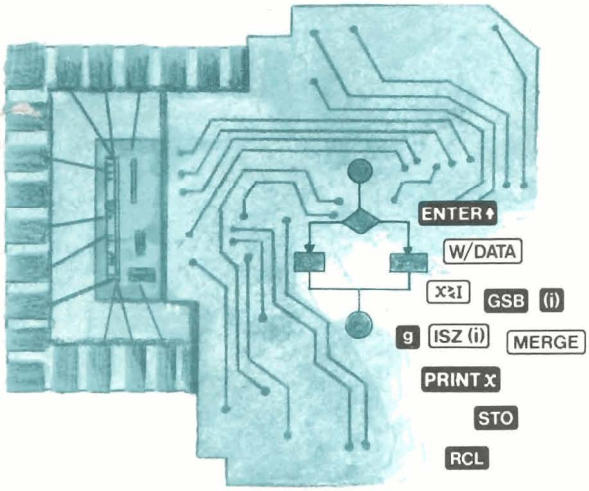

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Addendum and Library Solutions Books

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!

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.)*

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

William M. Kolb

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 & 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)	F3 (A)	F0 (A)	F0 (A)	F3 (A)	F0 (A)	F3 (A)	F3 (A)	F3 (A)	F3 (A)	F0 (A)	F2 (A)
		F3	F1 (B)	F1 (B)	SF3	F3 (B)	F3	F3	F0 (B)	F3	F3 (B)	F2
	F0 (A)			CF0	F2 (B)	F3	CF0	SF3	F0	F0 (B)	F3	F3 (B)
	F3	F0 (A)	F3 (A)	F0	F3	F0	F0 (B)	F0 (B)	F3	F3		F3
	F0	F3	F0 (B)		F2			F3		F0 (A)		
		F0	F3	F3 (A)		F0 (A)			F3 (A)	SF1		F2 (A)
		F3	F0	F0 (B)	F0 (A)	F1 (B)			F3	F1 (B)		F3 (B)
				F3	CF1	F1			F0 (B)			F3
			F3 (A)		F1 (B)	F0			F3	F0 (A)		F2
		CF0	F3	CF3						F1 (B)		
		F1 (A)	F0 (B)	F0 (A)		F0 (A)			CF3	F1		F0 (A)
		F0	F0	F1 (B)		CF1			F0 (A)	F0		F3 (B)
				F3		F1 (B)			F1 (B)	F0		F3
			F2 (A)			F0			F1			F3
			F3 (B)						F3	F0 (A)		
			F2							F1 (B)		
			F3						F0 (A)	F0		
									SF3	F1		
			F0 (A)						F3 (B)	F1		
			F3 (B)						F3			
			SF3							F1 (A)		
			F3							F0 (B)		
										F0		
										F1		
										F1		
	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

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LIST OF *USERS' LIBRARY SOLUTIONS* BOOKS

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

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

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: # from Hazard Rate
MLE: # 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

Personal business, tax, and investment programs for the professional.

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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.*

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.)

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.

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.*

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).*

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).

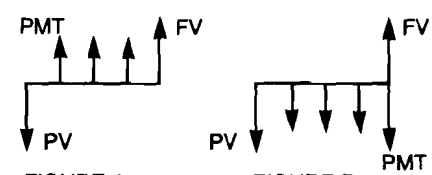


FIGURE A FIGURE B

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 I, 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	*LBL1	014	CLX
002	FIX	015	STO1
003	EEX	016	+
004	1	017	*LBL2
005	0	018	DSPi
006	X≤Y?	019	ENT↑
007	SCI	020	RND
008	X⇄Y	021	X=Y?
009	DSP9	022	RTN
010	ENT↑	023	ISZI
011	RND	024	X⇄Y
012	X≠Y?	025	GTO0
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 LBLfb	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:

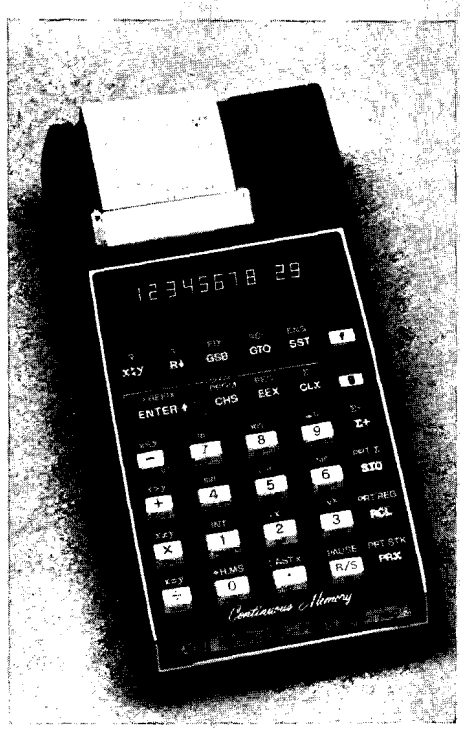
- #00097-13142. A package of three Program Card Holders: $10.*

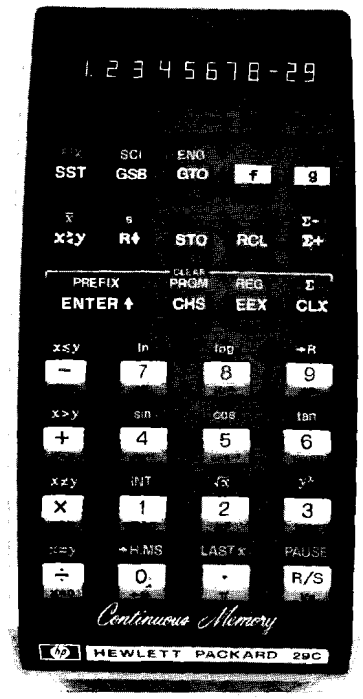
We are currently phasing out the old HP-65 blank card packs, accessory numbers 00065-67010 and 00065-67054. Inventories of these old packs still exist at some of our dealers, but Corvallis no longer has these old packs available.

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:

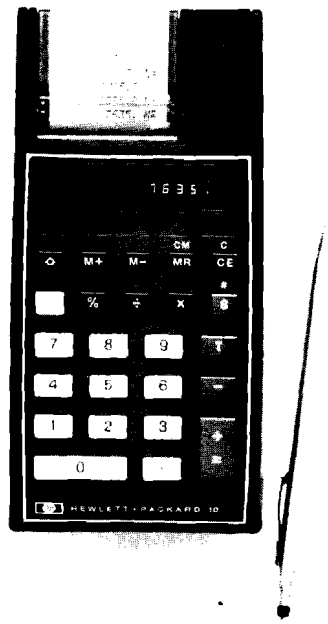
The HP-19C and HP-29C both have continuous memory capability so the programs you store are saved, ready for use, until you clear or rewrite them. Continuous memory retains your programs or data, even with the calculator turned off. You program frequently used calculations once, then use them as often 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.

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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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