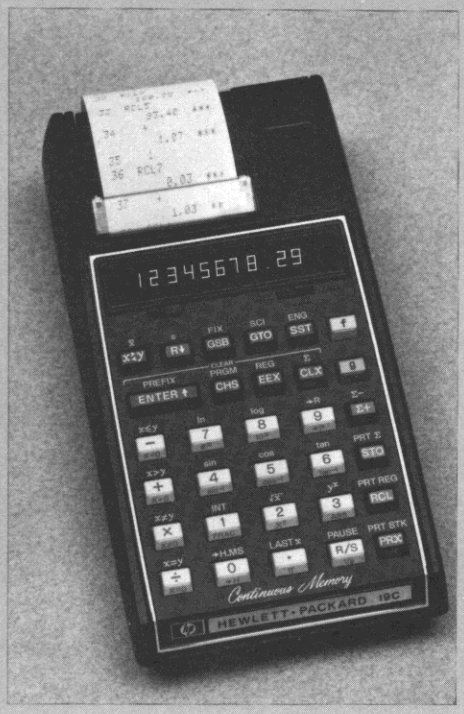
- #00097-13142. A package of three Program Card Holders: $10.*

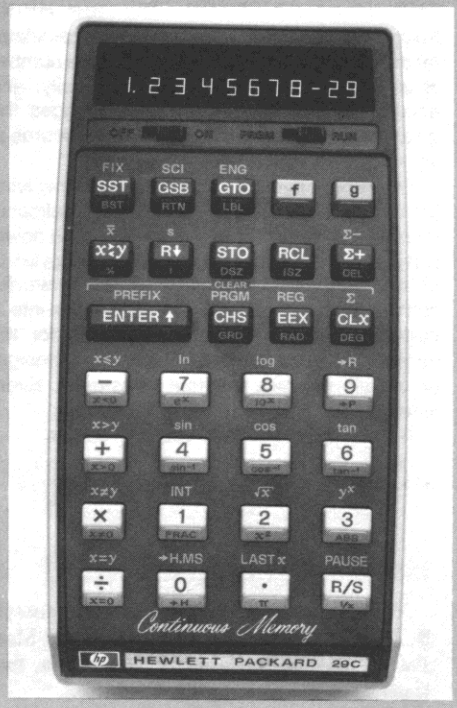
We are currently phasing out the old HP-65 blank card packs, accessory numbers 00065-67010 and 00065-67054. Inventories of these old packs still exist at some of our dealers, but Corvallis no longer has these old packs available.

For our European readers, please note that stocks of the old packs still exist in some areas, but they will be phased over to the new "universal" packs in the future.

Four New Calculators Released

Just after we printed the last KEY NOTES, we announced the new HP-10, HP-19C, HP-29C, and HP-92. All of these new calculators are, by now, on your local HP dealer's counter, so we won't bore you here with details. There is, however, one thing we'd like you to consider: If you have been looking for a quality calculator for your wife to use to keep track of the household expenses, bills, budget, checkbook balance, and so forth, take a good look at the new HP-10.





THE HP-19C CONTINUOUS MEMORY PROGRAMMABLE PRINTER:
THE HP-29C CONTINUOUS MEMORY PROGRAMMABLE:

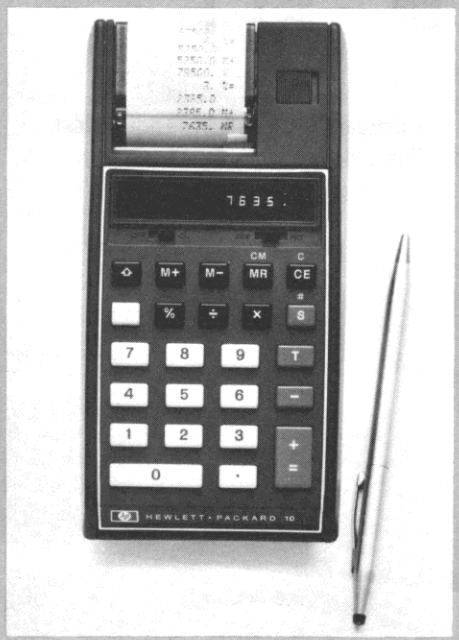
The HP-19C and HP-29C both have continuous memory capability so the programs you store are saved, ready for use, until you clear or rewrite them. Continuous memory retains your programs or data, even with the calculator turned off. You program frequently used calculations once, then use them as often as necessary—without lost time caused by reentering your program. The continuous memory of the HP-19C and HP-29C not only retains programs, it also retains the data stored in 16 of its 30 addressable registers and the display register.

You can merge up to four keystrokes in each of the 98 steps of continuous program memory on both models. So you can typically store programs—175 keystrokes or more—for those complex problems you face daily.

The HP-19C combines a full range of scientific functions, advanced programming features and RPN logic with a battery powered thermal printer. The HP-29C offers the same features and functions in an even smaller "pocket size" (without the printer). The HP-19C and HP-29C are designed to help you solve today's sophisticated scientific and engineering problems—quickly, easily, and accurately.

And, as a bonus, a comprehensive Applications Book is included with either calculator.

The HP-29C is $195* and the HP-19C is $345* at your HP dealer.



THE HP-10 PRINTING CALCULATOR:
The new HP-10 gives you all the features and dependability you'd expect from a full-size office calculator in one amazingly small, lightweight unit. A whisper-quiet thermal printer gives you a permanent record of all your business transactions. The 10-digit display can be used alone or in conjunction with the printer. In addition to the accumulator, a memory is available to store and recall a constant—or, if you desire, to maintain a separate running total of your calculations. The HP-10 performs instant quotations, commissions, dividends, percentages for taxes. The buffered keyboard, add mode, fixed and floating point notation, and print separator add up to making the new HP-10 the most powerful machine in its class.

Only $175* at your HP dealer.

*(*U.S. dollars. See notice on bottom edge of Cover.)*

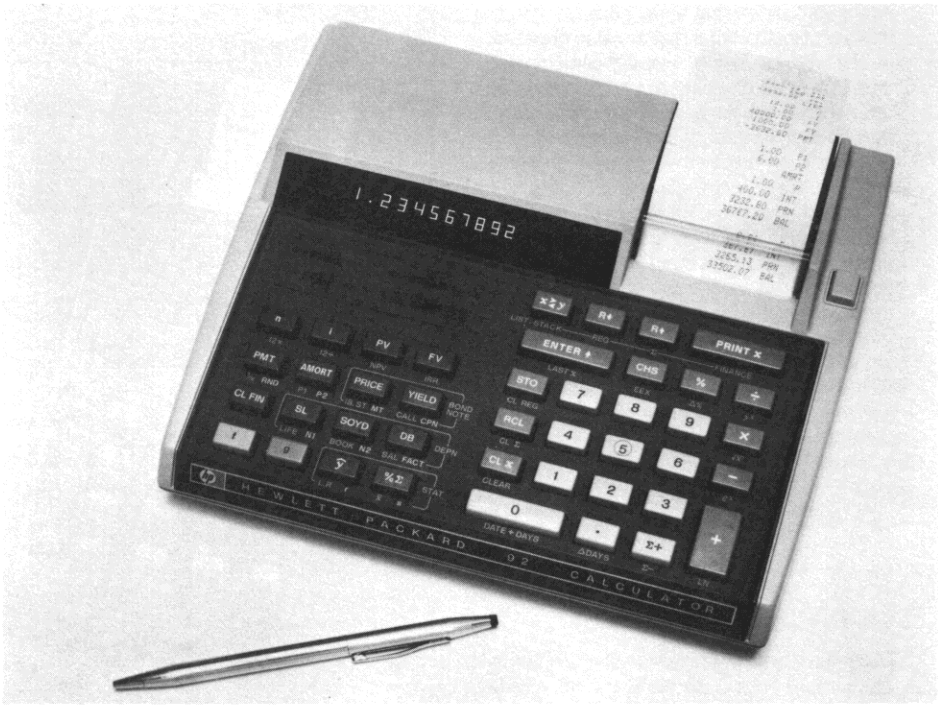
(Continued)

THE HP-92 INVESTOR: The new HP-92 Investor is a personal-sized financial calculator for the person who must evaluate a large number of investment alternatives quickly, easily, and accurately. The flick of a switch engages the quiet thermal printer for indispensable records of your calculations.

The HP-92 Investor solves problems involving time and money. Compound interest. Balloons. Internal rate of return for 30 uneven cash flows. Net present value. Bonds and notes. Three kinds of depreciation. And with all its powerful computational capability, the HP-92 fits into a standard sized briefcase—invaluable for the person on the go. The HP-92 Investor—designed to help you pick the right investment. Every time.

The HP-92 is $625* at your HP dealer.

**U.S. dollars. See note on bottom edge of Cover.*



HP-65 On Right Track!

There is an HP-65 being used in the Joseph B. Grundy Observatory at Franklin and Marshal College in Lancaster, Pennsylvania, that leads a somewhat unique second life.

Michael A. Seeds, Assistant Professor of Astronomy, wrote to tell us about this unusual application. (Incidentally, he was the author of the article.)

Dear Sirs:

Enclosed is a copy of a short article that appeared in the National Model Railroaders Association magazine, *Bulletin*, in March 1977. It illustrates how our HP-65 passes its time when it is not doing astronomy.

A SPEED COMPUTER

Many model railroaders do their yard switching at a scale speed that could win the pole at the Indy 500. It's not that they don't care, it's just that measuring scale speed is a pest. But a programmable pocket calculator like the Hewlett-Packard HP-65 can do everything but advance the throttle. If you don't have an HP-65, you may be able to lay hands on a different kind that can use a modification of this program.

In theory the scale (HO) speed is just 59.376 times the distance traveled in feet (real feet, not scale feet) divided by the time it takes in seconds. If an engine travels 5 feet in 7 seconds its scale is 42 mph. You can measure scale speed with a tape measure and a wristwatch if you are willing to do the arithmetic, using the formula:

$$S = \frac{D \times 59.376}{t}$$

If you own an HP-65 calculator use this program:

LBL A	LBL B	RCL 1	1
0	STO	÷	X
STO 1	+	3	RTN
1	1	6	
Enter	GTO	3	
Enter	B	.	
Enter	LBL C	6	
R/S	RCL 2	8	

Set up two reference points alongside your mainline, say, about 2 to 5 feet apart. Measure the distance between these points with a tape measure. Store the distance in real feet in register 2 and push A to prime the program. Then run a train past the points at a constant speed. As the engine passes the first point, push B, and then as the engine passes the second point, push R/S. Push C to get the scale speed in mph.

If you adapt this program to a different calculator you will need to change the constant in the program. This number, 363.681, is:

$$6.125 \frac{\text{counts}}{\text{sec}} \times \frac{60 \text{ mph}}{88 \text{ ft/sec}} \times 87.085$$

Thank you, Mr. Seeds, for the new Application. Many hobbyists can adapt this program and/or idea to fit their particular needs.

HP KEY NOTES

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Programming and operating tips, answers to questions, and information about new programs and developments. Published periodically for owners of Hewlett-Packard fully programmable personal calculators. *Reader comments or contributions are welcomed. Please send them to one of the following addresses.*

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