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HEWLETT  PACKARD

# HP Key Notes

## HP Creates A Whole New Standard . . .

On July 16, 1979, Hewlett-Packard unveiled a *whole new standard* in handheld personal calculation: The HP-41C Alphanumeric Programmable Calculator. Not *just a calculator*, however, it is a *complete system*! And here, and on following pages, we are proud to present this wonderful, powerful personal programmable and its plug-in peripherals.

As you have already guessed—or already know—there are quite a few “firsts” on this HP calculator. It has a liquid-crystal display (LCD). It has full alphanumeric capability. It has a completely redefinable keyboard. It has four “ports” at the top end for plug-in peripherals, Application Modules, and Memory Modules. And it is the first HP fully programmable calculator with Continuous Memory.

Yes, the HP-41C is *fully* programmable, with incredible power that can expand to over 2000 lines of program memory. Or 319 registers for data storage. Or any mix of data storage and program memory *you* choose. But with all this incredible sophistication, the HP-41C is also remarkably easy to use. It communicates in friendly English, so operation is simple even for a novice. There are even status annunciators to remind you of operating modes and battery life. And so you always know what's going on, you can *name* a program, then call it up *by name* for execution. How's *that* for convenience!

In addition, with only the lightest touch of a switch, the HP-41C can switch from a pre-determined calculator to a user-customized instrument, complete with “specialized” keyboard, thus allowing you to create a highly personalized calculator, precisely matched to *your* own special applications.

Plug in the “extra smart” Card Reader and you can easily store your own personal program library on magnetic cards that can be read again anytime you wish—even in any other HP-41C anywhere in the world. Yet, you can also create “private” programs, *for only your use*! And

here's real music to your ears: *HP-67/97 recorded cards are compatible!*

Then, plug in the Printer, which is a complete alphanumeric, plotting printer with three operational modes for documenting your calculations and program listings and for generating hard-copy and graphic outputs. Or, plug in both the Printer and the Card Reader and use them in support of each other!

And, lastly, there's a plug-in Wand that lets you conveniently load long programs by

reading bar codes printed on paper. (But, alas, you won't be able to order *that* innovation until early 1980.)

But we saved the best part for the end: The HP-41C uses the straightforward keystroke programming and time-proven RPN logic system that lets you slice with ease through the most difficult problems.

Now, is it any wonder that we call this magnificent calculator—this powerful system—

**A Whole New Standard?**



**HP Computer Museum**  
**[www.hpmuseum.net](http://www.hpmuseum.net)**

**For research and education purposes only.**



## CARD READER

The HP-41C Card Reader is similar to the reader in the HP-67 except that, instead of being only smart, it is **extra smart!** In fact, it can read and translate HP-67/97 cards (program or data) for execution in the HP-41C. (More about that in a following article.)

In addition, cards can be read in any order because the HP-41C notifies you—in the display—which track of the card is still required. And, because so many of you have asked for it, the new Card Reader provides "program security." Through user commands, the Card Reader can be instructed to record a card so that the program on that card can only be executed and not viewed or altered. How's that for being "extra smart"!

The Card Reader is powered by the batteries in the HP-41C. Although it uses very little power—and the HP-41C even less—it does lessen the battery life for the calculator, depending on how often the Card Reader is used. However, even with fairly heavy use, battery life will still be counted in months, not in hours, as it has been in the past.\*

The HP-41C Card Reader package includes:

An HP 82104A Card Reader.

An *Owner's Handbook*.

A Head Cleaning Card.

20 Blank Magnetic Cards.

A Card Holder for Magnetic Cards.

and the price of this package is \$195.\*

## THE PRINTER

The HP-41C Printer is a portable, quiet, thermal printer. It prints numbers, upper- and lower-case letters, special characters, and incorporates easy-to-use plotting routines. Like the HP-97, its three modes are *Normal*, *Manual*, and the popular *Trace*. It will even print double-wide characters, for highlighting

or what-have-you. And again because you asked for it, it has a five-position print intensity switch to make your printouts as light or as dark as you want them to be. It runs on rechargeable batteries (same pack as the HP-97) or ordinary house current, and will print about 4000 to 5000 lines on one charge. Also, it uses the same paper used in the HP-97.

There are a total of 127 standard characters that can be printed on the HP-41C Printer. You will not quickly run out of letters, symbols, signs, Greek letters, and so on with such a choice. But, if you want your own symbols of any kind, all you have to do is build your own, from the 7×7 matrix of dots that makes up each character-space across the 24-character-wide field available. This means you can create 2<sup>49</sup> different patterns with the HP-41C Printer. And if your calculator isn't handy, that's over 560 trillion patterns! As you can see, with the HP-41C Printer, your imagination, not the machine, is the limiting factor.

The HP-41C Printer package includes:

An HP 82143A Printer.

An AC Adapter/Recharger.

A Rechargeable Battery Pack.

An *Owner's Handbook*.

Two Rolls of Thermal Paper.

and the price of this package is \$350.\*

## THE WAND

The HP-41C Wand, which will be available in early 1980, makes the HP-41C the first calculator to accept programs and data from printed bar codes. You simply pass the Wand over a printed bar code and in seconds it translates these codes into information that is loaded into the calculator.

After the Wand is available, the *HP-41C Solutions Books* and Users' Library programs will have printed bar codes to facilitate easy program entry.

## THE SYSTEM

As you can see, this remarkable machine and its amazing peripherals form a system that is almost indescribably powerful and versatile. Yet it is friendly and easy to use. This system can *adapt* to meet changing requirements, and it can *grow* as your needs increase.

## A WHOLE NEW STANDARD

No matter what can be said about the HP-41C, above all else, it has the programming power to solve the most complex problems. *Even programs written for 8-kilobyte computers have been translated into the HP-41C!*

We could go on for pages and pages about this new standard of the calculator world. You simply have to see it and experience it to realize what a tremendous contribution it is. It's been a long time coming, but we know you will agree that the HP-41C was worth the wait. So go see your nearest HP dealer and see the HP-41C; we'll bet that you won't be able to resist it!

And to give you some *other* viewpoints, the following HP-41C articles include one by a user, one by one of our engineers, and one about HP-67/97 compatibility.

\*See article "About Batteries."

\*U.S. dollars. See note at bottom edge of cover.

## A User's View of The HP-41C

As many of you know, **Richard Nelson** was an early HP-65 User. He founded PPC\* in June 1974 (then called the HP-65 Users Club) and is Editor of the *PPC Journal*, a monthly publication of PPC. When not devoting most of his free time to PPC he works as a freelance writer/consultant and Applications Engineer for Statek Corporation in Santa Ana, California. He has written numerous calculator articles for such magazines as *Byte* and *Electronics* and has published eight papers on calculator applications.

Some time before announcement of the new HP-41C, we furnished Mr. Nelson with a prototype machine so he could become familiar with it before its introduction. We also thought that it would be a good idea for you to read the assessment of a skilled, long-time calculator user *before* you had a chance to see the HP-41C. In the following article are Mr. Nelson's thoughts and comments about the HP-41C. We hope you enjoy this "preview."

The recently introduced HP-41C calculator is a machine of great depth. The capabilities that exist in this programmable handheld calculator are so numerous that it would take reams of paper to describe *all* of them! Yet, the most significant characteristics are the friendliness and beautiful simplicity that this second-generation machine offers to the user—any user, from the person who doesn't program to the person who enjoys developing his own software.

Compared to the HP-65 and HP-67, the HP-41C is smaller, lighter, faster, and has a



simpler, less-cluttered keyboard. The machine has a Series E look. All keys are black with white lettering on the top except the single, unmarked, gold prefix key. Above each marked key is a function printed in gold. A blue letter or symbol is on the front sloping surface of all but four keys.

Instead of the two slide switches used on the HP-67, there are four "mode" keys below the display. These are easier to use and provide more functions.

Even with so many new features, the user with previous HP calculator experience will find the HP-41C easy to use. Major new features are the alphanumeric liquid-crystal display and the four plug-in ports at the display end of the machine. These vividly point out that the HP-41C is the heart of a calculator system, so there is no built-in card reader on the basic HP-41C. The system includes ROM (read-only memory) modules for plug-in HP software, RAM (random-access memory) modules to add program and data memory, and peripherals that presently include a card reader, a printer, and a wand that reads bar codes. And with all of that, the HP-41C also has Continuous Memory that retains all programs, data, and key assignments—similar to other HP programmables such as the HP-29C.



Richard J. Nelson

The most exciting feature that makes the HP-41C a second-generation machine is its alpha capability. With this capability, there are no key codes to remember, you may label your programs with words and symbols in any language, program prompts and instructions become part of the program, and a computed answer may be displayed or printed on the same line as the description of the answer. The HP-41C processes alpha data much like it does numeric data. Words may be stored, printed, and even compared.

The alpha capability opens a new vista of applications that has the potential to make the HP-41C into a personal information center. Names, telephone numbers, price lists, bank balances, and even a simple set of books are

possible. Memory size is limited because the HP-41C is not a data-processing handheld computer, but it is possible to store 32 names and telephone numbers in one Memory Module. Word games are practical, and the famous game Hangman is part of the *Standard Applications* handbook. However, alphabetical sorting is not practical on the HP-41C unless the required time to compare each data, character by character, is tolerable.

The computing power of the HP-41C is many times greater than the HP-67 or HP-65. HP-67 users often dream of more than one "I" register for indirect addressing. ALL registers of the HP-41C can be designated as "I" registers, and that includes the stack and last-X registers. Indirectly addressable instructions include just about every one it would make sense to address indirectly, including: store, recall, register arithmetic, display setting, tone, flags, position of statistical registers, catalogs, x-exchange any register, and many more.

The ISZ and DSZ counters of the HP-67 are greatly improved in the HP-41C. They are now called ISG for "increment and skip if greater" and DSE for "decrement and skip if equal." The control number in the designated register has three parts. The counter starting value, the branching value, and the incrementing value. Any register may be an ISG or DSE register, and the ISG/DSE function may be indirectly addressed. Full indirect addressing, full counter control, and six levels of subroutines provide the HP-41C programmer with unparalleled computing capability. The familiar scientific functions are included, along with a few new ones: modulo, LN1+x, sign, four flag tests plus set and clear operations, and an astonishing set of flags, just to mention a few.

The memory capacity of the HP-41C may be increased with up to four, 64-register, Memory Modules. The HP-67 has 26 data registers plus 32 memory registers of 7 steps each, for a total of 58 registers. The HP-41C has 63 registers and four bytes. (A byte is 1/7 of a register.) All HP-67 instructions are one byte long, but HP-41C instructions are one byte, two bytes, three bytes or even longer.

Program steps relate to discrete operations. On the HP-67 the number 1234567890 requires 10 steps (10 bytes). On the HP-41C, 1234567890 also takes 10 bytes, *but only one program line*. An HP-41C program line may hold from one to 16 bytes. Because of this, it is difficult to compare program lengths on the basis of steps and lines.

One of the features that makes the HP-41C simple to use is the USER mode. User programs, ROM programs, peripheral functions, and HP-41C functions may be assigned to any keyboard key except the gold key and the "correction" (⊖) key. The press of a single toggled USER key converts the keyboard into a set of custom functions that are labeled with supplied keyboard overlays. Thus, the HP-41C may be made into a custom machine that looks familiar to the user because it is identified with his terms in the display and on the keyboard. Non-technical users will appreciate the HP-41C as a friend and not some scientific or highly technical gadget.

A Catalog function displays user program names, ROM function names, and peripheral function names. CAT 1 displays user-written program names, CAT 2 displays peripheral and

ROM program names, and CAT 3 the 130 machine function names. R/S stops the rapid display of catalog content, and SST or BST allows you to step to a desired function. (*Pressing and holding any key other than R/S slows the listing so you can follow it easier. Ed.*) If the function is one of your programs, you can execute or edit it because the program pointer is at the beginning of the program when its name is displayed by CAT 1.

#### CAT 3

+	ENTER†	RCL
-	E↑X	RDN
*	E↑X-1	RND
/	FACT	RTN
1/X	FC?	SDEV
10↑X	FC?C	SCI
ABS	FIX	SF
ACOS	FRC	Σ+
ADV	FS?	Σ-
ADFF	FS?C	ΣREG
AOB	GRAD	SIN
ARCL	GTO	SIGN
ASHF	HMS	SIZE
ASIN	HMS+	SQRT
ASN	HMS-	SST
ASTO	HR	ST+
ATAN	INT	ST-
AVIEW	ISG	ST*
BEEP	LASTX	ST/
BST	LBL	STO
CAT	LN	STOP
CF	LN1+X	TAN
CHS	LOG	TONE
CLA	MEAN	VIEW
CLD	MOD	X=0?
CLP	OCT	X#0?
CLRG	OFF	X<0?
CLZ	ON	X<=0?
CLST	P-R	X>0?
CLX	PACK	X=Y?
COPY	%	X#Y?
COS	%CH	X<Y?
D-R	PI	X<=Y?
DEC	PROMPT	X>Y?
DEG	PSE	X<>
DEL	R↑	X<>Y
DSE	R-D	XEQ
END	R-P	X↑2
ENG	RAD	Y↑X

The card reader that attaches to the HP-41C is quieter, and "smarter" than the HP-67 card reader. The HP-41C card reader contains its own functions and has the ability to read and translate HP-67/97 programs to HP-41C programs—and translated programs run faster. A verify function can assist the user in sorting out magnetic cards by reading the card and displaying its type—HP-67 data or program, HP-41C data, program, status, or write-all. A "private" record feature writes a program and key assignment card that may be used but not viewed, altered, or copied.

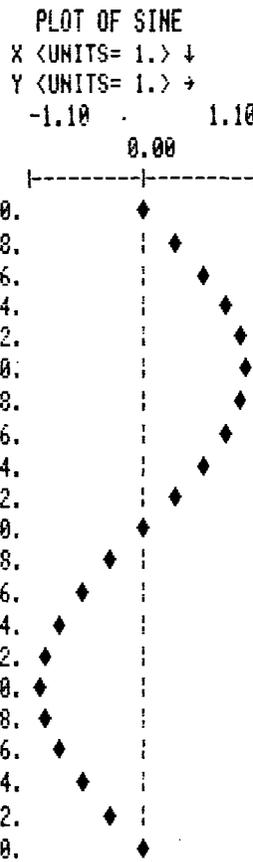
Other features make the HP-41C a pleasure to own and use. The primary (non-rechargeable) batteries give a new freedom of use. Six to nine months of usage without a battery replacement makes life much simpler and, considering battery life and recharger costs, quite cost-effective.\* With your programs and data *always* in the machine, the HP-41C will always be ready when you are.

Many other features make the HP-41C user-oriented. Ten tones can be programmed and a four-tone combo is called BEEP. Using the extensive control flags of the HP-41C allows: programs that automatically start when the machine is turned on, recording on a clipped-corner card if desired, ignoring range or system errors, disabling the tone function to speed up program execution if desired, printing lower-case or double-wide on the printer, detecting alpha or numeric data entry, and even adjusting the digit separators to periods if desired. And there are 56 flags on the HP-41C; the first five are indicated as being set in the display, along with six other annunciators.

The HP-41C printer is the most impressive of the three peripherals. It uses the same battery and paper as the HP-97 and has a similar moving print-head, but that is where the similarity ends. The HP-41C printer is belt-driven to be whisper quiet. Printing a program listing takes less than one second per line, and the print character set has 127 upper- and lower-case letters, numbers, and special symbols. Four direction arrows, reverse slash, ampersand, brackets, and even a dotted square are only a few examples of the special characters. The graphics capability of the printer even allows the user to make up his own character set, compose figures, and even a company logo. The 24-character line is composed of a 7 x 7 dot matrix for each character. This gives a resolution of 112 "dots" per inch across the paper.

#### STANDARD CHARACTER SET:

x	☒	←	α	β	Γ
↓	Δ	σ	◆	>	μ
∠	†	⊕	⊖	Ω	δ
À	á	Ä	ä	Ö	ö
0	Ü	Æ	æ	#	£
⌘	!	"	#	\$	
%	&	'	<	>	*
+	,	-	.	/	0
1	2	3	4	5	6
7	8	9	:	;	<
=	>	?	@	A	B
C	D	E	F	G	H
I	J	K	L	M	N
O	P	Q	R	S	T
U	V	W	X	Y	Z
[	\	]	↑	-	'
a	b	c	d	e	f
g	h	i	j	k	l
m	n	o	p	q	r
s	t	u	v	w	x
y	z	π		→	Σ
␣					



Plotting is a function that is also part of the HP-41C printer. The PRPLOT function plots in an 18-character field, with a resolution of 124 positions. It also plots an axis, upper and lower limit marks, and proper scales. An annotated program listing of PRPLOT given in the HP-41C printer handbook allows the user to modify the program to tailor it to his own needs. Multi-strip plotting is another approach that increases the plotting capability of the printer.

The printer also provides all the normal "housekeeping" functions of program listing, flag status listing, user assigned keys, and catalog listing. The single flag control of double-wide, upper- or lower-case, and the combination of the two makes the printer easy to use and a valuable addition to the basic HP-41C.

The bar code reading wand will make low-cost software in printed form easy to load into the machine. The number of instructions per page is fewer for bar codes than for printer listings. From a user's viewpoint, the wand also provides the possibility of an isolated data input port from another device.

The HP-41C is an extremely sophisticated and yet simple machine to use. Calculator users are accustomed to single-button execution of functions and programs. The ability to address and execute thousands of programs on a handheld, 39-key keyboard must have presented a challenge to the HP-41C designers. In larger computer systems the overall control of the computer is managed by the operating system. For the first time, calculator users will sense a mini-operating system in their programmable calculator that takes care of a lot of details. This frees the user to concentrate on his solutions and not the problems. The interfacing of the HP-41C to its peripherals, the carefully thought out methods of logical keystroke sequences, and the com-

mitment of system support made by Hewlett-Packard will maintain the HP-41C as the best personal calculator system for years to come.

\*Personal Programmers Club. For more information about this Club, send a self-addressed large (9"x12") envelope with first-class postage for 2 ounces to:

PPC JOURNAL (Dept. KN)  
2541 W. Camden Place  
Santa Ana, CA 92704 U.S.A.

and you will receive a sample issue of the PPC JOURNAL and other information. PPC is not sponsored, nor in any way sanctioned, by Hewlett-Packard.

\*See article "About Batteries."

## The Designer's View

To present yet another facet of the new calculator, we asked one of our HP-41C design engineers in Research and Development to write an article on *his view* of this new standard in calculators.

### MEET THE HP-41C

Since most of you are familiar with the HP-65, HP-67 and/or HP-97, the thrust of this article will focus on the major points of distinction between the products.

One of the first things you will notice about the HP-41C is the comparatively uncluttered keyboard. There is a single shift (gold) key and there are only two functions per key. The front slope of each key contains an alphabetic or special character for use in ALPHA mode. Yet the HP-41C has *more* functions than the 67/97. We just don't show all of them on the keyboard. Of the 130 or so functions in the HP-41C, only 58 are actually printed on the keyboard. The others are "buried" in the machine. But we have provided a way for you to "resurrect" any of these functions and assign it to any key or shifted-key location of your choosing. Then when you switch the machine to USER mode, the calculator no longer behaves like we've programmed it, but like *you've* programmed it.

SINGLE WIDTH  
DOUBLE WIDTH  
UPPER CASE  
lower case

**HP** Hewlett-Packard

In fact, you can extend the concept of USER mode to include not only HP-41C functions, but also functions added by the plug-in Application Modules and peripherals as well as "functions" you program yourself in user memory. As you add a peripheral such as the HP 82143A Printer, the complete catalog of printer functions is available to you for execution or key reassignment. Or, you can write your own program, give it a name, and assign it to a key.

So that you don't forget how your keyboard is configured, we provide removable overlays which you can use to relabel the keys. Also, if you press a key and hold it down, the alphanumeric liquid-crystal display (LCD) will show the assigned function mnemonic (yours or ours, whichever one will execute) in the display. Releasing the key will initiate the function execution. And, since the HP-41C has Continuous Memory, it remembers everything, key-

assignments included, when you turn it off. In fact, because of Continuous Memory and the LCD, it is really not necessary to turn the unit OFF to save power! (If you let it sit for approximately 10 minutes without exercising a function, it will shut itself off.)

There are several uses of the alphanumeric display in addition to the function-prompting capability. First there is the ability to display function mnemonics rather than numeric key codes when in PROGRAM mode, to aid you in program development and debugging. Also, the "alpha register" concept enables you to construct alpha strings that can be combined with the contents of numeric registers to provide alpha or alphanumeric messages for input prompting ("KEY IN SPEED"), or output labeling ("RATE = 23.72%").

The ability to name programs or subroutines with alpha strings and have that name appear in the display is an aid not only for key reassignments as mentioned above but also for program development: XEQ (execute) "ROOT", GTO "COST", etc.

Error messages (and others) are now more decipherable. We now have a useful meaning to a conditional executed from the keyboard. Press FS?23 (is flag 23 set?) from the keyboard and the HP-41C display will respond YES or NO.

Another exciting new capability that the HP-41C provides is the ability to configure your system with the addition of plug-in modules and peripherals. Additional user memory, plug-in applications software, a Printer, and an "extra-smart" Card Reader are all available for the HP-41C, with more devices and capabilities on the way. And when you plug in the optional Card Reader the HP-41C will behave like an HP-67 if you feed it an HP-67 card, or like an HP-97 if you have the optional Printer plugged in as well.

These are only a few of the features of the HP-41C. We could go on and on for pages about this new and very powerful system. So, for the complete story, visit your HP dealer and experience the HP-41C for yourself.

## HP-67/97 Compatibility

By now you are wondering how you will find the time to translate your library of HP-67/97 programs for your new HP-41C. That's easy! Just feed your HP-67/97 cards into your HP-41C Card Reader, wait a few seconds, and presto, you have an equivalent HP-41C program, ready to run. Data cards will work too!

To use HP-67/97 programs or data recorded on magnetic cards, you need:

1. An HP-41C.
2. An HP 82104A Card Reader.
3. One HP 82106A Memory Module.

With this HP-41C system you will be able to use about 97% of all HP-67/97 program cards and all data cards.

The following account for most incompatibilities:

1. Programs using unsupported HP-67/97 capabilities usually will not operate (e.g., pseudo-alpha displays generated by use of non-normalized numbers).

2. The "Rapid Reverse Branch" (GTOi or GSBi when the content of I is negative) of the HP-67/97 is not supported.
3. Multi-step digit entry strings immediately following conditional tests do not execute properly. For example, the HP-67/97 steps:
 
$$x=y$$

$$1$$

$$2$$
 will not be translated properly because the HP-41C will construct a single program line with the two digits and skip (if false) the entire digit string. The HP-67 and HP-97 would skip (if false) the individual digit 1 and place a 2 in the X-register.
4. The HP-67/97 "Merge" function is not supported.

These, and other minor incompatibilities, are described in detail in the *HP 82104A Card Reader Owner's Handbook*.

These, and other minor incompatibilities, are described in detail in the *HP 82104A Card Reader Owner's Handbook*.

## The First HP-41C Program!

Before you take us to task on that title, let us clarify it. We are referring to the first HP-41C program contributed by a customer and accepted into the Users' Library.



The author of this program, **Charles I. Dinsmore, P.E.**, has been an active contributor to the HP-67/97 Users' Library. His contributions include excellent programs for structural steel and concrete analysis. In fact, his HP-67 submittals were so well done that we decided to ask for his help for the *Structural Analysis Pac* for the HP-41C. His contributions in frame analysis and concrete design helped make the pac a powerful tool for the structural engineer.

Mr. Dinsmore credits a good deal of his professional achievement to his first programmable calculator, an HP-25. It got him started in programming and motivated him to investigate topics he might otherwise have passed over. However, he soon found the need for more capacity, so he purchased an HP-67. And, now, his new HP-41C should help him to continue to grow within his profession.

Mr. Dinsmore currently lives in Seattle, Washington, with his wife, Rita, and their son, Michael. He is employed by Victor O. Gray & Company, Consulting Engineers.

Mr. Dinsmore's HP-41C program encompasses 26 pages of first-class documentation

and 6 magnetic cards. The title is **Column Solver #00270C**, and the cost is \$6.\* This program does an extremely complete analysis of steel W-shaped, I-shaped, or H-shaped columns, according to the 1978 A.I.S.C. specifications for structural steel buildings. Because of the structure and nature of this program, three Memory Modules must be used in the HP-41C to use this program.

## Software For The HP-41C

One of the assets of owning a card-programmable calculator is being able to conveniently record programs already written, checked, and ready to run. The HP-41C has an abundance of programs, books, and Application Pacs, and more are on the way. Here are lists of the various categories of software.

### APPLICATION PACS (\$45 each)\*

- Aviation (Available late 1979)
  - Clinical Lab and Nuclear Medicine
  - Circuit Analysis
  - Financial Decisions
  - Mathematics
  - Securities
  - Statistics
  - Stress Analysis
  - Structural Analysis (Available late 1979)
  - Surveying
- The following pacs are under development:
- Games
  - Home Management
  - Machine Design
  - Navigation
  - Real Estate
  - Thermal and Transport Science

### HP-41C SOLUTIONS BOOKS (\$12.50 each)\*

- Business**
  - Business Statistics/Marketing/Sales
  - Home Construction Estimating
  - Lending, Saving, and Leasing
  - Real Estate
  - Small Business
- Computation**
  - Geometry
  - High-Level Math
  - Test Statistics
- Engineering**
  - Antennas
  - Chemical Engineering
  - Civil Engineering
  - Control Systems
  - Electrical Engineering
  - Fluid Dynamics and Hydraulics
  - Heating, Ventilating, and Air Conditioning
  - Mechanical Engineering
  - Solar Engineering
- Other**
  - Calendars
  - Cardiac/Pulmonary
  - Chemistry
  - Games
  - Optometry I (General)
  - Optometry II (Contact Lens)
  - Surveying
  - Physics

\*U.S. dollars. See note at bottom edge of cover.

## Library Corner

Most of you who were current subscribers as of last month should have received your copy of *Catalog Addendum #4*. If you do not receive a copy by late August, please contact the Users' Library. With truck strikes and so forth, bulk mail is not getting a priority these days. Also, *if your address is not kept current*, you are going to miss your particular copy.

Addendum #4 contains 520 new program abstracts, and this makes 3,270 that are now available to you. In this addendum we hope you find the new Application Category Table an improvement over the former table. It is impossible to accommodate every subject, but the new table should make your *Catalog* easier to use and the program you need, easier to find.

The Library is already getting started on the next addendum. Forward any new programs, corrections, or errors you find, or suggestions you might have, to the Users' Library (address on back cover).

By now you know that this issue is dedicated to telling you about the incomparable HP-41C. And that also means big news for Library subscribers! Why? Because most of the HP-67/97 programs in the Library will run on the HP-41C. (But HP-41C programs will not run on the HP-67 or HP-97.) That means there are *already* about 3,270 programs available for the HP-41C. In addition, the Library has about 300 new programs that were written just for the HP-41C. So, if you have not taken advantage of the many benefits the Library offers subscribers, you might consider it now. Contact the Library directly.

For the present, there will not be a separate HP-41C Library. Thus, the Users' Library will be even bigger and better than ever, because the HP-41C programs will appear together with the HP-67/97 programs. However, HP-41C program numbers will end with a "C." The abstracts for the new calculator will appear in the *Catalog* with a "41-Title," as they have in the past with "67" and "97" denoting the programs written on those calculators. (The only differences in 67 and 97 programs are the key codes.) However, we must emphasize again that the examples in all of the contributed programs are run by our applications engineers, and we will reject programs that do not run on both the HP-67 and HP-97 calculators. However, HP-67/97 programs do not have to run on an HP-41C.

### ORDERING PROGRAMS

None of the programs in this issue are available in Europe at this time. However, if you live in the U.S., you can order Library programs you see here in KEY NOTES by using the Order Form in a previous issue, or you can order by calling toll-free at (800)648-4711, ext. 1000 (in Nevada 800-992-5710).

Until November 1, 1979 (see next paragraph), Library programs are available in two forms: a set of the program listings and instruc-

tions (software) is \$3\*, and the fee is \$5\* for a set of software *and* a recorded magnetic card(s).

### PRICE CHANGES

November 1, 1979, some changes go into effect in the Users' Library. After that date, all Library programs (67, 97, 41C) will be \$6\* each. Each program will include documentation *and a prerecorded magnetic card!* Magnetic cards by themselves will NOT be available. There will be no more \$3 and \$5 programs. These changes are the result of added paper and postage costs that we have so far absorbed and can no longer continue to do.

Also on November 1, 1979, all Library subscriptions will be \$20\* a year for the U.S. and Canada. All other foreign subscriptions will be \$30 a year.

Prices for the *HP-65 Library Catalog* and programs will remain at \$8\* and \$3\* each, respectively.

### NEW PROGRAMS (HP-67/97)

Although *Addendum 4* is probably now in your hands, there are some recent program submissions we think you might enjoy. But before you order any of these, be sure you read the preceding paragraphs.

#### 67/97 Receiver Parameters (#03719D)

This program interrelates several parameters important for radio receivers and similar devices. Sensitivity may be found in voltages, power, and dBm as a function of bandwidth and noise figure. Intermodulation distortion may be related to power level, intercept point, and dynamic range. Conversions may be made between noise figure and temperature, and between voltage and power ratios and dB. (224 steps, 7 pages)

Author: **William J. Riley, Jr.**  
Pittsford, New York

*(Well done, Mr. Riley! This program calculates an awful lot, and very easily. Should interest amateur radio operators and radio engineers. Ed.)*

Now, here are a *pair* of programs that are very similar in their capabilities and operation. The data storage is such that, while computing a backwater curve using one program, the other program card may be entered if the channel cross-section changes! For example: A circular storm sewer emptying into a trapezoidal channel. The backwater calculations may be continued uninterrupted and *without restoring any data*.

#### 67/97 Trapezoidal Channel Water Surface by Standard Step Method (#03680D)

This program calculates water surface profiles for trapezoidal, rectangular, and triangular channels. Required input is Manning's "n," bottom width, channel side slopes, flowrate, and channel slope. After being given the

\*U.S. dollars. See note at bottom edge of cover.

beginning station and flowline elevation, and known or assumed depth at the beginning station, the program outputs station, elevation of energy grade, hydraulic grade, and flowline, followed by depth, velocity, velocity head, and friction slope. Subsequent stations are then input and the above information is again printed out (or read out). Equations in stationing, flowline drops, and channel data changes are allowed. Normal and critical depth calculations may be made without interrupting backwater calculations. Manning's equation and English units are used, but a metric conversion routine is included. Data storage is compatible with Circular Channel Program #03681D. (224 steps, 11 pages)

Author: **Christopher R. Stevens**  
Phoenix, Arizona

#### 67/97 Circular Channel Water Surface by Standard Step Method (#03681D)

This program description is virtually identical to the one above except that the calculations are for circular channels (pipes). Also, data storage is compatible with #03680D. (222 steps, 10 pages)

Author: **Christopher R. Stevens**  
Phoenix, Arizona

*(Although the subject of Mr. Stevens' programs might not interest everyone, surely his documentation would! Excellent is the word that comes to mind when reading the pages of comments, diagrams, etc. Kudos to you Mr. Stevens! Ed.)*

Next, we have some "special" programs for you. These two, below, were written in Japan by **Kenichiro Akita**, and are a *tour de force* in programming and documentation. Mr. Akita is Deputy Manager of the Textile Project Group for Nissho-Iwai Company, Ltd., in Osaka, Japan. And, although these programs can be used on an HP-67, they were designed primarily to use tape readouts from the HP-97.

The first "special" is: **Constant Payment to Principal Loan, Exact Amortization #67000-99974**, and the price is \$10.00.\* Here is the abstract:

Once fundamental data inputs on an annual basis have been entered, exact amortization schedules of Constant Payment to Principal Loan may be generated in different forms: all outputs on a single tape or on separate tapes of the same length, the Payment Numbers, Dates, Total Payments, Interests, CPMT to Principal, and Balances. By being of the same length, the tapes can be joined together to produce lists. There is one Input Card for fundamental data, seven cards for individual amortization, and seven cards for yearly amortization. Basic data is retained for repeated use by different cards. Options are: Rounding Mode, Accrued Interest for 365 or 360 Day Basis, and Totals-To-Date. And you can freely set the "time frames" to fit not only the calendar year but also fiscal years, taxation years etc. (2,781 steps, 15 cards, 60 pages)

The second of Mr. Akita's "specials" is:

**Mortgage Loan, Exact Amortization #67000-99975**, and the price is \$10.00.\* The abstract is essentially the same as for the preceding program except that the schedules of mortgage loans are generated. And this program also allows setting of "time frames" to match your requirements. (2,338 steps, 15 cards, 60 pages)

Author: **Kenichiro Akita**  
Amagasaki, Japan

And, finally, here is a set of programs that is being offered as a "special." These seven programs in the field of x-ray crystallography should prove useful to others working in this and such related disciplines as physical chemistry and conformational analysis. In the words of the author, **John P. McAlister**: "These programs perform calculations normally available only on large multi-purpose computers to those actively pursuing research in x-ray crystallography. Such programs are less commonly available to others whose principle interest is in another area but whose work is augmented by the results of crystallographic analysis. As a crystallographer, I find these programs useful because it is frequently more convenient to perform a few calculations at my desk than to endure the interruptions and general hassle required to log on and use the general laboratory computer. While these programs were developed with the analysis of crystallographic data in mind, those performing coordinate manipulations or calculations based on coordinate geometry might well find applications in other areas. All the programs function in the context of a general oblique coordinate system and therefore will accept the more usual Cartesian system as a special case when properly initialized."

The title of this set is **X-Ray Crystallography #67000-99976** and the price is \$30.50.\* The set includes seven separate, but coordinate, programs, and the last six depend on the data card generated by the first program. The program titles are:

- #03739D Crystallographic Data Card Initialization.
- #03740D Coordinate Assignment in Crystallographic Systems.
- #03741D Crystallographic Preliminaries.
- #03742D Crystallographic Coordinate Transformations I.
- #03743D Bond Distances and Angles From Crystallographic Data.
- #03744D Torsion Angles From Crystallographic Data.
- #03745D Least Squares Plane From Crystallographic Data.

Author: **John P. McAlister**  
Madison, Wisconsin

*(Quite a feat, Mr. McAlister! In all, 62 pages of documentation, 1,855 steps, and 9 magnetic cards. But I should warn readers that although each program is available separately for the standard fee, you need #03739D to run*

*any of the others, and the programs are definitely a better buy as a "package." Beautifully documented and typed; excellent work. Just one question, Mr. McAlister: Who did all that typing? Wow! Ed.)*

\*U.S. dollars. See note at bottom edge of cover.

## "Hooked" on HP!

Not long ago we received a letter from a calculator owner who has owned an astonishing array of calculators. Most of his first ones operated with algebraic logic and were made by several different manufacturers. But going from one to the other was a confusing mess. So 16 months ago he bought an HP-97, got rid of the others, and life has changed somewhat. Here's an excerpt from his letter.

Since the purchase of the HP-97, I have also added the HP-67, HP-22, HP-19C, and HP-21 to my collection. The fact that all of these calculators use RPN and function basically the same, makes going from one to the other very simple. Also, I have bought a second HP-21 for my wife to use, and she is very well satisfied with it. In fact, I am so well pleased with the HP line of calculators that I even designed and hooked a rug to let everyone know that I feel that Hewlett-Packard is unequalled by anyone else. Enclosed you will find some photos of the above rug and calculators.



Hope you enjoy the photos, It's just too bad that I can't send the rug to you, but I think as much of it as I do of my calculators.

Sincerely yours,  
**David D. Walton**, Cincinnati, Ohio

*(Thanks for the color photos, Mr. Walton. Too bad we can't print in full color. That rug is a remarkable work of art, right down to the "HP blue" color! Congratulations for a fine job. Ed.)*

## Another Excellent "Calculator" Book

Since all of you are reading this newsletter because you have a deep interest in learning how to apply your calculators to your specific needs or problems, and since we know that a lot of you are in one of the many fields (!) of the electronics industry, it is a pleasure to tell you about an extremely good book that will soon be in the bookstores. And, because the author of this book has contributed many excellent programs to the Users' Library and has been featured in KEY NOTES before (Vol. 2 No. 2, page 4), it gives us even more pleasure to present this new book, *Handbook of Electronic Design and Analysis Procedures Using Programmable Calculators*.

Besides being an avid HP calculator fan and a contributor of excellent programs, the author



**Bruce K. Murdock**, is a staff consultant to the Electronic Design Engineering section at Delco Electronics in Santa Barbara, California. There, his responsibilities include the design and analysis of such electronic equipment as underwater acoustic and sonar systems, radio and cable telemetry systems, servo systems, highpower amplifiers, and power conditioning equipment. Mr. Murdock has also lectured at the University of California at Santa Barbara on the subject of network analysis and synthesis.

This book should be of real use to electrical engineers and technicians who have access to programmable calculators or desktop computers. The book collects a vast amount of material and is clearly the result of a great deal of work. It contains 39 program descriptions concerning problems within the electrical engineering field; however, this range is very wide, from magnetic component design (transformers and solenoids) to microwaves, and from circuit and signal analysis to circuit and filter synthesis. Also, this range can be seen from the titles of the five sections in the book: Network Analysis, Filter Design (active and passive), Electromagnetic Component Design, High Frequency Circuit Design, and

Engineering Mathematics. The usefulness of the book is further enhanced because many of the programs are really sets of solutions to closely related problems (the interchangeable solution concept).

Although each program description ends up with a superbly annotated and flowcharted HP-67/97 program listing (and some algebraic program listings), the main strength of the book is in the program descriptions. After a clear statement defining the use of the program and some background on the subject, there is a concise step-by-step development of the equations that are to be used, along with references (58 in all) for those readers wishing more background on the particular subject. Every equation is numbered, and the book is fully cross referenced by equation number. The reader is literally "guided by the hand" through the development of the equations and resulting algorithms. The author never says "it can be shown," he *shows* it in detail. This material alone would be a valuable addition to any engineer's technical library, and represents over half of the book's 544 pages.

After the program algorithm development are step-by-step operating instructions for the associated programmable calculator program. Following these operating instructions are several program examples, complete with HP-97 printout showing all program input and output. These examples enable the user to fully verify his use of the programs. Many answers given in the examples are compared with answers obtained by other means (such as from published tables) to demonstrate the correctness of each program solution.

The HP-67/97 (and algebraic) program listings are completely and fully documented. The program comments and equations on the right-hand side of the program listing read like a flowchart. The flowchart nature of the programs is further enhanced with lines and arrows on the left-hand side of the program listing; i.e., a line connects "GTO 5" with "LBL 5," or "GSB A" with "LBL A," so the reader can easily follow the program flow. The contents of all registers are also completely listed.

The many elegant routines within the programs that both shorten the program length and maximize program execution speed reflect both the author's cleverness and experience in his field.

The book has received excellent reviews from both **Sidney Darlington** (the father of modern filter design and for whom the Darlington transistor connection is named), and **Philip R. Geffe**, noted filter designer and consultant.

The price of the book is \$26.50,\* which buys over 540 pages (8½-by-11-inch format) of excellent data, 39 very complete and very-well-documented programs, and a sturdy hardbound cover with dust jacket. The book will be available in October 1979.

To order your copy of the book, send your check or money order (including any local sales tax) to:

**Van Nostrand Reinhold Company**  
**Mail Order Service**  
**7625 Empire Drive**  
**Florence, Kentucky 41042**

The publisher will ship your book postpaid, on a 15-day money-back guarantee basis. This offer is available only in the Continental U.S., Alaska, and Hawaii. For shipments outside these areas, write to the following address for information on price and how to order.

**Litton Educational Publishing**  
**International**  
**135 West 50<sup>th</sup>**  
**New York, N.Y. 10020 U.S.A.**

*(Congratulations, Mr. Murdock! I cannot imagine an engineer, in fields related to this book, not wanting it. This is an excellent book. And, remember, it's very likely you can deduct the cost of it from your income tax. In many more ways than that, it is truly a bargain. Furthermore, none of Mr. Murdock's programs from the Library are in the book in their original form. What few Library programs are in the book are significantly changed. Even the program listings have been revised to be faster, shorter, more accurate, and to provide more output. Finally, there is some possibility of preprinted prerecorded magnetic cards being made available if enough interest is shown. If you wish to correspond with the author regarding magnetic cards, write to the address below. Ed.)*

**Bruce K. Murdock**  
**P.O. Box 2325**  
**Goleta, CA 93018 U.S.A**

\*U.S. dollars. See note at bottom edge of cover.

## Random Numbers, Means, Regression, And The Programmable Calculator

The title of this article is also the title of a new book. It was written by **Thomas W. Beers**, Professor of Forestry at Purdue University's School of Agriculture in West Lafayette, Indiana.

The five chapters comprising this monograph were originally written as individual documents to be used in the teaching of undergraduate students in a Forestry Biometry-Forest Inventory course. The goal was to make use of the programmable handheld calculator as a tool to remove the tedium of the calculations and to provide some "excitement" to a potentially boring subject. The HP calculator family is used because of the convenience of the RPN logic system employed in the HP line. The programs described throughout this monograph are presented in considerable detail, and with examples, to facilitate their use by the novice. The chapters are:

1. Random Numbers for 3-P Sampling by Handheld Calculator.
2. The Meaning of Means and the HP-67.
3. Simple Linear Regression and the HP-67.
4. Multiple Regression, Simultaneous Equations and the HP-67.
5. Multiple Regression: Significance, Estimation, Deletion, and the HP-67.

The book is softbound in 8½-by-11-inch format, contains over 138 pages, and should interest not only Foresters but also professionals in education. For the U.S., Canada, and Mexico you can purchase the book for \$8\* per copy, postpaid (fourth class mail). If you order from other countries the price is \$9\* postpaid.

Mail all orders to:

**T & C Enterprises**  
**Box 2196**  
**West Lafayette, IN 47906**  
**U.S.A.**

\*U.S. dollars. See note at bottom edge of cover.

## Want To Help Find More Oil?

Do you want to possibly help relieve the energy crisis? Well, here's your chance.

**Edwin J. Ballantyne, Jr.**, special editor for an upcoming Society of Exploration Geophysicists (SEG) manual of handheld calculator programs for geophysics applications, is requesting contributions of programs. Specifically requested are programs for data reduction and interpretation in both algebraic and reverse-Polish notation. Separate manuals for calculators of each type are projected. Areas of special interest are: gravity, magnetics, radio-metrics, refraction seismics, reflection seismics, resistivity, induced polarization, electromagnetics, well logging, and physical properties. Other topics of interest to geophysicists are encouraged.

Each contribution should include: (1) a brief program description, including equations; (2) user instructions; (3) a program listing; and (4) test examples.

**Send all contributions to:**  
**Jerry W. Henry**  
**Society of Exploration Geophysicists**  
**P.O. Box 3098**  
**Tulsa, Oklahoma 74101**

Deadline for receipt is December 31, 1979. Target date for publication of the manual is mid-1980.

Any questions or comments should be directed to:

**Edwin J. Ballantyne, Jr.**  
**Amoco Minerals Co. - Mail Code 5407**  
**200 E. Randolph Drive**  
**Chicago, Illinois 60601**  
**Telephone (312) 856-2503**

*(Here's your chance to maybe help these folks find some new sources of oil. Anyone knows by now that we sure do need it! Ed.)*

## Editorial

The HP-41C has been on the market two weeks as of this writing. Already it is a great success. The most-asked question I hear about it is "Will it push the HP-65, HP-67, and HP-97 into oblivion?" The answer is no. KEY NOTES has no intention of abandoning these predecessors to our newest marvel. And if you don't see HP-65 articles or news, it's because there hasn't been any or I haven't received any from you. Also, don't forget that the HP-65 Library is still there, still functioning, still available, with over 5,500 programs in the U.S. Library.

Something is missing from this issue for the first time. The address block on the back cover no longer carries the statement "Address Correction Requested, Return Postage Guaranteed." You will find another statement in its place. The reason for this is easy to explain. Americans move around a great deal, and postage costs are escalating with inflation, so our costs for keeping track of where you are have become too high to continue this way. In the future, if you want to continue getting KEY NOTES, be sure you inform me of your address changes. I'll forward your address change to the Library if you're a member.

It is not unknown to us that some of you examine our products with a *very* critical eye. Some of you are looking for those "hidden" functions that you just *know* are lurking in there—somewhere. Then too, some of you are just curious as to what makes these things work. But the scrutiny we are referring to transcends *all* of that. For example:

Several weeks ago the phone rang, I innocently picked it up—as usual—and there was **Craig Pearce** (Berwyn, Illinois), who is the *ne plus ultra* of calculator enthusiasts. You'd have had to have been here to have really appreciated the conversation: "Hello, Craig; how are you?" "Fine, thanks. Say, Henry, I just got one of those remarkable Swiss Army knives—this one even has a nice magnifying glass in it—and I've been busy playing with it and looking at all sorts of things." "That's nice, Craig, but what does that have to do with calculators?" "Henry, did you know that the small decimal point in the HP-19C display has a tiny HP logotype on it?"

Your editor's life is never dull . . .

Letters to the editor should be addressed to:

**Henry Horn, Editor**  
**HP KEY NOTES**  
**Hewlett-Packard Co.**  
**1000 N.E. Circle Boulevard**  
**Corvallis, Oregon 97330 U.S.A.**

We cannot guarantee a reply to every letter, but we will guarantee that every letter received will be read by the editor, and as many as possible will be answered either in KEY NOTES or in a personal response. Please be sure to put your return address on the face of your letter. Letters sometimes get separated from envelopes!

## Base Conversion, Slightly Off-Base ...

On the back cover of Vol. 3 No. 2 we had an article, "Base Conversion Routine," contributed by **Cass Lewart**. Just before we went to press, a piece of crooked typesetting from our phototypesetting machine was replaced where the "answer" appears, just above the routine's listing. Unfortunately, the machine injected a double error. The last line of text *should* read:

Answer: 903081113 = 938 BD hex.

The infernal machine dropped a "1" and jammed-up some letters.

Also, we received a letter from **Bob Edelen** of Denver, Colorado, informing us that Mr. Lewart's routine has a slight malfunction in it. And that is true. To correct the original routine, insert an "INT" step between original steps 033 and 034.

Mr. Edelen found the omission of "INT" when he tried to run 3486784400 decimal to base 9. He got 8888888889, and he should have gotten 8888888888.

Thanks, Mr. Edelen, for sharing this "fix" with all of our readers.

## About Batteries...

Because the new HP-41C uses alkaline batteries instead of rechargeable batteries, there are some things you should know about them. As with *all* batteries, battery life is very dependent on the age of the battery (shelf life) and the amount and type of use.

With no plug-ins and with normal use, meaning day-to-day calculations and running several programs, an HP-41C will have a battery life of 9 to 12 months.

An HP-41C that is continuously executing (nonstop) a program will run from 50 to 100 hours. As you can see, this is an *extreme* case. Intermittent use will extend battery life enormously.

Most HP-41C users will find that, with normal use of the card reader and the plug-in modules, the batteries will last from several months to six months or even more.

With *extremely heavy* card reader usage, battery life will average somewhere between a week and two weeks. However, even though the batteries will no longer operate the card reader at that point, they will continue to operate the calculator for quite some time.

Early in 1980, an accessory AC adapter will be available to run the HP-41C on ordinary house current.

## Don't Use Solvents!

Because it is possible for batteries to leak under certain circumstances, some people are tempted to spray the battery terminals and battery compartment in their calculator with, typically, a "silicone spray" from a pressurized can to protect that part of their calculator. These aerosols usually contain a solvent of one kind or another, and most common solvents have a detrimental effect on most common plastics. Therefore, we do not recommend the use of these sprays on the batteries or in the battery compartment.

Proper care of the batteries in your calculator will preclude the need for spray coatings. Do not leave discharged batteries in your calculator, and remove the batteries if you do not expect to use the calculator for extended periods.

## More About Merging

For the last several issues, we have been publishing a lot of material about merging so that you can find a comfortable or convenient way to write multiple-card programs and thus extend the power of your HP-67/97. We don't want to bore you with the subject, but here is another excellent letter on merging. The author of this letter is also the author of a new book that is reviewed elsewhere in this issue. We think you'll like his ideas.

My reason for writing has to do with the article on merging. (Vol. 3 No. 2, page 5.) While the methods in the article work as advertised, chaining of long programs can be done more simply and still achieve the same results. If a PAUSE instruction is encountered during the execution of a program, and a new program is loaded during this time, the new program will replace the old one. When the pause time-out ends, the calculator will still be running a program, *but it will be the new program*. The new program starts execution at step 001.

I have used this technique in my book to chain programs requiring more than one card. I generally place the PAUSE instruction in a loop: LBL, PSE, GTO. Whatever was in the X-register prior to entering the loop will be displayed during the pause. This display can be the identifying number of the magnetic card to be read. The user need not wait for the pause. The next magnetic card to be read can be inserted into the card reader as soon as the program has been started. When the pause is encountered, the card will be read.

This instruction sequence does not have to be placed at the end of the current program, nor at steps 222 through 224; it can be placed anywhere it is convenient. The next card in the sequence does not have to have anything special at the beginning (steps 001 through 003). The first step of the new program is the first step the programmer wants executed. By not using the MERGE instruction, even greater program efficiency is achieved.

Remember, the MERGE instruction is used to modify a section of current program. Generally, when programs are chained, no part of the

previous program needs to be saved; hence, the MERGE instruction is not appropriate in this instance.

I hope this dissertation has shed some more light on program chaining.

Very truly yours,

Bruce K. Murdock, Goleta, California

## Pac Corrections

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 pac copy is correct, you have a later, revised issue.

### HP-67/97 SURVEYING PAC

Program SU1-19A1, "Geographic to Alaska 2-9," has been found to contain some errors that can cause inaccurate results in some calculations. On pages L19-01 and L19-02, mark the following corrections in the listing.

1. At bottom of L19-02, add "USED" in the box for flag 2.
2. Delete step 185.
3. Delete step 182 and add "x<sup>2</sup>."
4. Delete step 178.
5. Between steps 175 and 176 add "F2?, CHS."
6. Delete step 133 and add "x<sup>2</sup>."
7. Delete step 130.
8. Delete step 088.
9. Delete steps 075 and 074 and add "RCLB."
10. Between steps 054 and 055 add "X<0?, SF2, STO B."

To receive a revised card, you must mail your old card to: HP Service Department; P.O. Box 999; Corvallis, Oregon 97330. This new card will be available on October 15, 1979.

Program SU1-19A3, "Alaska 2-9 to Geographic," has been found to contain some errors that can cause inaccurate results in some calculations. On pages L19-05 and L19-06, mark the following corrections in the listing.

1. At the bottom of L19-06, add "USED" in the box for flag 2.
2. Between steps 198 and 199 add "F2?, CHS."
3. Delete step 179.
4. Between steps 149 and 150 add "x<sup>2</sup>."
5. Between steps 087 and 088 add "x<0?, SF2."
6. Between steps 001 and 002 add "STO C."

To receive a revised card, you must mail your old card to: HP Service Department; P.O. Box 999; Corvallis, Oregon 97330. This new card will be available on October 15, 1979.

## "25 Words" (More or Less!)

The column is somewhat truncated this issue because of the space devoted to the HP-41C, but if you have contributed something in the past weeks or months, don't give up. We'll expand the column in November to try to "catch up."

Our first input is from Justus A. Villa who lives in St. Thomas in the Virgin Islands.

Here is my contribution to your "25 Words" feature. It is a flexible increment/decrement routine. To set it up:  $\pm n$ , STO9, P $\geq$ S (n can be an integer or not). Thereafter: increment by  $\Sigma+$  and decrement by  $\Sigma-$ . Notice that the other statistical registers are not necessarily disqualified as accumulators.

Here is another tip for statisticians. It's from Michael Tarnowski of Wiesbaden, Germany.

I have found a routine that I think would be appropriate for your "25 Words" column. The routine calculates the value of  $\chi^2$  statistics for the goodness of fit test.

$$\chi^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i}$$

To test the routine, press  $\square$ , key in O<sub>i</sub>,  $\square$ , E<sub>i</sub>, and press  $\square$ . To delete wrong values, key in O<sub>i</sub>,  $\square$ , E<sub>i</sub>, and press  $\square$ . After the last input has been keyed in, press  $\square$  1 for  $\chi^2$ . That's it! The routine can be used by itself or as part of a larger statistical program.

001	*LBLA	014	ST-1
002	CLRC	015	1
003	CLX	016	ST-0
004	RTN	017	RCL0
005	*LBLB	018	RTN
006	GSB0	019	*LBL0
007	ST+1	020	ST02
008	1	021	-
009	ST+0	022	X <sup>2</sup>
010	RCL0	023	RCL2
011	RTN	024	=
012	*LBLC	025	RTN
013	GSB0	026	R/S

What do they do with HP-67/97's in Maydon Wharf, South Africa? That's easy to answer. Just read what Richard Helps has to say:

Here are two short routines that I have not seen published in KEY NOTES. I hope they may be of some use to your readers.

Sometimes in a programme it is necessary to know what trigonometric mode the calculator is in (e.g., using trig mode as an extra three-way flag). The routine: EEX, 2, COS will return -0.17 for DEG, +0.86 for RAD, and 0.00 for GRD, which can be tested using X<0?, X>0?, and X=0? for branching, etc.

If you wish to test only for DEG and RAD, then use: 2, COS, X>0?, SF2 which will set flag 2 for DEG mode and leave it clear for RAD mode. Of course, any flag or branch instruction can be used at the last step (SF2).

Now, from Rex H. Schudde of Carmel, California, comes this alternate solution to the angle conversion routine in the last issue.

On page 9 of Vol. 3 No. 2 you printed an 11-step program for 000° to 360° angle conversion by Mr. Caldwell. Attached is a listing of a nine-step program, sent to a mutual friend by Mr. Ian McKinnon of Toronto Islands, which accomplishes the same result in a very elegant manner. Further, this routine is not limited to angles less than or equal to 720°; Mr. Caldwell's routine does have this limitation. Thought that you and Mr. Caldwell would be interested.

```
001 *LBLA
002 3
003 6
004 0
005 +R
006 +P
007 X<Y
008 X<0?
009 +
010 R/S
```

Here is a letter about an article in the last issue (page 6). It is from Richard G. Cosway of Phoenix, Arizona. His routine is pretty neat!

With regards to Mr. Craig's article "Spring is Seed Time!" in the May 1979 issue, I have what I feel is a much simpler and shorter random number generator.

Assuming the seed is in register E and is between zero and one (though no starting seed is necessary):

```
001 *LBL E
002 RCLE
003 F i
004 +
005 e^x
006 FRC
007 STO E
008 RTN
009 R/S
```

This routine has the advantage of requiring only one register since no multiplicand needs to be stored. Also, it produces numbers which, from what I've been able to determine, are random.

But how's this one for brevity? It was contributed to KEY NOTES by Charles Close, who lives in Alexandria, Virginia.

I believe the following statement almost meets the criteria for the "25 Words or Less" column.

"If the total number of identical repeated steps in a program exceeds eight (8), the program will be shorter if those repeated steps are placed in a separate subroutine, to be called when needed."

(Continued)

Not quite 15 words, but almost! Keep up the good work in KEY NOTES.

*(Thanks for the compliment, Mr. Close. And, by the way, take another look at the column title. You were closer (!) than you thought! Ed.)*

Perhaps a lot of our readers have the same problem mentioned in this letter from **Guy Dresser** of Lawrence, Kansas. There are undoubtedly other solutions than his, but it *does* work.

I use the following routine, which compares decimal numbers to fractions, in an employee time card totalling program, and thought it might qualify for "25 Words or Less."

001	*LBL E	017	X≠Y?
002	ENT↑	018	GT01
003	ENT↑	019	R↓
004	RCLA 06	020	RCLA 06
005	2	021	RCLB 07
006	=	022	+
007	0	023	GT00
008	*LBL 0	024	*LBL 1
009	STOE 07	025	R↑
010	R↑	026	PSE
011	FRC	027	R↑
012	X≠Y	028	INT
013	-	029	RCLB 07
014	ENT↑	030	+
015	R↓	031	RTN
016	ABS	032	R/S

The routine selects the fraction closest to the decimal portion of a number, displays the difference between the fraction and the decimal number, then ends with the integer and "fraction" added together in the display.

Since we pay on the basis of quarter-hours but the time clock is calibrated in hundredths of an hour, the routine will establish how many hours and quarter hours to pay for, and also the number of hundredths over or under to carry forward to the next week. It will work, though, for any fraction, so it might also be useful in teaching children the relationships between fractions and decimals.

To try the routine, put  $\frac{1}{4}$  (.25) in register A, key in a value such as 40.68 and press [E]. The calculator will pause, displaying -0.07 (difference between fraction selected and decimal), and then it will display 40.75 (40 $\frac{3}{4}$ ). Then put  $\frac{1}{6}$  (6, 1/X, STO A) in register A, key in 40.68, and the results will be 0.01 and 40.67 (40 $\frac{1}{6}$ ). If you are unsure of the fraction you end up with, (how many sixths is .67?) use FRAC, RCL A, +, which could be appended to LBL 1 in the program, after a pause.

Do you find yourself watching the clock at the end of the day? If so, here is a neat routine that will interest you, or perhaps you can apply it to other projects. It is from **John L. Gafford** of Jackson, Michigan.

Here's one for your "25 Words or Less." I call it "Clockwatcher." Load the program, look at your digital watch, key in the time, press A and presto—hours and minutes (and seconds if you DSP4) until quitting time! It will accommodate any time between 6 A.M. and 6 P.M. Negative numbers mean you are working overtime! The

test in step 005 determines whether the time keyed in is before or after noon. The appropriate routine under LBL0 or LBL1 then makes the calculation. Quitting time is placed in steps 010 through 013 in 12-hour format, and in 013 through 022 in 24-hour format.

001	*LBL A
002	ENT↑
003	6
004	X≠Y
005	X≠Y?
006	GT00
007	GT01
008	*LBL 0
009	CHS
010	4
011	.
012	4
013	5
014	HMS+
015	RTN
016	*LBL 1
017	CHS
018	1
019	6
020	.
021	4
022	5
023	HMS+
024	RTN

Our quitting time happens to be 4:45 P.M., so the user should correct the entries to correspond to his quitting time.

On a more serious note, the program could be adapted to quickly calculate the time between the present instant and some future event.

## Just Before We Went To Press...

As we were putting this issue "to bed," Hewlett-Packard announced that, effective August 1, 1979, the price of the HP-67 would be reduced to \$375.\* The price of the HP-97 remains the same, at \$750.\*

\*U.S. dollars. See note at bottom edge of cover.

### HP KEY NOTES

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