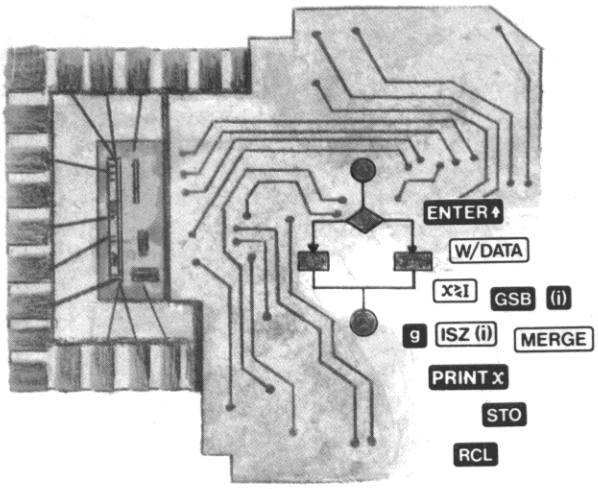


Featuring, this issue:

March 1980 Vol. 4 No. 1

HEWLETT PACKARD

HP Key Notes

Have You Seen the HP-85?

How often have you wished, while you put your programmable calculator in your pocket or briefcase in preparation to leave the office at the end of a day, that it was a computer? Many, many times, we'll bet! Well, now you *can* have a *real* computer that you *can use* almost anywhere, anytime.

In case you haven't heard, Hewlett-Packard's Corvallis Division now makes a personal computer for professionals. It's the HP-85, a complete computer system designed for individual use. In the lab, on your desk, or in your study, the HP-85 provides professional computing power when and where it's needed. That means no more waiting for data to be processed and returned. A big plus for the professional.

Comparable in size to a portable typewriter, the HP-85 boasts a completely integrated keyboard, CRT display, thermal printer, magnetic tape unit, and operating system. And at 20 pounds, it offers the added convenience of portability—*true portability.*

The HP-85 contains many features not ordinarily found in a personal computing tool. The HP-85's extended BASIC language is easy to use, yet with more than 140 commands and statements, it provides an extremely powerful problem-solving ability.

In addition to a typewriter-like keyset, the keyboard has a numeric keypad, system control and editing keys, and eight "soft" keys that may be defined by the user to select optional courses for program execution.

A highly detailed graphics system is a standard part of the HP-85. And because the 16 graphics statements are integrated into the HP-85's BASIC language, you can draw graphs, label axes, plot data, and control the graphics display either from the keyboard or in programs. User-defined graphics, another graphics feature, allows the user to create and to display custom characters such as symbols, logos, etc.

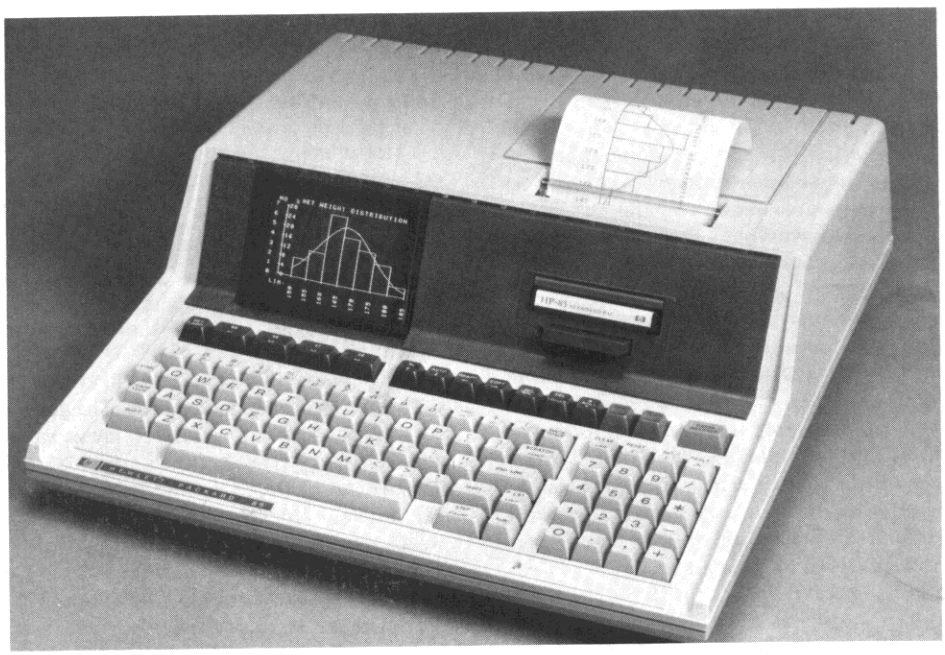
The bidirectional printer is built-in and whisper-quiet. Yet with a single command it will transform display contents into printed copy.

Magnetic tape cartridges supply the HP-85 with high-quality digital tape storage. High search speed and data access rates coupled with automatic tape directories give the HP-85 superior storage capabilities. Each magnetic tape cartridge can hold up to 217K bytes in up to 42 separate files, plus a "catalog" command tells you exactly what is on any tape. And you can double RAM capacity to 32K or expand ROM firmware from 32K to 80K with optional modules that plug right into the HP-85.

Also, it's easy to enhance the system's capability by adding powerful HP peripherals like a high-speed full-width line printer, full-size plotter, or flexible-disc drive.* You can also streamline your problem-solving with HP Application Pacs that offer preprogrammed solutions in a wide variety of disciplines on prerecorded magnetic tape cartridges.

But don't just look at the picture; go experience the HP-85 for yourself. However, please note: **The HP-85 is not available by mail-order from Hewlett-Packard.** In the U.S., call 800-547-3400 (in Oregon call 758-1010) for the HP-85 Dealer nearest you, or call your local HP Sales Office. Outside of the U.S., please contact the dealer or HP Sales Office nearest you.

**Contact your local dealer or HP sales representative for availability information.*



Hewlett-Packard's New HP-85 Personal Computer for Professionals

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

Editorial

A lot of you jumped on me about the photo of "...all the calculators that HP has produced..." that appeared on the cover of the last issue, because it did not include the HP-46 and the HP-81. Well, *you* are right; HP *did* produce those desktop versions of the HP-45 and HP-80, but they were produced in Loveland, Colorado, at our Desktop Computer Division. You see, what I *meant* to say was "...all the calculators that this HP Division has produced... ." There sure are a lot of sharp eyes out there ... and a lot of HP-46/81 owners!!

While we're on the subject of mistakes, there were a couple of them in the last issue. On page 6, in the first column, the "VIEWSZE" routine will not work for SIZE 000. Just add an INT between lines 11 and 12 and it will correct that flaw. Then, in the next column, under the "ΣFIND" routine, line 12 should have been x>y and lines 28 and 32 should have been x<>z. You wouldn't believe how those errors occurred, so I won't tell you. The author's original tape was correct, so you can blame me for that one. And, then in the next column on page 6 (an unlucky page number?), at the end of the third-to-last line under "Mathematics Pac," that should have been FS?C. Somehow, our typesetting machine dropped the C after I proofread the original tapes. That same insidious machine also misinterpreted some codes on its punched-tape input and garbled an entry on page 11, third column, under **Vic Schmidt's** contribution. Under "Spherical to Cartesian," Y:5u should be "Y:θ," and near the end, there should have been "Y:y" between X:x and Z:A. I've already apologized to Mr. Schmidt, so I'll now apologize to all our readers who were confused and frustrated by this error. But other than that, you all seemed to like the last issue very much.

I still get a lot of programs in the mail, presumably so they can be printed in KEY NOTES. Please submit all programs to the Libraries, here or in Europe. *We do not print programs in the newsletter* because, for one thing, the selection process would be nearly impossible to control, and how could we be fair to everyone? But we'll still highlight good programs that are submitted to the Libraries.

For those of you who did not see Vol. 3 No. 3, I'll repeat an editorial note that appeared atop column 3 on page 4: *Pressing and holding any key other than R/S slows the Catalog listing so you can follow it easier.* This did not appear in original printings of the owner's manual, so **Kim A. Heathman** of Phoenix, Arizona, suggested I repeat it for all of our *present* readers. (It has been added to the manual.)

Sharp-eyed *habitues* of KEY NOTES probably noticed a small change on the cover (or did you?). This issue is dated March instead of February. And from now until further notice, KEY NOTES will be mailed worldwide from Portland every March, June, September, and December. You can attribute this change to a severe case of type B influenza, a long-overdue long vacation last December, and the added time that it took to coordinate printing and shipping of worldwide editions from only one source: Corvallis. And, although you've had to wait longer than usual for this issue, we'll bet that it was worth the wait.

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 do guarantee that every letter 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" Revisited

It would be the understatement of the last year if we said that this routine has caused "a bunch" of mail. So, here, for the very last time, is the last word on the subject.

The original "Base Conversion" routine was written by Cass Lewart and printed on page 12 of Vol. 3 No. 2. Following that, Bob Edelen sent in a "fix" that was printed on page 10 of Vol. 3 No. 3. It now appears that the "fix" was not 100 percent correct but, first, a letter from Mr. Lewart.

My routine works with arguments up to 9 digits long. However, as expected, it may introduce errors in the least significant digit in some 10-digit arguments. Mr. Edelen's "fix" is no fix at all. Though 3486784400_{10} →base 9 is performed correctly, it fails for 3486784396, where my unmodified routine gives the right answer.

Unfortunately, there is no simple way to correct for round-off error for an *arbitrary* set of arguments except by increasing the 10-digit accuracy of the calculator or by performing integer modulo arithmetic (replace division with repeated subtraction). I did not want to do it in my KEY NOTES submission because it would obfuscate (confuse) the basic novel algorithm.

Well, an awful lot of people still attempted to "correct" the original routine. The general consensus of the letter-writers' ideas was to add "DSP0, RND" between steps 033 and 034 instead of the "INT" added as a fix by Mr. Edelen. And this brings up a fact that we all tend to lose sight of once in a while: These routines are published for your use as *ideas* that other users have developed. We do not mean to imply that each and every one is perfect. Quite often, a novel arrangement of steps is the really critical thing we want you to see, not necessarily the routine itself.

However, we don't want any of you to think that we won't print a correction or improvement to a routine published in your KEY NOTES, providing it aids or helps the majority of people. Nor do we want any of you to feel that we, or you, are infallible. Remember, programming is an indefinite art: there are innumerable ways to write routines, and none is perfect.

New HP-41C Software

Three new application pacs became available in February. They are:

Clinical Lab and Nuclear Medicine 00041-15024 $45*
Securities 00041-15002 $45*
Stress Analysis 00041-15027 $45*

In April, the following two new pacs will be released:

Structural Analysis 00041-15021 $75*
Home Management 00041-15023 $45*

And in case you've forgotten, Application Pacs that have been available for some time are:

Mathematics 00041-15003 $45*
Statistics 00041-15002 $45*
Surveying 00041-15005 $45*
Financial Decisions 00041-15004 $45*

You will also be interested in knowing that five more pacs are presently in various stages of production. They will appear before mid-year. We'll tell you more about them in the June KEY NOTES.

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

Important HP-41C Information

Quite often, the initial buyers of a complex calculator discover a few things about the product that were not known at the time of introduction, or were known but were not highlighted in the original version of the owner's manual. These items are then incorporated in later revisions of the manual, but we want *all* HP-41C users to be aware of them. Perhaps the following two paragraphs should be included as the first items under Service, on page 242. (You might even have received them as an addendum card with your present manual.)

Using state-of-the-art technology, the HP-41C Continuous Memory circuits operate continuously—even while the calculator is turned off. Because these circuits are always drawing very low power from the batteries, they are susceptible to disruption at all times. Disruption can be caused by *inserting or removing plug-in modules or peripherals while the power is turned on; electrostatic discharge to the unit; strong magnetic fields; plugging devices into the HP-41C that are not supported by Hewlett-Packard for use with the HP-41C;* or other

conditions that can traumatize the calculator.

Of course, all causes of disruption should be avoided, but should disruption occur, the most common symptom is a loss of keyboard control of the calculator. The HP-41C has been designed to allow recovery from these conditions. The procedure for resetting the calculator is to simply remove the battery pack and replace it again immediately. This will reset the HP-41C without causing a **MEMORY LOST** condition (unless the trauma itself was great enough to cause a **MEMORY LOST** condition). After several attempts, if this procedure fails to reset the calculator, work through the service procedure in the *HP-41C Owner's Handbook and Programming Guide,* page 242.

The next three paragraphs might be added on blank pages 253/254 in your present handbook.

Program Mode Power-Off. If you turn off the HP-41C (or if it turns off automatically) while the unit is in PRGM (program) mode, you should toggle into and back out of PRGM mode again when you resume operation. This ensures that changes made to programs in previous editing sessions will be compiled by the HP-41C system.

Program Clearing Restrictions. When you wish to clear very long programs (longer than 233 lines), you must set the HP 82143A Printer (if present) to MAN (manual) mode when you execute the CLP function. Programs longer than 1089 lines must be cleared using DEL nnn. (For example, to clear a 1980-line program, execute DEL and press EEX 980.) Refer to the *HP-41C Owner's Handbook and Programming Guide,* page 135, for more information about long programs.

ALPHA String Testing Restrictions. If you are testing two ALPHA strings that were originally longer than six characters (when created in the ALPHA-register), then you must perform the following procedure to ensure proper string truncation and test results. Strings can only be tested with the x=y? or X≠Y? functions.

1. Store the first string into a register using ASTO nn. If the string is not longer than six characters, skip this step and go on to step 4.
2. Clear the ALPHA register with CLA.
3. Recall the string into the ALPHA register using ARCL nn.
4. Store the string into the X-register using ASTO . X.
5. Store the second string into a register using ASTO nn. If the string is not longer than six characters, skip this step and go on to step 8.
6. Clear the ALPHA register with CLA.
7. Recall the string into the ALPHA register using ARCL nn.
8. Store the string into the Y-register using ASTO . Y.
9. Execute x=y? or X≠Y?.

We Have a New Number!

After April 1, 1980, you can place toll-free telephone calls directly to the factory, providing the call originates in the Continental U.S.

To give you better and faster service, we've moved our toll-free number from Nevada to Corvallis, Oregon—the home of Hewlett-Packard calculators. This new service will be available Monday through Friday of each week, from 7:00 a.m. to 7:00 p.m., Pacific Standard Time.

This new service consists of direct phone lines to the factory, with special operators assigned to answer your calls, which will terminate at these phones. Calls on the toll-free number can NOT be transferred to other phones in the factory. This new service will be available for:

1. Locating HP Dealers and/or Full-Line Accessory Dealers.
2. Product or literature inquiries.
3. Service information.
4. Status on new-product availability.
5. Ordering calculators, accessories, or software.

The service will NOT be available for answering technical questions nor for applications assistance. Those functions will be handled, as before (not toll-free), by the Customer Support department.

Oh, yes ... the number is **800-547-3400**, excluding Alaska and Hawaii (in Oregon call **758-1010**).

Software Changes

If you have early copies of the following two HP-41C or HP-67/97 Application Pacs, you should make the following corrections in your copy. Later copies have an addendum card, or the corrections have been incorporated in the finished product.

HP-41C STRESS ANALYSIS PAC and HP-41C STRUCTURAL ANALYSIS PAC

In the program, "Simply Supported Continuous Beams" (version 1A*), an error was found in the "FIXR" option. If you have a beam with a fixed right end, follow the procedure described in the user instructions up to the point of executing "MOMENTS." Before executing "MOMENTS," perform the following keystrokes.

RCL 19, 7, −, 0, STO // . Y

*You can distinguish the "1A" version of the module (which contains the error) from the "1B" version (which is correct), with the following procedure.

Turn off the HP-41C and remove all peripherals. You do not need to remove memory modules. Insert the "Stress" or the "Structures" module. Press // CATALOG 2. The first entry in the catalog specifies the module name (STRESS or STRCTA), followed by the revision code (1A, 1B, 1C, ... etc.). If the revision code on your module is 1A, follow the above procedure. For later revisions, ignore the above procedure.

HP-41C FINANCIAL DECISIONS PAC

1. In the FINANCE 1B Module, the prompts for the Modified Internal Rate of Return (MIRR) program were inadvertently reversed. When SAFE RATE=? is displayed, key in the risk rate. Likewise, when RISK RATE=? is displayed, key in the safe rate. In the example on page 25 of the applications book, the risk rate is 8% and the safe rate is 10%.

2. The "Bonds" program does not correctly calculate the yield of a short-term bond. When you wish to determine the yield of a bond held for one full coupon period or less, you must do the following:

a. Store either the call price or 100 in register 19.
b. CF 22
c. Press E to calculate the yield.

HP-67/97 M.E. PAC

Program ME1-09A, "Helical Spring Design," has been found to contain an error. Lines 147 (STO 8) and 148 (GTOA) should be deleted and replaced with GTO5. The bottom of page 09-11 should be changed to:

Sure enough, insufficient clearance. Try the smaller wire..

.035 R/S	→→→ 19.6600***	(Coils)
B	→→→→→→→186.303 ***	(S_s, psi)
C	→→→→→→→5.000 00	(Code)

Since the design checks out, calculate the dimensions:

E	1.563 00***	(L_f)
	758.0 −03***	(L_s)
	190.0 −03***	(D)
	225.0 −03***	(OD)

To receive a revised card (ME1-09B), **you must mail your old card to: HP Service Department; P. O. Box 999; Corvallis, Oregon 97330.** This new card will be available on or after June 2, 1980.

HP-67/97 BUSINESS DECISIONS PAC

Program BD1-11A, "Savings—Compouding Periods Different From Payment Periods," has been found to contain an error. Step 007 (F0?) should be changed to SF0, and CF0 should be inserted between steps 005 and 006.

To receive a revised card (BD1-11B), **you must mail your old card to: HP Service Department; P. O. Box 999; Corvallis, Oregon 97330.** This new card will be available on or after June 2, 1980.

Fitting 67/97 Programs Into The HP-41C

We have heard comments that some HP-41C owners are having difficulty in fitting HP-67/97 programs into their calculator when it does not contain a Memory Module. Well, as you know, we want *all* of our customers to be happy, so we made an attempt to load every HP-67/97 Application Pac program into the HP-41C (one at a time, of course!). Of the 207 programs, 105

Continued

fit without any program changes and 102 did not. However, approximately 10 percent of the programs that did not initially fit, *did fit* after using several of the tips and techniques listed below.

TIPS AND TECHNIQUES

What can you do if a program won't fit in the basic HP-41C? Fundamentally, you need more program memory, and if you don't have Memory Modules, the only way to gain memory is to decrease data storage requirements.

Let's assume that the HP-41C is sized for 26 data storage registers (as it should be when initially attempting to load an HP-67/97 program). From this starting point, you can take the following steps to seek more program memory.

1. Notice the correspondence between HP-67/97 and HP-41C data storage registers.

HP-67/97 Registers	HP-41C Registers
Primary Registers	R00-09
Secondary Registers	R10-19
A	R20
B	R21
C	R22
D	R23
E	R24
I	R25

Our objective is to reduce the data register requirements (thus increasing program memory), so you must first analyze the program's data register usage, using the program listing. If the I-register is used, go directly to step 2. If not, review registers A thru E (in that order), checking to see if the HP-67/97 program accesses them or not. The HP-41C SIZE requirement can be reduced by one for each *successive* unused register, starting with the I-register. For example, if registers I and E thru C are unused, but register B is used, you can down-size the HP-41C to SIZE 022.

After identifying any possible downsizing by the above technique, resize the HP-41C and again attempt to load your HP-67/97 program. If it fits, great! If it doesn't, don't give up; just continue to step 3.

2. If the I-register is used, you must scan the program listing to see if it contains any of the following HP-67/97 functions:

ISZ I	ISZ(i)
DSZ I	DSZ (i)

If *any* of these functions are contained in the program listing, you *must* use SIZE 026, for they all access R25 in the HP-41C. There is no recourse if SIZE 026 prevents successful program loading when one of the functions listed above is present in the program. If the I-register is being used for other than loop control, continue on to step 3.

3. You must now attempt to modify the program in a way that will enable you to further decrease your SIZE requirements. This can be done by reassigning register usage from high-numbered HP-41C equivalent registers to lower-numbered HP-41C equivalent registers. For example, if the HP-67/97 E-register is used (R24 in the HP-41C) but the HP-67/97 A-register (R20 in the HP-41C) is not, you can reduce the HP-41C SIZE requirement one register by modifying the HP-67/97 program to use register A instead of E.

Before beginning the modification procedure, test to see what the maximum allowable size is by attempting to load the program while using a successively smaller allocation of data registers. Once the program fits, you know how extensive your program modifications must be. For example, before making the modification suggested above (using register A instead of register E), you should check to see if SIZE 023 will allow the program to fit. If it does, that modification alone is sufficient. If not, more extensive modification is needed and it makes sense to see if this is possible before attempting to do so.

There are several important guidelines to consider when reassigning data registers. These are so important that they should be considered as rules by those not thoroughly familiar with the program being modified.

a. Be extremely careful when primary/secondary register commands are used within the program. If they are used simply to access an extra data register (i.e., P⇌S, STO 1, P⇌S) you can modify the program once it resides in the HP-41C by deleting the register exchanges and changing STO 1 to STO 11 (HP-41C register 11). If the P⇌S command is isolated (not paired like the earlier example), it is best not to tamper with it. In this case, no reassignments should be made to any of the HP-67/97 primary or secondary registers. Reassignments are therefore limited to registers A thru E (HP-41C registers R20-24).

b. If any statistical operations are performed in the HP-67/97 program, no reassignments should be made for any of the HP-67/97 secondary registers. Reassignments should be limited to the HP-67/97 primary registers (R00-09 in the HP-41C) and registers A thru I (HP-41C registers R20-25). Also, double-check for primary/secondary exchanges whenever statistical functions are present in the HP-67/97 program.

c. After modifying a program, test its operation with known data. Many (>30) modifications may be necessary to successfully reassign register usage, and the user should make sure that all modifications were properly made.

EXAMPLES

To give you a more positive "feel" for converting HP-67/97 programs for use on the HP-41C, here are a few examples of several conversions we made, using the tips and techniques described above.

1. *Standard Pac,* "Triangle Solutions SD-07A." This program did *not* fit into the HP-41C when SIZE 026 was used. A review of the data register usage indicated that the I-register was *not* used. After down-sizing to 025, the program successfully fit into the HP-41C.

2. *Surveying Pac,* "Resection SU1-08A." Using SIZE 026, this program would not fit into the HP-41C. (Primary registers 0 thru 8 and registers A thru E were used in this particular program.) And since the I-register isn't used, we tried SIZE 025, but that didn't work either. So a test was made to see if SIZE 024 would work, and it did. Then, with seven program modifications, register 9 (HP-41C register 09) was used instead of register E (HP-41C register 24). The program now successfully fit and functioned in the HP-41C.

3. *Surveying Pac,* "Intersections SU1-03A." In this program, primary registers 0 thru 9 were used, as were registers C, D, and E, which presented a "fitting" problem. This program would not fit into the HP-41C using either SIZE 026 or 025. Testing showed that it *would* fit using SIZE 023. Therefore, the data assigned to register D was reassigned to register A, and the data in register E was reassigned to register B. This procedure required 17 program modifications, but it allowed the HP-67/97 "Intersections" to successfully fit and function in the HP-41C, using SIZE 023.

4. *Games Pac,* "Tic-Tac-Toe GA1-11A." Used in this popular program were primary registers 0 thru 9, except register 2, plus registers A, B, E, and I. It was found that SIZE 026 would not work, so a search was made for indirect control statements in the program listing, but none were found. Satisfied that the I-register was used simply for data storage, a test was made to identify the SIZE requirement. SIZE 024 enabled the program to fit. Register usage was then reassigned from registers E and I to registers C and D (21 modifications were necessary to do that), and this allowed the HP-67/97 program to successfully fit and function in the HP-41C.

CONVERSION ANALYSIS

To make it easier for you to assess your collection of HP-67/97 Application Pac programs, we've listed below all the programs that will fit *without any modifications* into the basic HP-41C. But don't forget: all of the HP-67/97 Application Pac programs *will* fit into the HP-41C if you use one Memory Module. And remember: if you modify a program, always test it with known data to make sure that it works.

The following listing is by Application Pac program number/Users' Library number and, in parentheses, the HP-41C SIZE requirement.

Surveying Pac

SU1-04/00085D (025)	SU1-11/00092D (008)
SU1-07/00088D (010)	SU1-13/00094D (020)
SU1-09/00090D (025)	SU1-15/00096D (026)
SU1-10/00091D (022)	SU1-17/00098D (026)

Games Pac

GA1-02/00175D (010)	GA1-10/00183D (010)
GA1-03/00176D (006)	GA1-14/00187D (022)
GA1-04/00177D (024)	GA1-19/00192D (017)
GA1-09/00182D (026)	

Standard Pac

SD1-01 (026)	SD1-11 (026)
SD1-02 (026)	SD1-12 (000)
SD1-06 (026)	SD1-14A (009)
SD1-07 (025)	

E.E. Pac

EE1-01/00020D (025)	EE1-13/00032D (005)
EE1-02/00021D (026)	EE1-14/00033D (021)
EE1-08/00027D (006)	EE1-15/00034D (021)
EE1-11/00030D (008)	EE1-16/00035D (026)
EE1-12/00031D (007)	

M.E. Pac

ME1-01/00038D (025)	ME1-17/00056D (024)
ME1-03/00040D (026)	ME1-19/00058D (026)
ME1-10/00049D (026)	ME1-21/00060D (010)
ME1-11/00050D (026)	ME1-23/00062D (010)
ME1-15/00054D (022)	ME1-23/00062D (024)
ME1-16/00055D (025)	

C.E. Pac

CE1-01/01123D (025)	CE1-06/01128D (026)
CE1-04/01126D (026)	CE1-16/01138D (025)
CE1-05/01127D (026)	CE1-18/01140D (010)

Stat Pac

ST1-02/00102D (026)	ST1-12/00112D (026)
ST1-03/00103D (023)	ST1-14/00114D (021)
ST1-04/00104D (026)	ST1-15/00115D (009)
ST1-06/00106D (022)	ST1-16/00116D (004)
ST1-07/00107D (022)	ST1-18/00118D (003)
ST1-09/00109D (022)	ST1-19/00119D (025)
ST1-10/00110D (007)	ST1-20/00120D (009)

Clin. Lab. & Nuc. Medicine Pac

CL1-01/00001D (026)	CL1-10/00010D (026)
CL1-02/00002D (026)	CL1-11/00011D (026)
CL1-03/00003D (026)	CL1-12/00012D (026)
CL1-04/00004D (026)	CL1-13/00013D (026)
CL1-05/00005D (026)	CL1-14/00014D (026)
CL1-06/00006D (026)	CL1-16/00016D (020)
CL1-07/00007D (026)	CL1-18/00018D (023)

Business Decisions Pac

BD1-01/00122D (026)	BD1-11/00132D (025)
BD1-02/00123D (026)	BD1-14/00135D (008)
BD1-03/00124D (025)	BD1-15/00136D (009)
BD1-05/00126D (009)	BD1-16/00137D (026)
BD1-06/00127D (026)	BD1-19/00140D (026)
BD1-07/00128D (026)	BD1-20/00141D (026)
BD1-08/00129D (007)	BD1-22/00143D (026)
BD1-10/00131D (008)	

Navigation Pac

NAV-01/01371D (022)	NAV-09/01379D (024)
NAV-03/01373D (010)	NAV-10/01380D (021)
NAV-04/01374D (026)	NAV-13/01383D (003)
NAV-06/01376D (026)	

Math Pac

MA1-04/00066D (026)	MA1-10/00072D (026)
MA1-05/00067D (026)	MA1-12/00074D (026)
MA1-08/00070D (026)	MA1-17/00079D (020)
MA1-09/00071D (026)	MA1-19/00081D (020)

"25 Words" (More or Less!)

Your letters indicate that you both appreciate and value this column. Well, that's good, because we enjoy bringing it to you. Let's face it, calculators can be interesting *and* a lot of fun. That's why we publish such a variety of material in this column. And, speaking of variety, let's start the ball rolling with a "clean house!"

This first routine is the contribution of **James M. Dzierzanowski** of Pennsylvania State University in University Park, Pennsylvania. We have to admit that it's a "clean" routine (no pun intended!).

(41C) The HP-41C Continuous Memory circuits add a great deal of power to everyday calculations. With this feature, I have found that better housekeeping of statistical registers, the stack, and addressable storage registers is necessary. As a habit, I like to clear the Continuous Memory, so previous results will not interfere with future calculations. A short housekeeping routine is:

```
01*LBL "CLEAN"      05 CLA
02 CLΣ              06 FIX 2
03 CLST             07 TONE 4
04 CLRG             08 RTN
```

The statement FIX 2 is included to establish a default fixed point display of two significant figures. The TONE 4 command signals the user that program execution is completed.
(Line 02 is not necessary if line 04 is done. Ed.)

And now, Mr. Dzierzanowski, meet our next contributor, **Ernesto A. Malaga**, of Los Angeles, California. Both of you were on the same track!

(41C) Willing to clear just *some* registers? The HP-67/97 had a way to do it: f CLREG. But the HP-41C has none. But wait! There *is* the CLΣ function. If you want to clear R_{10} thru R_{18}, for example, just press—or program:

XEQ "ΣREG" 10	to clear R_{10} thru
CLΣ	R_{15}, and
XEQ "ΣREG" 13	to clear R_{13} thru
CLΣ	R_{18}.

Done! Consumption=6 bytes. The longer sequence 0, STO 10, STO 11, ..., STO 18 would use-up 13 bytes!

Next, we have another tip from **Mr. Malaga**. This time he's found a way to "extend" the basic HP-41C.

(41C) Sometimes, when keying in a program that uses all the memory registers not used for storage, you'll find a situation where the last two or three steps will not fit, and the display will keep showing PACKING and TRY AGAIN. So, try this:

1. Delete key reassignments of standard HP-41C functions, and try again. If this is not enough, go on to step 2.
2. Reduce the allocated number of storage registers by one, thus using a smaller SIZE.
3. Key in the program steps that didn't fit, and then PACK memory.
4. Restore the previous SIZE.

Surprisingly, this works! I've found myself many times in this situation (I have no memory modules yet), and it almost always was the solution.

If you can't restore the previous SIZE, you will have to do other byte-saving procedures; such as:

1. Shorten ALPHA labels or ALPHA strings, if any are used.
2. Delete some END instructions and put RTN in place of them.
3. Use stack registers for indirect or looping control, instead of using a storage register. This will allow you to use a smaller SIZE, so that your program can be longer—or fit, if it didn't before.

(In your letter, your tip about deleting ENTER to save a byte won't work, Mr. Malaga. Although you key in, say 36, then ENTER, then 6, and delete the ENTER as you key it in, the HP-41C always *knows that 36 and 6 must be two separate entries, so it deletes the ENTER—at your command—but it puts a "null" byte in its place. Even executing PACK will* not *remove this null byte; otherwise you would have 366 in memory and not 36 and 6. Of course, this deletion of ENTER* does *cut down on listings, and it* does *save some paper in your printer, but don't be fooled into thinking you are "saving" bytes. Ed.)*

Let's travel over to Evanston, Illinois, now, for a contribution that should be of interest (pun intended!) to nearly every one. **Richard Sperling** is the author of this neat routine.

(67/97/41C) My contribution to "25 Words" is a routine for calculating "effective" interest cost. It is the net cost of borrowing: "Actual interest, less the reduction in income taxes resulting from including the interest cost on the income tax return as a deduction."*

Input the amount borrowed ENTER, the amount of interest ENTER, and the tax rate (from your income tax bracket). Press A and the routine will calculate the effective after-tax cost and the effective after-tax interest rate.

```
001  *LBLA      009    %
002   STO3      010    -
003     R↓      011   PRTX
004   STO2      012   RCL1
005     R↓      013    ÷
006   STO1      014   EEX
007     R↑      015     2
008     R↑      016     x
                017   RTN
```

Enter the interest and tax rates as whole numbers; that is, enter 12 percent as 12 and a 50 percent tax bracket as 50.

Reference:* **Fundamentals of Financial Accounting, *revised edition, 1977, Welsh and Anthony, pp. 15-16.*

Next is an improvement on a routine we printed in the last issue. It is the contribution of **Fred A. Kanel** of Research Triangle Park, North Carolina.

(67/97/41C) Here's a version of the A/B=C/D ratio equation routine shown at top center on page 12 of Vol. 3 No. 4. This version saves four lines of memory.

Continued

```
001  *LBLA      010    R↑
002   X=0?      011    +
003   GTO2      012   ENT↑
004    R↓       013  *LBL1
005   X=0?      014    R↓
006   GTO1      015    ÷
007    R↓       016    ×
008   GTOA      017   RTN
009  *LBL2      018   R/S
```

Instructions are the same: (A) 13, ENTER; (B) 22, ENTER; (C) (unknown) 0, ENTER; (D) 44, [A]. After [A] is pressed, the answer "26" will appear in the display.

The last routine works well on either the HP-67/97 or the HP-41C. But here is a routine from **David Spear** of Philadelphia, Pennsylvania, that was designed specifically for Mr. Spear's HP-41C, and it uses only 14 lines of memory. However, it also works quite well on the HP-67/97. Try it.

(41C/67/97) Here is an interchangeable solution to A/B=C/D in only 14 lines. Start by entering the data into the stack; for example, (A) ENTER; (B) ENTER; (C) ENTER; (D) XEQ RATIO. The unknown should be entered as 0 in the appropriate position (Terry Mickelson's idea in Vol. 3 No. 4). The routine uses the transposition AD=BC. If either A or D is 0, the other is divided into B*C. If neither is 0, the routine loops to test B and C, and divides the other into A*D. If you forgot to enter 0 for the unknown, the routine signals by continuing to loop.

```
01*LBL "RATIO"   08 RDN
02 RDN           09 GTO "RATIO"
03 X=0?          10*LBL 01
04 GTO 01        11 RDN
05 X<>Y          12 /
06 X=0?          13 *
07 GTO 01        14 RTN
```

(Very good, Mr. Spear. But for HP-67/97 owners not familiar with HP-41C code, here's some help. Change line 001 to LBLA and line 009 to GTOA. Lines 2, 8, and 11 are "roll downs." The asterisk in line 13 denotes "multiply" on the HP-41C. Ed.)

How about two more HP-41C tips from **David Spear**? He's really been busy with that new calculating marvel.

(41C) Most people double a number by keying [2] [×]. This uses 2 lines, 3 bytes, and loses the T-register. Keying [ENTER] [+] uses one less byte. But the best way is to key [STO] [+] [.] [X]. This uses only 1 line, 2 bytes, and saves the T-register.

(It not only saves space, Mr. Spear, it also runs faster in a program. Very good tip! Ed.)

(41C) Here is a solution to the quadratic equation $ax^2 + bx + c = 0$. It takes 19 lines and uses no registers. Key in a, ENTER, b, ENTER, c, XEQ QUAD. If the roots are imaginary, the annunciator will show that flag 1 is set. The real part will be in the X-register, the imaginary part in the Y-register.

```
01*LBL "QUAD"    11 X>0?
02 X<> Z         12 SF 01
03 ST/ Z         13 ABS
04 ST+ X         14 SQRT
05 CHS           15 ST- Z
06 /             16 X<>Y
07 STO Z         17 FC? 01
08 ENTER↑        18 +
09 *             19 RTN
10 -
```

(Neat! But one thing to watch: If first example gives complex results, second time through would also give complex results. Flag 01 is never cleared. Ed.)

Let's jump across the world, now, to Nova Gorica in Jugoslavija (Yugoslavia, to us! And this author's home is about 33 kilometers north of Trieste—as the crow flies. Thought we didn't know, eh?) This contribution is from **Dipl. Ing. Rajer Jernej**.

(67/97) As a contribution to "25 Words," I send you this routine that I use to solve the formula for χ^2. The original contribution by Michael Tarnowski, which was printed on page 11 in Vol. 3 No. 3, required 24 lines of memory, whereas mine uses only 14 lines.

```
001  *LBLA      009    CHS
002    R/S      010    +
003   STOA      011   GTOA
004    -        012  *LBLB
005    X²       013   SF2
006   RCLA      014   GTOA
007    ÷        015   R/S
008   F2?
```

This routine can be used autonomously or as part of other programs. To use it, press [CLX], then [A], and key in O_i, ENTER, E_i then press [R/S]. To delete wrong values, key in O_i, ENTER, E_i, then press [B] and [R/S]. The value of χ^2 is constantly visible in the X-register.

(I received a lot of mail about Mr. Tarnowski's routine, but must admit no one quite duplicated this contribution that came from a small town on the Italy/ Yugoslavia border just north of Monfalcone. As you can see, HP-67's do get around! And, for that matter, so does your KEY NOTES! Ed.)

There aren't many contributions to this column from Ireland. This one is from **Tom Veale,** who lives with his HP-67 in Dublin.

(67/97) The following routine will produce a 1-second pause or, alternatively, a 5-second pause, depending on the status of flag 1, which is preset by a trigger (in this case LBLe) on the HP-67. This I find useful in checking inputs that I have written down (using the 5-second pause), by rerunning the program with the 1-second pause, which is sufficient for comparing the written figures with those displayed.

```
001  *LBLe      on-off trigger.
002    F1?
003   GTO9
004    SF1
005     1       1 in display indicates F1
006   RTN       set.
007  *LBL9
008    CF1
009     0       0 in the display indicates
010    CF2      F1 clear.
011   RTN

052    F1?      pause choice function.
051    SF2
052    F1?
053   PRTX      5-sec. pause when F1 is
054    F2?      set.
055    F2?
056   PSE       1-sec. pause when F1
                 clear.
```

If, in a program, the pause "choice function" occurs frequently, it could best be treated as a subroutine in order to save steps.

The above may be useful to your readers. I have not noticed such a routine in KEY NOTES. It is an interesting illustration on the use of test-cleared flags (F2 in this example).

How about a couple of short routines from **George Miller** of Cincinnati, Ohio? There must be several dozen variations of the first one, but we're printing it for those who haven't as yet discovered this trick.

(41C) The following routine is a simple-minded "locking" device that prevents tampering with the HP-41C by those unfamiliar with its operation. Line 03 sets the auto-execution flag, then line 04 turns off the calculator. Line 05 is the first line executed when the ON key is pressed.

```
01*LBL "LOCK"
02*LBL 00
03 SF 11
04 OFF
05 GTO 00
06 END
```

Instructions:

1. Instead of turning off the HP-41C, key in XEQ "LOCK," and it will turn itself off!
2. Attempts to turn on the HP-41C will be indicated by the auto-execution "beep" and the calculator staying OFF.
3. To override the "LOCK," simply hold down the R/S key while pressing the ON key.

The use of GTO 00in line 05 allows more rapid execution than the use of GTO "LOCK."

(41C) The following two subroutines are handy for requesting input from many programs where input without stopping the running program is desired. The calling program provides a prompting message in the ALPHA-register, and the subroutine provides a steady display while waiting for a response. After the response, control is returned to the calling program. One level of subroutine call is used to provide this service. The first subroutine takes 20 bytes, the second, 23 bytes.

```
01♦LBL "NUM?"
02 AVIEW
03 CF 22
04♦LBL 01
05 PSE
06 FC?C 22
07 GTO 01
08 RTN
```

```
01♦LBL "WORD?"
02 CF 23
03 AON
04 AVIEW
05♦LBL 01
06 PSE
07 FC?C 23
08 GTO 01
09 AOFF
10 RTN
```

Instructions:

1. Load prompting message into ALPHA-register.
2. a. For numeric input, XEQ "NUM?".
   b. For alpha input, XEQ "WORD?".

Control is returned to the calling program, with the numeric response in the X-register or the alpha response in the ALPHA-register.

This next input is not a routine, but it is a contribution, and something you might overlook on the HP-41C. It's from **John L. Gafford** of Waco, Texas, who, in the August 1979 issue, was from Jackson, Michigan, proving that Americans are very peripatetic people.

(41C) A comment on Craig Pearce's "SIZE" routine in Vol. 3 No. 4, page 5. His instructions are LBL "SIZE," and the first line of his program is 01 LBL "SIZE." If one uses one of the standard functions as a program label (i.e., "SIZE"), then the function cannot be executed from the keyboard until the program label is removed or changed to some name other than a standard function.

For a change, how about a routine from the land that produces exceptional tapestries, among other things. This routine is the product of **Didier de Callatay** of Brussels, Belgium—or is it? We'll let *you* decide... .

(67/97) Please find here a little "moving average" routine: very short (less than 25 lines), very fast (less than 25 tenths of a second), very powerful (up to 24—yes! less than 25— entries in the "moving average,") and very easy to use (less than 25 words to explain).

```
001  *LBLA
002    X≷I
003   X=0?
004   RCLE
005    X≷I
006   ST+0
007   RCL i
008   ST-0
009    R↓
010   STO i
011   DSZI
012    SF3
013   RCL0
014   RCLE
015    ÷
016   RTN
```

Store the number of sets of data in the moving average in register E. For each entry, press [A], and see the "moving average" of the last (R_e) entries.

Well, I forgot to say that this routine was written by my daughter, who is less than 25 ... months (exactly 16; see photograph).

(Very clever presentation for this column, Mr. de Callatay! But I'm not convinced that your daughter was the author. However, since I'm retiring 3 years from now, perhaps your daughter ... naw, it's too good to be true! P.S. I edited your explanation; that's why it's now over *25 words. Ed.)*

There are many, many "SIZE" routines for the HP-41C, but we've never seen one quite the same as this next contribution. The author is **David B. Rifkind** of Tucson, Arizona.

(41C) Here is a modified version of the "SIZE" routines printed in Vol. 3 No. 4. It uses a nice technique called a "bracketing loop" for much faster execution with large "SIZES."

```
01♦LBL "SIZE?"
02 10.4001
03 ENTER↑
04 SF 25
05♦LBL 00
06 ISG Y
07 CLX
08 RCL IND Y
09 FS? 25
10 GTO 00
11 CLX
12 10.0001
13 -
14 ENTER↑
15 SF 25
16♦LBL 01
17 ISG Y
18 CLX
19 RCL IND Y
20 FS? 25
21 GTO 01
22 RDN
23 FIX 0
24 "SIZE="
25 ARCL X
26 AVIEW
27 FIX 4
28 RDN
29 RTN
```

I like to have routines that leave the X-register alone, and this one does.

Not far from Arizona—in fact in Gardendale, Texas— there's another HP-41C owner, by the name of **Patrick Murphy**. Let's see what he's doing with his new calculator.

(41C) Here is a little tidbit that may be suitable for your "25 Words" column. These are fast octal ←→ decimal conversion routines that handle real numbers. There may be some error in the result if the number is irrational in octal, or if the precision of the calculator is exceeded during calculation. The stack is destroyed, but no registers are used.

```
01♦LBL "ROCT"
02 ENTER↑
03 INT
04 OCT
05 RCL Y
06 FRC
07 1073741824
08 *
09 INT
10 OCT
11 1 E10
12 /
13 +
14 RTN
```

```
01♦LBL "RDEC"
02 ENTER↑
03 INT
04 DEC
05 RCL Y
06 FRC
07 1 E10
08 *
09 INT
10 DEC
11 1073741824
12 /
13 +
14 RTN
```

There were some letters about the article, "SST-ing Thru Subroutines" (on the HP-97), which appeared in Vol. 3 No. 2, page 12. It seems many people were interested in a possible solution for this on the HP-67. Well, here's one from **Charles H. Bowles** of Marathon Shores, Florida.

(67) Mr. Schaeffer is right, his method of "SST-ing" through subroutines on the HP-97 will not work on the HP-67. But here is one that will; in fact, two that will.

Method 1. If you have an unused LBL and program space, and you want to SST through the program *and* subroutines, insert an "f GSB n" as the second step of any subroutine you wish to be able to SST through. LBLn will read "f LBLn, h RTN." You can then SST through any program, including the subroutines.

Method 2. While holding down the SST key, press R/S and hold it. Release the SST key (still hold R/S). Then release the R/S key and immediately press it again. You will be at the first step of the subroutine and can proceed to SST through it, and it will RTN to the proper place at the proper time.

(Seems Somewhat Tedious but Sure Seems To work. Someone Studying This might Sense Some Traps, but we think Mr. Bowles Sure Solved That problem! Ed.)

Russian Calculators?

In the last issue, one of you asked a question regarding calculators in Russia. So we're happy to bring you the following news, which we thought would interest you.

Dear Mr. Horn:

In reply to Mr. Santoyo's letter published in the November 1979 issue of KEY NOTES (Vol. 3, No. 4), I am glad to furnish the following information about calculators made in the U.S.S.R.

I was there for a four-week period in October 1979, and I looked carefully in the stores in Moscow as well as in Leningrad, in addition to asking some colleagues in the Institute of Control Sciences at Moscow and in the Computer Centre at Leningrad. At that time they were making calculators in the U.S.S.R., but these were of the non-programmable type. The best one you could get in Moscow was the simple four-function plus reciprocal and square-root type, and it cost 50 rubles (approximately $75.00 U.S. at the official rate of exchange). Since this was rather expensive (the average salary of scientists was between 300 to 500 rubles per month), I did not see any of the scientists with personal calculators. Most of them were using slide rules.

When I brought this matter up for discussion at the Computer Centre, I was told that they were aware of the bad effect of the calculator on the high school students in the U.S.A. and, hence, the official policy was not to make calculators available at a low price.

In the Scientific Exhibition in Moscow, they had as an exhibit a scientific non-programmable calculator, but I was told that this was not available in the market.

Yours sincerely,

Professor Naresh K. Sinha
McMaster University, Ontario, Canada

Library Corner

There are now over 4,250 programs in the HP-67/97 Library and over 350 programs in the HP-41C Library. And when you consider that there are over 5,500 programs in the HP-65 Library, it brings up an astonishing statistic: *There are over 10,000 programs in the Corvallis Users' Library!* No matter how you look at it, that is quite a huge mass of information, and it covers just about every subject known to modern science, industry, and medicine. Our heartiest congratulations go to all of the authors for making this milestone possible.

CATALOG UPDATE

If you are a current subscriber to the Users' Library and as of this date have not received the last (November) update for the *Catalog of Contributed Programs*, contact the Library by mail or phone. The next *Catalog* update is scheduled for release in the May/June time-frame. We'll have more about that in the June KEY NOTES.

HP-85 LIBRARY

Once again the Library has expanded to meet the needs of another distinctive product, the HP-85 Personal Computer for Professionals. If you have not seen this marvel, the Library staff recommends that you get to your dealer *fast* and test one.

The HP-85 Users' Library is a separate, unique entity. Subscriptions are $40* a year for the U.S. and Canada, and $60* a year for all other countries (except Europe). Europe will have their own HP-85 Library, so contact them (Geneva) for prices in that area.

Library programs for the HP-85 are available at $10* for each program listing and documentation. Members of the Library will receive a 40-percent discount on each program, so *their* net cost will be only $6* a program. But that's not the only membership benefit. As a member of the HP-85 Library you will receive (1) a catalog full of program abstracts, (2) special promotions available only to members, (3) access to lots of programming ideas, (4) a membership card with *your* number. And, best of all, if you subscribe within 60 days after purchasing your HP-85, you will receive a special cartridge containing programs written especially and exclusively for the HP-85 Users' Library.

ORDERING PROGRAMS

HP-67/97 and HP-41C programs are $6* each, and they include documentation and a prerecorded magnetic card. Whenever possible, use the Users' Library Order Form in your *Catalog of Contributed Programs* to place Library orders. If you want a program that you see in this issue of KEY NOTES, and you can't find an order form, a plain piece of paper with your name and address and the program numbers you desire is certainly adequate. Mail your order and a check or money order to the Corvallis address listed on the back cover of this issue. Don't forget to include your State and local taxes. Or, in the U.S., you can place your order by calling toll-free: 800-547-3400, except Alaska and Hawaii (in Oregon call 758-1010). Yes, these are new numbers; see the article on page 3.

NEW PROGRAMS

Here are some new submittals you might like. Most do not appear in the new *Catalog* update. None of the programs in this issue are available in Europe at this time.

(67/97) The first one is a "special" that's titled, simply, **Navigation #67000-99971**, and the price is $43.50.* It is the work of **Captain Kenneth R. Orcutt** of Valley Center, California, who managed to program this large composition in 4059 lines, 20 cards, and 94 pages. So they don't call him the "Calculatin' Captain" for no reason!

This integrated set of navigation programs, used daily at sea by Captain Orcutt of Matson Navigation Company, is now available from the Library. Or you can purchase them separately, at the standard Library rate of $6* a program.

Captain Orcutt and his navigators have worked and reworked all of these programs from the bridge of a ship, so how can *you* go wrong? And you have to admit that the complete set is a software bargain, particularly when it *includes* cards. The set contains:

00455D Sun LOP Sight Reduction (224 lines, 1 card, 5 pages)
04160D Sun Azimuth (217-1-5)
00451D Sun Azimuth for Compass Adjustment (223-1-5)
00456D Time of Meridian Transit of the Sun and Meridian Altitude (223-1-5)
04161D Longitude by Sun Transit and Circles of equal Altitudes (218-1-5)
00457D Time of Sunrise and Sunset (222-1-5)
00453D Planet Sight Reduction (169-1-5)
00454D Moon Sight Reduction (172-1-5)
04162D Stars Sight Reduction (223-1-5)
04163D Star Azimuth (205-1-5)
04164D Star Identification and Sight Reduction (222-1-5)
00452D Stars and Planets (595-3-14)
00446D Great Circle Navigation, Including Composite and Rhumb Line (224-1-5)
00447D Sailings--Mercator, Rhumb, Great Circle (210-1-5)
04165D Voyage Planning, ETA and Speed (118-1-4)
04226D LORAN Line of Position (594-3-11)

Next are three programs that should be of interest to geologists and seismologists (and perhaps a lot of people living along the San Andreas Fault in California!). The programs are especially complete, even as to maps that show the continental shifts, so you can actually calculate the shifts that have taken place.

(67/97) Plate Tectonic Geometry—Pole of Several Rotations (#04229D)

The finite motion of a rigid plate on the surface of a sphere may be described as a rotation about an axis passing through the center of the sphere. In this program, a series of successive rotations about given poles of rotation may be concatenated, and the resultant pole and angle of rotation determined using the method of Phillips and Forsyth. (Will run okay on the HP-41C.) (224 lines, 5 pages)

Author: **Victor A. Schmidt**
Pittsburgh, Pennsylvania

(67/97) Plate Tectonic Geometry—Pole of Finite Displacement (#04230D)

This program allows the calculation of poles of rotation for finite motions of rigid plates on the surface of a sphere, given the latitudes and longitudes of two fixed points on the plate before and after rotation. The angle of rotation about the pole is also calculated. Useful in reconstructing plate motions and plate configurations throughout geologic time. (Will NOT run on the HP-41C without extensive modifications.)
(326 lines, 2 cards, 7 pages)
Author: **Victor A. Schmidt**
Pittsburgh, Pennsylvania

(67/97) Plate Tectonic Geometry—Rotate a Point About a Pole (#04231D)

The program rotates a point A on a sphere about a specified pole B by a given angle of rotation, yielding the new latitude and longitude of point A. Useful in mapping problems and in reconstructing ancient plate motions from published poles of rotation. Faster and more convenient for this purpose than program #00075D. (Will run okay on the HP-41C.)
(168 lines, 6 pages)
Author: **Victor A. Schmidt**
Pittsburgh, Pennsylvania
(Very good, Mr. Schmidt! This author is in the Department of Geology and Planetary Science at the University of Pittsburgh. Ed.)

We seem to be stressing measurements in this batch of programs, and these next two are not out of line (!) for that subject. Best of all they point out the difference in the HP-67/97 and HP-41C, because the author has written the same thing for two different calculators. Notice that the HP-41C uses less lines.

(67/97) Straight Line Forced Thru Any Point (#04227D)

This program calculates the bearing of a least squares fit straight line forced through any given point. Predictions of new E' and N' on that line may be made from values of N and E. Coordinate pairs (N,E) may be added or deleted at any time. (113 lines, 6 pages)
Author: **Frank C. Blachly**
Hyattsville, Maryland

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

(41C) Straight Line Forced Thru Any Point (#00327C)

Abstract identical to #04227D, above, but outputs have ALPHA prompts and labels and the printout on the HP-41C printer makes a more-easily-recalled-at-a-later-date program. (86 lines, 6 pages)

Author: **Frank C. Blachly**
Hyattsville, Maryland

(Nice programming, Mr. Blachly. Too bad most people will never see both *programs. Ed.)*

Now, how about a program from a doctor at the famous Mayo Clinic, who refers to his programming as: "...I am a rank amateur at this and self-taught besides." But you'll agree, if you see this program, that **Dr. Tucker** has nothing to be ashamed of if he can do this type of work.

(67/97) Renal Clearance & Reabsorption (#04232D)

A program for calculation of body surface area from height and weight (inches and pounds), corrected and uncorrected clearance of creatinine, phosphorus (or uric acid), chloride, osmolality, and free water. In addition, it will provide an estimate of distal renal tubular reabsorption of chloride and percent of filtered phosphorus and chloride reabsorption. (189 lines, 8 pages)

Author: **Ross M. Tucker, M.D.**
Rochester, Minnesota

(Thank you, Dr. Tucker, for taking the time to document this program. I'm sure a lot of your peers will enjoy your work. Ed.)

And, lastly, we have quite a unique application for you, from a Research Horticulturist in the land of koalas and wallabies.

(67/97) Labour or Rhythmic Event Timer/ Predictor (#04228D)

The program can be used for timing and predicting contractions during labour or for events of similar rhythmic nature. Running the program requires the use of only two keys (START and FINISH), giving: the interval since the last contraction/event and then a countdown of time remaining until the contraction/event ends; or the duration of the last contraction/event and then a countdown of time remaining until the next contraction/event. Starting can be done using the calculator to time contractions/events until prediction is possible, or by manually inputting values for previous cycles. (221 lines, 5 pages)

Author: **Stephen C. Morris**
Gosford, NSW, Australia

(In almost 6 years of writing KEY NOTES, I've seen a lot of "diverse" or "unique" programs, but must admit this one is "different." But before you scoff at this, read the following excerpt from the author's letter. Good show, Mr. Morris! Ed.)

"Having seen several programs incorporating timers, a program was written enabling the HP-67 to handle all timing and prediction tasks, leaving me completely free to assist with breathing and massages. Despite initial skepticism by my wife and even incredibility by the assisting nursing staff, all were agreed that the HP-67 did a terrific job helping with the natural birth of our first child."

About Batteries . . . Continued

In the August 1979 issue, we defined the useful life you could expect from the disposable type N alkaline batteries that are used in the HP-41C. Defined were the maximum and minimum limits of these batteries. In that same article ("About Batteries . . ."), we also stated that an accessory AC adapter would be available early in 1980. However, we found that a nickel-cadmium battery pack that can be recharged either inside or outside of the calculator is by far the preferred accessory for the majority of users. Furthermore, a good many of you already own an AC adapter/recharger (for the HP 82143A Printer) that can be used with a rechargeable battery pack. Also, we have solved the technical problems associated with making nickel-cadmium batteries work well with a low-power CMOS* device. And so, for these reasons, we decided to offer a rechargeable battery pack instead of an AC adapter.

The new rechargeable battery pack will exactly replace and be interchangeable with the present battery case assembly you now have in your HP-41C. Built into the rechargeable pack is a recessed socket that aligns with the small port on the right side of your calculator just below the SST key. When the rechargeable pack is in your HP-41C, you can use the printer's AC adapter/recharger to furnish power for the calculator by merely removing the small charging-port cover and inserting the plug from your AC adapter/recharger.

Now, when you use your calculator with a card reader and/or wand and/or memory modules, you will not rapidly deplete the batteries if you are a heavy user of all the peripherals.

You also can recharge the new pack while it is removed from the calculator, making it, effectively, also a "reserve" power pack. Thus, with two of the new packs, you should be able to calculate, read cards, and print to your heart's content. And, as a further backup, there's always the original battery case assembly and its four N-cells.

A fully charged pack will typically provide 6 to 12 hours of continuous run-mode *calculator* operation. Peripherals that draw power from the calculator's power supply will, of course, reduce the total power available for calculator operation to something less than the 6 to 12 hours, depending on the extent of peripheral use.

The nickel-cadmium cells in the rechargeable battery pack operate much differently than the alkaline N-cells you now use. After the low-battery indicator turns on, the rechargeable pack will provide a reserve operating time of only 1 to 2 minutes—much less than that offered by alkaline batteries.

The following rechargers can be used with the new rechargeable battery pack.

Model	AC Voltage	Identification
HP 82059B	90 to 120	United States
HP 82066B	210 to 250	Europe
HP 82067B	210 to 250	United Kingdom
HP 82067B Opt. 001	210 to 250	Republic of S. Africa
HP 82068B	210 to 250	Australia
HP 82069B	90 to 120	Europe

The rechargers will *not* be provided with the new pack, primarily because many of you received one with the purchase of your HP 82143A Printer or with an HP-97, HP-92, HP-19C, HP-10, or HP-91.

This new product is nearly ready for distribution to our dealers, and we expect that it will be available for purchase on June 1. However, **that is still not a firm date.** But the June issue of KEY NOTES *will* present more details about the new pack, including photos, the price, etc.

In the meantime, there *is* one way you can extend the useful life of your N-cell batteries if you heavily use the peripherals. Because a significant amount of battery life remains for *calculator-only* operation after the batteries will no longer operate the card reader, many HP-41C owners are stretching disposable battery life by exchanging batteries in tandem with card reader use. They load in fresh batteries to operate the card reader, then use older batteries to use only the calculator.

To make this battery exchange easier for those of you who use that method, we have established a price and a place of purchase for HP-41C battery case assemblies. With *two* battery case assemblies, you can easily exchange a set of batteries at a time, rather than one at a time, thus saving time and trouble. Furthermore, it is easier to mark the battery case assembly than it is to mark small N-cell batteries.

In the United States, only (anyone with a ZIP-code address), you can order battery case assemblies (HP Part Number 00041-60009) for $1.00** each, plus any applicable sales tax and a $1.50** *per order* handling and shipping fee. Notice that we stated the fee is "per order." Get together with a friend or two or three and you still pay only $1.50. The battery case assemblies must be ordered from:

Continued

*CMOS: Complimentary metal-oxide-semiconductor.

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

Customer Service Center
Hewlett-Packard Company
Mail Order Department
P. O. Drawer No. 2
Mountain View, CA 94043

Or, you can order by phone, using your Master Charge, VISA card or American Express credit card, by calling **415-968-9200,** extension 341 or 342.

In Europe and in other countries outside the U.S., contact your local HP Sales Office about the availability of the 00041-60009 Battery Case Assembly.

Another tip for stretching battery life is to make sure that the circuits inside the plug-in peripherals get initialized properly. When some of the peripherals are plugged in, in particular the card reader, their circuits may occasionally be powered-up in an indeterminate state that causes unnecessary current drain from the batteries. This condition corrects itself as soon as the calculator is turned ON. Therefore, to save battery life, it is a good idea to make sure the calculator has gone through at least one ON-OFF cycle before leaving the peripherals attached to the calculator for a long period of time.

Accessories Hot Line

You may have thought that ordering an accessory directly from the factory was the quickest way to obtain it. Chances are that you are wrong, especially if you live on the East Coast of the United States.

In their quest for cost efficiency in this era of double-digit inflation, our shipping department is NOT mailing accessories via first-class mail. So, unless you live in a remote area, there probably is an HP Full-Line Accessory Dealer near you who has that battery, application pac, recharger, or thermal paper you are looking for, and who will get it to you a lot faster than by ordering it from the factory.

Out of all the dealer outlets in the U.S. that handle our products, we have identified a large number of them who have committed to continually stocking certain "Class A" or "key" accessories (all batteries and rechargers, thermal paper, blank magnetic cards, software, etc.). And if they don't . . . we expect to hear from you.

To locate a "Full-Line Accessory Dealer," all you have to do is call our toll-free number 800-547-3400, except Alaska and Hawaii (in Oregon call 758-1010), and ask for the nearest dealer. They are listed by ZIP-code number, so our operators can easily recommend one near you. In fact, now that we have our own operators (see page 3), they probably can give you almost *any* information you need, short of *exactly* how many and the *price* of accessories that the particular store has.

Because this program has been very successful and has contributed to greater customer satisfaction, as of February we have actively referred all of our "direct"customers to our Full-Line Accessory Dealers. And, with each accessory shipped from the factory to a "direct" customer, we have included a card that encourages them to call our toll-free number and use the services of our full-line dealers, who are very happy to see their businesses grow in this way.

Try it. You'll like it!

Indirect Addressing

One of the most powerful programming concepts implemented on programmable calculators is indirect addressing. In addition to saving lines in programs (program memory), indirect addressing allows the programmer to write programs that, without extensive logic testing, will perform operations based on previous results. But before we get into the details of indirect addressing, let's first review addressing in general.

The instructions programmed into the calculator usually require an argument of some kind. For example, the SIN key takes the sine of the angle (any number) in the X-register. The angle is the argument of the SIN instruction. In the case of the SIN instruction, the argument does not have to be part of the instruction because it is assumed that you have placed in the X-register the angle whose sine you want. Other isntructions, however, require that you provide the argument as part of the instruction itself. The STO (store) instruction is a typical example. If you wish to store a specific number, 3.14159 for example, in register 3, you would have STO 03 in your program. The 03 is the argument of the STO instruction. The calculator requires the user to complete the STO instruction with the location or address to store the number. The 03 in STO 03 is the address. Technically there are two arguments for the store instruction. One is the location of the number to be stored, the other is the location to store it. Since it is understood that all numbers to be stored by the STO instruction are in the X-register there is no need to specify the location of the number being stored.

The example of storing the number 3.14159 in register 3 illustrates direct addressing. The location in which the calculator is to store 3.14159 is specified in the instruction. Suppose, however, you wanted to store the number 3.14159 into a register that depended upon previous calculations and you couldn't predict what its number would be? To implement this concept, the address is specified by another register. For example, let's place the number 3 in register 17. The instruction STO IND 17 would store 3.14159 in register 3. The IND in the instruction means indirect. When the calculator implements the STO IND 17 it stores the X-register number into the register specified by the number in register 17.

If you haven't thought about indirect addressing, or haven't used it, you may not realize how handy it can be. But let's clarify one more detail of how the HP-41C implements indirect addressing before we show how to use this most powerful instruction. If you have a calculator available, try the illustrative routines as we proceed. In the last paragraph, the example used 17 as the argument of the STO IND instruction. The number 3 was stored in register 17 and served as the address at which to store the number 3.14159. The implementation of the indirect instruction is to use only the absolute value of the integer portion of the number in the argument register. This is very useful and it means that register 17 could have contained the number −3.4567 and the operation would have been exactly the same.

The following example illustrates how indirect addressing can save program memory. Suppose we wish to evaluate a random number generator for uniform production of the digits 1 thru 9. The problem is to generate digits, tally the number of each digit generated, and evaluate the totals for a uniform distribution; e.g., an equal number of each digit. The programming approach is to add all the 1's generated, all the 2's generated, etc., and keep the sum of the 1's in register 1, the 2's in register 2, etc. A program that uses this straightforward approach is shown below. For illustration and test purposes we will provide the input digits and use routine "A" to sort and tally them. The random number generator is omitted, but could easily be included, calling routine A as a subroutine after each digit is generated. Registers 1 thru 9 are assumed to be cleared before a given batch of digits are summed.

```
01♦LBL A        19 X=Y?
02 1            20 ST+ 05
03 X=Y?         21 CLX
04 ST+ 01       22 6
05 CLX          23 X=Y?
06 2            24 ST+ 06
07 X=Y?         25 CLX
08 ST+ 02       26 7
09 CLX          27 X=Y?
10 3            28 ST+ 07
11 X=Y?         29 CLX
12 ST+ 03       30 8
13 CLX          31 X=Y?
14 4            32 ST+ 08
15 X=Y?         33 X<>Y
16 ST+ 04       34 ST+ 09
17 CLX          35 CLX
18 5            36 RTN
```

The number of each digit summed is determined by recalling register n, and dividing

by n. The same operation can be performed using indirect addressing. Routine E (below) illustrates this, and table 1 compares the two routines.

1. LBL E
2. STO + IND X
3. CLX
4. RTN

Table 1. Routines A and E Compared

Routine	Stack Regs. Used	Speed	Program Lines	Program Bytes
A	2	fast	37	49
E	1	very fast	4	9

The indirect store instruction is greatly enhanced in the HP-41C because any register may be used as the argument. In this example, the input data itself directs its storage and summation.

The 26 HP-41C instructions that may have indirect arguments are tabulated in table 2, along with the ranges of the contents of their argument registers. The argument itself may be any valid HP-41C register 00 thru 99, X, Y, Z, T, or L. Routine E could have TONE IND X following the STO IND X if an audio indication of the digit stored were desired. However, this would slow down the program considerably.

The STO and RCL instructions are probably the most commonly used indirect instructions. Close seconds, however, are GTO and XEQ. An example of an ALPHA application is the recall of a telephone number (and/or other desired information) from program memory when given a name. A program that displays the telephone numbers of JANET, BOB, and NANCY illustrates the indirect XEQ (line 7 in routine C).

```
01♦LBL C          10♦LBL "JANET"
02 "NAME"         11 "533-555-1212"
03 AON            12 RTN
04 PROMPT         13♦LBL "BOB"
05 AOFF           14 "723-555-6767"
06 ASTO X         15 RTN
07 XEQ IND X      16♦LBL "NANCY"
08 AVIEW          17 "621-555-4141"
09 STOP           18 RTN
```

To use the telephone retrieval program, press USER, then the C key. The "NAME?" prompt indicates you may key a name of up to six characters. Next, press R/S for the number. The program stores the name in the X-register and executes indirectly the label of the same name. If no label is found the very appropriate message "NONEXISTENT" is displayed. Using this program, 16 to 18 names and telephone numbers may be stored in a *basic* HP-41C.

XEQ or GTO will only work with global labels. The single letters A thru J and a thru e cannot be used as labels without a special technique. A typical example where single letters would be used is a large letter banner printing program that uses a printing routine for each letter. If an "A" is to be printed, it is most convenient to store the "A" in the X-register and XEQ IND X. The "A" printing routine would have a LBL A. As mentioned above, "A" is not a global label. LBL AA, however, is a global label, and it is an easy matter to make all labels double labels and double the letters as they come up. The ALPHA register is used for this process. (The text is stored in scratch registers to free up the ALPHA register.) The program instructions would be:

ASTO X	Stores "A" in X-register.
ARCL X	ADD "A". Produces "AA".
ASTO X	Stores "AA" in X-register.
XEQ IND X	Executes global label AA.

The use of indirect addressing saves so much program memory that the added byte for each label to make a double letter label is still memory-efficient.

The HP-41C was used to illustrate indirect addressing, but the ideas also apply to the HP-67/97, HP-19C/29C, and the HP-34C, except that the argument is a single, fixed register. When indirect addressing is used with incrementing and decrementing counters, it becomes even more effective in saving program memory. From the above examples you should be able to apply all the instructions in table 2 whenever you have multiple executions of an instruction with only a change in the data. Indirect addressing not only saves memory but also reduces logic testing in many applications.

Table 2. HP-41C Instructions That Can Be Executed Indirectly

Indirect Instruction	Argument Register Value Range	Error Message If Out of Range
STO IND nn*	000-318	NONEXISTENT
STO + IND nn	000-318	NONEXISTENT
STO − IND nn	000-318	NONEXISTENT
STO X IND nn	000-318	NONEXISTENT
STO / IND nn	000-318	NONEXISTENT
ASTO IND nn	000-318	NONEXISTENT
RCL IND nn	000-318	NONEXISTENT
ARCL IND nn	000-318	NONEXISTENT
VIEW IND nn	000-318	NONEXISTENT
GTO IND nn	00-99	NONEXISTENT
XEQ IND nn	00-99 or ALPHA NAME	NONEXISTENT
FIX IND nn	0-9	DATA ERROR
SCI IND nn	0-9	DATA ERROR
ENG IND nn	0-9	DATA ERROR
ISG IND nn	000-318	NONEXISTENT
DSE IND nn	000-318	NONEXISTENT
TONE IND nn	0-9	DATA ERROR
ΣREG IND nn	000-313	NONEXISTENT
ST IND nn	00-29	NONEXISTENT
CF IND nn	00-29	NONEXISTENT
FS? IND nn	00-55	NONEXISTENT
FC? IND nn	00-55	NONEXISTENT
FS?C IND nn	00-29	NONEXISTENT
FC?C IND nn	00-29	NONEXISTENT
X<> IND nn	000-318	NONEXISTENT
CAT IND nn	1-3	DEFAULTS TO CAT 3 IF ≥ 10 DATA ERROR

**Note: nn may be any valid HP-41C data register, 00-99, X, Y, Z, T, or L.*

About Foreign Orders

It is no secret that inflation and rising fuel costs have forced many businesses to curtail some services. And so we regret that we must stop accepting orders from any country outside of the U.S. To be more specific, until further notice, **any order that must be shipped to any address that does not include a U.S. ZIP code will be returned to the sender.**

As we said, this is regrettable. However, inflation has increased our costs to the point where we can no longer economically process foreign orders. There are also many extra mail costs and delivery problems and, of course, the many and diverse customs regulations. Then, too, the fluctuating currency-exchange rates are a constant headache and cause our costs to increase. It all boils down to one fact: We cannot continue to accept foreign shipment orders at the factory.

Beginning **April 1, 1980**, please send all of your accessories and product orders to your local HP dealer/distributor if you live outside of the U.S. Don't forget, as the dealer business increases, these dealers will stock more products and accessories, making them more available to you than ever before.

Price Changes

Over the years since the HP-35 was introduced, we have managed to maintain fairly stable prices for our products. In some cases we were able to lower prices, when costs to us decreased. And in many cases, when material costs or "normal" inflation caused added costs, we did not pass them on to you.

In today's world, however, things are vastly different. You all know what has happened in recent months to the prices of gold, silver, copper, and all products related to petrochemicals. Unfortunately—or fortunately, depending on how you look at it—our high-quality products use a considerable amount of plastics and precious metals. Therefore, effective March 3, 1980, the factory prices for the HP 82104A Card Reader and the HP 82143A Printer for the HP-41C were raised 10 percent. The new prices are:

HP 82104A Card Reader	$215*
HP 82143A Printer	$385*

All customer and dealer orders made on or before February 29 will be honored at the old price.

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

Book Reviews

The following book was published in September of 1979 but only recently came to our attention. It is NOT a book for financial neophytes, so if you are not comfortable with complex financial formulas or algorithms, make sure you examine the book at a bookstore before you plunge ahead and buy it.

However, for those involved in the intricacies of high finance, particularly in the analysis of investments, mortgages, leases, sinking funds and other financial arrangements in which the time value of money plays a critical role, this book is for you.

The book: *Financial Analysis Using Calculators: Time Value of Money,* is the product of three authors: **Elbert B. Greynolds, Jr.,** Assistant Professor of Accounting at Southern Methodist University (SMU) in Dallas, Texas; **Julius S. Aronofsky,** Professor and Chairman of Management Science and Computers (SMU); and **Robert J. Frame,** Professor of Finance and Director of the Management Center (SMU). It contains 473 pages and is produced only in a "soft-cover" edition. And the information presented in this book can be adapted to a large variety of calculators. Following is a list of the chapters.

1. Introduction
2. Manual Calculations
3. Basic Concepts in Compound Interest
4. Simple Annuities
5. General Annuities
6. Continuous Compounding and/or Continuous Payments
7. Variable Cash flows and Internal Rate of Return
8. Balloon Annuities: Applications Using Present Values
9. Special Applications

There are numerous applications scattered throughout the book. Also, because the chapters are functional (in the sense that they deal with basic problem-solving concepts or approaches) many types of applications (e.g., mortgages, leases, capital budgeting, etc.) are encountered in several places. An applications index is provided in chapter 1 to assist the reader in locating illustrative material and examples of interest. And, last but not least, the book contains a large number of drill exercises, with answers provided for half of them.

In the Continental U.S., the book costs $12.95* (plus any applicable sales tax) and can be ordered from:

McGraw-Hill Book Co.
Princeton Road
Hightstown, New Jersey 08520

In Canada, if you cannot locate the book in a local bookstore, write to:

McGraw-Hill Ryerson Ltd.
330 Progress Avenue
Scarborough M1T 2Z5
Ontario, Canada

In all other countries, if you cannot locate this book write to:

Barbara Mutinsky
McGraw-Hill International Book Co.
1221 Avenue of the Americas
New York, N.Y. 10020 U.S.A.

Because of fluctuating currency exchanges, transportation costs, and so forth, the price of this book is subject to change, especially in countries outside the Continental U.S.A.

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

We Get Letters . . .

Gentlemen:

I have implemented the following section of code on my HP-41C. When assigned to a key, and when that key is used to turn off the calculator, this routine enables the calculator to "wake up" and display pertinent information about the owner (name and phone number). Of course, any information can be displayed, and if the calculator is lost, its return is not guaranteed. But this does let a considerate finder know who to contact, since the first act involved with finding a calculator is to take it out of the case and turn it on.

You may elect to use this information with every new HP-41C, or you may wish to publish it in your newsletter.

```
01♦LBL "OF"
02 SF 11
03 OFF
04♦LBL 00
05 SF 11
06 "  IF FOUND"
07 AVIEW
08 PSE
09 "    CALL"
10 AVIEW
11 PSE
12 " DAVID ILER"
13 AVIEW
14 PSE
15 "  377-7656"
16 AVIEW
17 PSE
18 PSE
19 GTO 00
20 END
```

Now, I have a few questions for *you.* Are you going to make a data cartridge drive for the HP-41C? Are you going to make a plotter for the HP-41C? If so, when will they be available and what will be the suggested list price? Can you send me any information concerning these items?

Sincerely,

David L. Iler, Provo, Utah

(Good idea, Mr. Iler! But I am not permitted to answer all those questions. We do not disclose information on future products. No, that does not mean the above are *future products. However, although it rains a lot, here in Oregon, we aren't getting rusty. Look at the HP-85 if you want some encouragement about the future. That's all I may tell you now. Ed.)*

HP KEY NOTES
March 1980 Vol. 4 No. 1

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

Hewlett-Packard Company
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Corvallis, Oregon 97330 USA

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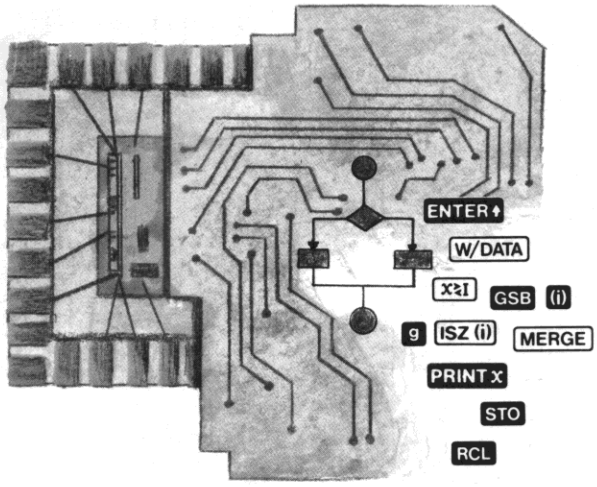


June/July/August 1980 Vol. 4 No. 2

HEWLETT PACKARD

HP Key Notes

The Wand You've Been Waiting For!

Good news! The **HP 82153A Optical Wand** began shipping in the United States July 1, with international shipments beginning two months later.

The HP 82153A Optical Wand is Hewlett-Packard's newest addition to the HP-41C calculating system. With the Wand, programming the HP-41C takes on yet another dimension. The Wand reads bar code, a quick, convenient, and inexpensive means of inputting HP-41C programs and data. This exciting capability is an important advancement in calculator technology, and it will no doubt contribute to your programming pleasure.

The Wand opens up a world of bar code benefits. By scanning rows of bar code, programs as well as data can be loaded much easier than by key entry—and without errors! Bar code is convenient, too, because it's printed on standard paper. You can store it in a three-ring binder, or send it to a friend as you would a letter. You can duplicate bar code with many office copiers, or with an offset printing machine.

Something you'll all be glad to hear is that all HP-41C Solutions Book and Users' Library programs are now available in bar code form. With The Wand, you can save time and improve accuracy when you load HP or user-contributed software.

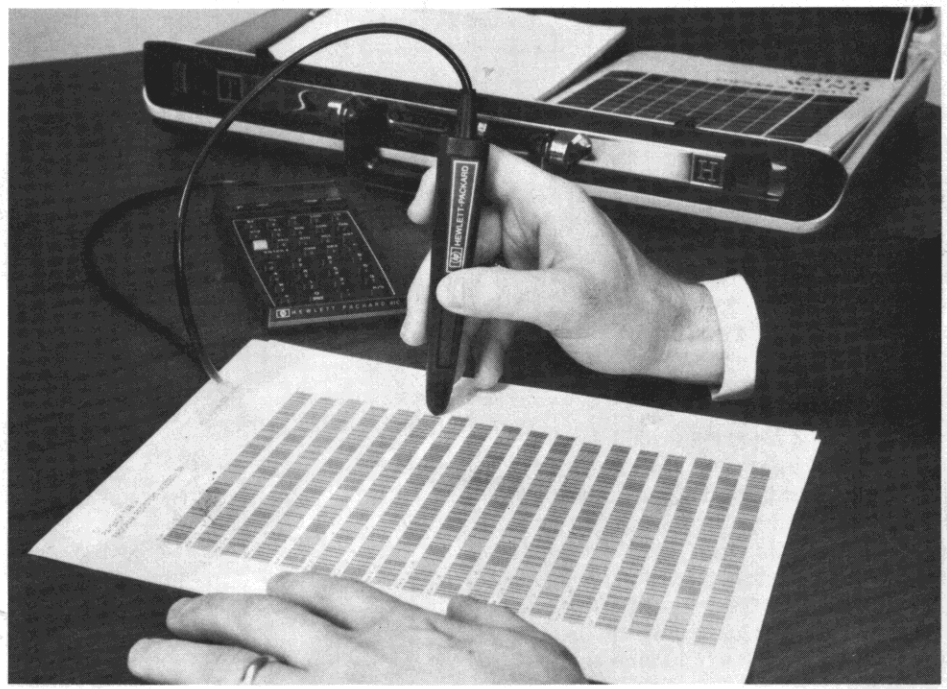
Those of you who want to create your own bar code programs can do just that. Pressure-sensitive bar code labels are included with the Wand, allowing you to quickly paste-up short bar code programs with little effort. To help you develop long programs in bar code form, Hewlett-Packard has arranged for inexpensive bar code production with an independent firm, which promises high quality and excellent service. An order form for this service is included with the Wand. You can even produce your own bar code if you have access to a "daisy wheel" or "dot matrix" printer, or a plotter, or Comgraphics system, and purchase the "Creating Your Own Bar Codes" accessory, which will be available in the fall. More about that in your next KEY NOTES.

A great time-saver offered with the Wand is the paper keyboard. All of the HP-41C system functions, including peripheral functions, are printed on a paper keyboard in bar code form. By using the paper keyboard, many HP-41C functions can be entered faster and with fewer errors. As an example of time savings, you can execute the prompt function in one quick pass of the Wand, rather than by executing the nine keystrokes normally required. The paper keyboard is handy for function execution, data entry, and even while programming.

Some of you may want to know more about HP 82153A bar code. The Wand reads bar code formatted in a simple binary design, with narrow bars denoting zeros and wide bars denoting ones. Narrow bars have a minimum width of 15 mils and wide bars are twice the width of narrow bars. Spaces have the same width as narrow bars. Bar size can be larger than 15 mils, but bar and space sizes must increase proportionately. As the Wand scans over bar code, it recognizes alternating areas of low reflectance (bars) and high reflectance (spaces), as well as the differing widths of the bars themselves. You'll be happy to know that the Wand is a speed-reader of sorts, for it scans most effectively at rapid speeds.

By now you're probably saying "Price, price. What about the price?" The HP 82153A Optical Wand, which comes complete with Wand, owner's manual, paper keyboard, and pressure-sensitive labels, has a list price of $125* in the United States. With all of the time and money saving

(Continued on page 2)



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

benefits it offers, many of you will no doubt be visiting your dealers for a closer look at this new addition to the HP-41C system. Once you see it, we're sure you'll agree the HP 82153A is a fantastic product—**"Wand" worth waiting for!**

Wand Functions

We know you are going to want to see this new marvel at your nearest HP Dealer, so we have included here a bit more data about how it works. Then, when you go to see it, you'll be able to more quickly understand its use.

The Wand functions are contained in the Wand circuitry and become active in the HP-41C system whenever the Wand is plugged into the HP-41C. Wand functions may be executed manually or under program control in the same manner as other HP-41C functions. All can be terminated early by pressing the [←] or [R/S] keys. Following is a review of each Wand function.

The **WNDDTA** (Wand data) function halts a running program to allow you to scan a single row of numeric or alpha bar code. After you scan the row of data bar code, program executing resumes.

The **WNDDTX** (Wand data by X) function also halts a running program to let you scan data bar code. However, under WNDDTX control, you can load an entire set of data directly into one or more of the calculator's memory registers. You specify the registers to be used by placing a value BBB.EEE in the X-register prior to execution of WNDDTX, where BBB is the beginning data storage register address and EEE is the ending data storage register address.

The **WNDLNK** (Wand link) function causes the calculator to halt program execution so that you can use the Wand to load and automatically execute a new subroutine. If the new subroutine ends with a RTN instruction, the HP-41C will then automatically resume execution of the original program.

WNDSUB (Wand subroutine) works in a manner similar to WNDLNK, except that after the new subroutine is scanned, program execution resumes with the first instruction in memory after the WNDSUB instruction. The Wand's WNDSUB function is equivalent to the HP 82104A Card Reader's RSUB function.

WNDSCN (Wand scan) is a rather complex function intended for use in advanced applications. This function allows you to read nonstandard bar code or to define your own bar code functions. Basically, the function reads any row of bar code that follows HP's specifications for narrow bars, wide bars, and spaces, and then stores in the HP-41C's storage registers the decimal equivalent of the binary number represented by the bars. It does this in eight-bar (1 byte) increments, with a maximum of 16 bytes (128 bars) for any one scan.

The **WNDTST** (Wand test) function allows users to test the quality of their bar code, or if the bar code is in good condition, to identify that their Wand is not working properly. To use this function, execute WNDTST, then scan the bar code row in question. The bar sequence will be displayed eight bars at a time, allowing easy review by the user.

New HP-41C Power Source Available

In the last issue we said we would tell you about a new power source for the HP-41C. True to our word, here it is: the *HP 82120A Rechargeable Battery Pack.*

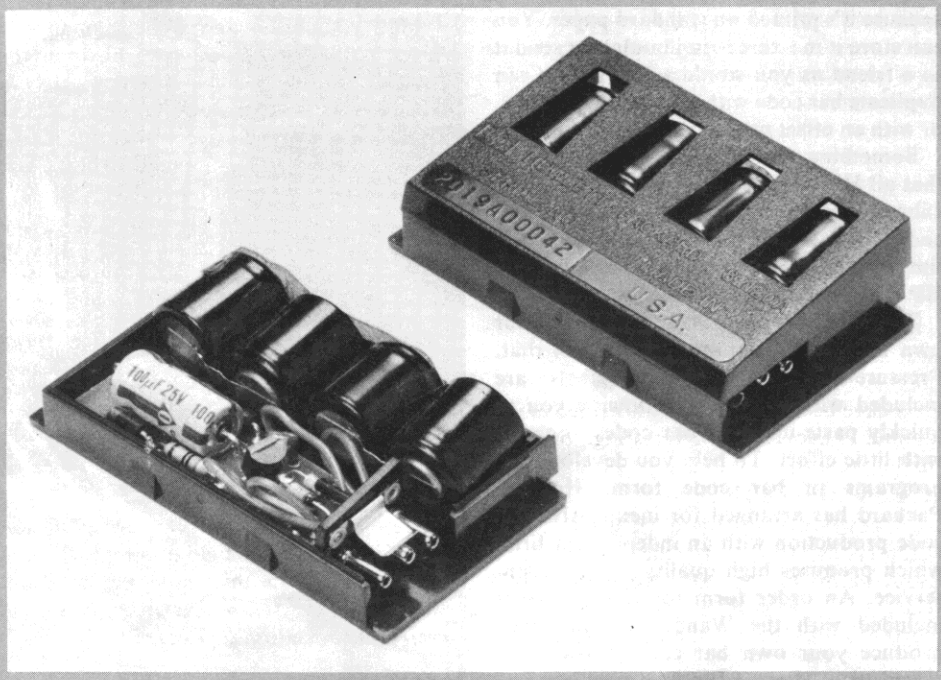
As you can see in the photograph, it is exactly the size and shape of the present battery case assembly, and they are interchangeable. On the right is the complete pack and on the left it is shown with the bottom cover removed. Besides the four nickel-cadmium batteries, there is some circuitry that rectifies and regulates AC to DC and powers the calculator while the batteries are being charged.

Fully charged, the Rechargeable Battery Pack will typically provide 6 to 12 hours of continuous program-running time for the HP-41C, with no plug-in peripherals or accessories. It takes 12 to 16 hours to fully charge the pack. If the pack is fully discharged, it takes about 60 seconds of charging before the first card-read can be accomplished. On a fully charged pack, you can expect about 300 card-reads. Typical nominal lifetime for the new pack is about 500 charge/discharge cycles, which is approximately equal to 50 to 100 alkaline N-cell batteries.

Let's look at the battery life question one more time, because a lot of people are not familiar with rechargeable battery idiosyncrasies. Nickel-cadmium batteries have very long operating "lives," whether you measure by their number of charge/discharge cycles or by the actual number of years they last. Also, these cells can offer long and trouble-free lives whether they are actively used in a repeated charge/discharge mode or maintained by trickle-charge in a ready-to-use condition. They will normally operate for more than 1000 charge/discharge cycles, which allows the user to avoid the inconvenience of replacing primary cells—not to mention the cost of dozens and dozens of primary cells.

Let's also look at life expectancy, which is of special interest to owners of portable electronic machines. The life expectancy of the type of nickel-cadmium cells we use in the HP 82120A Rechargeable Battery Pack, used in a charge/rest/discharge routine, can be considered in terms of the number of charge/discharge cycles required to deplete the available capacity to 50 percent of the rated value. Thus, depending on the variations in the conditions of use, the life expectancy of these cells ranges from 500 cycles to well more than 1000 cycles. Typically, these cells will produce a minimum of 80 percent of their rated capacity for 500 cycles.

Most rechargeable battery packs that fail early are not used in a normal charge/



discharge manner. They are often used, say, one hour and then recharged. Repeated over and over, this greatly reduces the normal life of the pack. However, if charged, used over long periods, and *then* recharged, the rechargeable packs *do* exhibit very long life. Properly used, rechargeable battery packs will give you long life, reliable service, and very economical operating costs.

The new HP 82120A Rechargeable Battery Pack can be recharged in or out of the calculator, using the same AC adapter/recharger used for the HP-41C printer. The Rechargeable Battery Pack is NOT supplied with a recharger. If you don't have one for the printer, you should order or buy it separately.

Cost of the new battery pack is $40.*

Library Corner

We have very good news for our European readers: this column will no longer be deleted from the European issue of KEY NOTES. In the past, because of problems involved in selling U.S. Library programs in Europe, we could not include them here. Now, since we have solved those problems, all of the programs you see in KEY NOTES will be available from both Corvallis and Geneva. But, before you order any, *make sure you read the paragraph below*: **"Ordering Programs."**

GENEVA LIBRARY NEWS

In the next issue, we will start a column of specific news about "Users' Club Europe," for our faithful readers in that part of the world. As you can see, KEY NOTES is becoming a more universal—or world wide—newsletter, and we expect to be able to produce only *one* version in the near future, rather than two, as we now do. That also means that there will be more access to programs in both Libraries, and we are sure that this will please everyone. Making the programs in this issue available in Europe is the first step, and we expect others will soon follow. But, before you order, be sure to read: **"Ordering Programs."**

CORVALLIS LIBRARY NEWS

There are now over 4400 programs in the HP-67/97 Library and over 450 programs in the HP-41C Library. And, best of all, HP-41C programs are now starting to literally **pour** in! By the time we produce the next KEY NOTES, this mass of programs will have been processed and verified, so we should have some interesting ones to highlight in this column.

CATALOG UPDATE

A new *Catalog* update for the Corvallis Library is fresh off the press. It is *Addendum #1* to the November 1979 *Catalog*. It was mailed bulk rate to all current subscribers to the Users' Library, so it may take a while to get to you. Please wait until the end of September before contacting the Users' Library.

This update includes 271 new HP-41C programs and 319 HP-67/97 programs. Our Applications Engineers tell us that 95% of the HP-67/97 programs will work in the HP-41C, providing you have at least one Memory Module in your HP-41C. However, if you receive a program that will not work, the Users' Library will either replace it or refund your money.

ORDER TURNAROUND

The Corvallis Library is excited about a new function that they have undertaken—that of handling the Order Processing of your order. With this new responsibility, they expect to provide better service for you. Since acquiring this function, they have been able to maintain a 48-hour turnaround on subscriptions and program orders. As always, along with cash orders, your credit card and company purchase orders are welcome.

ORDERING PROGRAMS

HP-67/97 and HP-41C programs mentioned in KEY NOTES are now available from both the Library in Corvallis and the Library in Geneva. Readers in Europe should order from Geneva (address on back cover) to get quicker service. Readers elsewhere should order from Corvallis, where programs cost $6* each, and each program includes documentation and a prerecorded magnetic card. Whenever possible, use the Users' Library Order Form in your *Catalog of Contributed Programs* to place orders for programs you see in KEY NOTES. If you do not have an order form or if you are ordering from Europe or Asia, a plain piece of paper with your name and address and the program numbers you desire is certainly adequate. **Make certain that your address is legible and complete.**

Mail your order and a check or money order to the Corvallis address shown on the back cover of KEY NOTES. Don't forget to include your State or local taxes. Or, in the U.S., you can place your order by calling toll-free: 800-547-3400, except Alaska and Hawaii (in Oregon call 758-1010).

** U.S. dollars. Orders from anywhere outside the U.S. must include a negotiable check (or money order), in U.S. dollars, drawn on a U.S. bank. All orders from anywhere outside the U.S. must include an additional 10% for special handling and air mail postage. (For example, an order for two programs = $6 × 2 = $12 + $1.20 = $13.20 total.) If you live in Europe, you can order directly from Geneva,* but make certain you make payment as required by the Geneva Library*; the above $6 fee is good only for orders to the Corvallis Library.*

NEW PROGRAMS

Here are some interesting new submittals covering a very wide field of interests. All of the programs in this issue are available worldwide, *but before you order, be sure to read (above)* **"Ordering Programs."**

(41C) Script Letters (#00099C)

This program uses the "special-characters" feature of the HP 82143A Printer to form legible script characters. (89 lines, 8 pages.)

Author: **Kenneth E. Newcomer**
Corvallis, Oregon

(41C) Musical Composer (Complete) (#00312C)

With *this* program, your calculator can compose music! The program selects an appropriate tempo and then calculates the pitch and duration for each note or rest, which is then displayed, using the alphanumeric capabilities of the HP-41C. You may select any number of beats per measure, and you can vary the length of a note by using the "add-a-beat" feature. *Only the HP-41C is needed to run this program.* (203 lines, 10 pages)

Author: **Richard S. Altman**
Richmond, California

(41C) Diet Planning (With Output Labeling) (#00316C)

Most diet plans only count calories for a fixed-calorie input, regardless of an individual's caloric requirements. This program estimates an individual's basal metabolism from height, weight, age, and sex. Then the required calories per day for maintaining (or changing) weight are estimated, using the hours per day spent at each of five activity levels. The program is based on HP-97 Program #01074D. *One Memory Module is necessary.*
(171 lines, 9 pages)

Author: **Richard Altman**
Richmond, California

(41C) Simplex Algorithm (#00320C)

This program uses the simplex techniques to optimize the objective function of a set of linear inequalities. Main features of the program are: relatively fast execution, size of matrix (only limitation to the size is number of Memory Modules available), minimize or maximize options, error messages, review and check input data option, and a correctly labeled output. With two Memory Modules up to a 77-element matrix can be handled. *The array size in* this *program requires two Memory Modules.* (401 lines, 13 pages).

Author: **Laurence A. Esterhuizen**
Johannesburg, South Africa

(41C) Molecular Weight Calculator (#00326C)

This program calculates molecular weight from the chemical formula for the molecule. For example, to compute the molecular weight of sodium sulphate, Na_2SO_4, the user keys in Na, 2, S, 1, O, 4 in response to prompts in the program. The chemical formula is displayed together with the molecular weight. You also can look up the atomic number, given the chemical symbol for an element; and you can look up the

(Continued)

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

atomic weight, given the atomic number. *Requires one Memory Module.* (160 lines, 7 pages)

Author: **Dave Conklin**
Corvallis, Oregon

(41C) Resistor Color Code Chart (#00328C)

This program gives the exact value of a resistor when the three color bands are keyed into the calculator. Also, if the fourth color band is keyed in, the program will calculate the high and low tolerance values. *Requires one Memory Module.* (254 lines, 8 pages)

Author: **David D. Walton**
Cincinnati, Ohio

(41C) LAN Error Minimization (#00347C)

Given a sequence of sun shots made before, during, and after Local Apparent Noon, the program determines the most likely time of LAN and the sextant altitude of LAN by fitting a parabola to the data, with the mean square error minimized and the slope of the directrix constrained to be infinite. *Requires one Memory Module, and printer is optional.* (180 lines, 9 pages)

Author: **Curtis G. Adams**
Sun Valley, Idaho

(41C) Gasoline Consumption Analysis (#00372C)

This programme enables a vehicle operator to keep a tank-by-tank record of gasoline consumption and cost. A record is kept on a magnetic data card, and it is updated for each tankful. A summary programme will display/print totals to date for volume, distance, and cash. It also displays/prints averages, over the period concerned, for consumption, cost per unit volume, and cost per unit distance. There are duplicate routines for Metric/English, an automatic print routine, and fully prompted inputs and labelled outputs. *Requires a card reader, and a printer is optional.* (340 lines, 10 pages)

Author: **Arthur C. Attwell**
Durban, South Africa

(41C) Print Checkbook Listing (#00375C)

This program tabulates and prints checkbook balances and items (checks or deposits) from your checkbook listing or bank reconciliation statement. It arranges by column and prints check number, deposit date, "C" or "D" as appropriate, amount of check or deposit, and balance (positive or negative). *Requires a printer.* (142 lines, 7 pages)

Author: **Bob Curry**
Austin, Texas

(41C) Triangle Solution—Automated (#00392C)

This program finds the unknown parts of a triangle. You enter the known parts in arbitrary order; the program chooses the proper algorithm and generates the solution. Then you request the output, in any order. After key assignments are cleared, this program will run on an HP-41C without Memory Modules. (230 lines, 8 pages)

Author: **Keith Jarrett**
Manhattan Beach, California

(41C) PI- and T-Network Calculator With Plot Option (#00415C)

This program calculates normalized reactances for PI- and T-networks. Inputs are source and load normalized impedances (either series or parallel). Outputs are series/parallel equivalents of source and load; values of JX2, JX3, JX4, and JX5 for the selected network; and relative power response of network, with plot option. *Requires one Memory Module (printer optional).* (334 lines, 17 pages)

Author: **John S. Sutton**
Tucson, Arizona

(41C) Tissue Blood Flow (#00421C)

This program solves equations associated with a thermodynamic technique for measuring regional tissue blood flow and heat transfer characteristics. (Also listed below for HP-67/97 as program #04366D.) *Requires one Memory Module.* (238 lines, 9 pages)

Author: **Dr. Thomas Adams, Dr. S. R. Heisey, Dr. M. C. Smith, Mr. M. A. Steinmetz, Mr. J. C. Hartman, and Ms. H. K. Fry**
East Lansing, Michigan

(This program was originally written as an aid in solving some complex equations in an article written by the above authors. The article, "Thermodynamic Technique for the Quantification of Regional Blood Flow," is copyrighted by the American Physiological Society; Am. J. Physiol. 238 (Heart Circ. Physiol. 7): H682-H696, 1980. The authors are in the Departments of Physiology and Mechanical Engineering at Michigan State University in East Lansing, Michigan. My congratulations to them for their fine work and to Dr. Adams for bringing this to my attention. Ed.)

(41C) Foreign Currency Converter (#00432C)

This program consists of two related routines that enable: (a) conversions between any two of the 52 stored currencies; (b) conversion from 1 to all 51 other currencies. It also provides interconversion between any foreign currency and your "home" currency. Added features are convenient entry and error recovery. *Requires two Memory Modules (three preferable), and a card reader is optional.* (223 lines, 18 pages)

Author: **George G. Sandoval, Jr.**
Caloocan, Philippines

(41C) Buy and Sell Stock Market Timing (#00449C)

This program anticipates bull and bear markets using readily available (*The Wall Street Journal*) short sales information of "insiders" activities. This is not a "hot tip" approach, but one used by canny investors who have achieved remarkable success at predicting shifts of 10% or more in stock prices. *Requires no peripherals, but a printer can be used effectively.* (78 lines, 7 pages)

Author: **Norman J. Gordon**
Los Altos Hills, California

(Before you scoff, check the author's hometown; it has one of the highest per capita income rates—if not the highest*—in the U.S. If you buy this program and strike it rich, don't forget to mention you "...owe it all to KEY NOTES." Ed.)*

(67/97) Bode of Ratio of Polynomials in S (#04302D)

This program provides gain and phase angle plots versus frequency for transfer functions expressed by the ratio of polynomials in S, to the sixth power in the numerator and to the seventh power in the denominator. On entry, term coefficients are tagged by the associated power of S for orderly processing within the program without further consideration by the user. (168 lines, 6 pages)

Author: **Martin H. Oxman**
Malden, Massachusetts

(The above program came to my attention because the Applications Engineer who reviewed it wrote, "We have received many such programs, but this one is implemented better—in my view, at least—than any other." Congratulations, Mr. Oxman. Ed.)

(67/97) Tissue Blood Flow (#04366D)

This program is the HP-67/97 version of the HP-41C program (#00421C) listed above. (139 lines, 8 pages)

Next, we have for you some *large* program contributions. The first group of four, by **Kenneth R. Dawson**, are newer additions to the Library. (Several other of his programs are listed in your Catalog.) These are excellent examples of what can be done with a card-programmable calculator, and they are exceptionally well annotated, described, and researched. Congratulations, Mr. Dawson!

(67/97) Curved Beam Loaded Normal to the Plane of Curvature (#04245D)

This program solves for the transverse shear, bending moment, twisting moment, deflection, bending slope, and roll slope at any point on a curved beam having clamped ends. Load is applied perpendicular to the plane of curvature as a point load, moment, or torque. (Reference: Roark, 5^{th} edition, table 19, cases 1E, 2E, 3E.) (409 lines, 12 pages)

Author: **Kenneth R. Dawson**
Alpine, California

(67/97) Local Crippling of Compressive Elements (#04246D)

This program will compute the third variable from the other two variables in the crippling equation. It is useful for optimizing

the elements of a beam cross-section for maximum efficiency. The three variables are element length (b), element thickness (t), and crippling stress (fcc). Crippling stress may be for one end free or both ends fixed. The program also will compute crippling stress of a section (fcc). The equations used are applicable to all ductile aircraft alloys at both room and elevated temperatures. (130 lines, 8 pages)

Author: **Kenneth R. Dawson**
Alpine, California

(67/97) Fastener Reactions—Eccentric Loading (#04258D)

This program computes the shear load and shear load angle acting on each fastener in an eccentrically loaded joint. A joint may consist of any number of fasteners up to a maximum of 15. Fastener locations are specified by their x and y coordinates relative to any point of origin. The force acting on the joint may be inputted in three different formats. The program then computes and displays the centroid of the fastener pattern as well as fastener number, load, and angle of load for each fastener in the joint. (211 lines, 5 pages)

Author: **Kenneth R. Dawson**
Alpine, California

(67/97) Cubic Spline Curve Fit With Simpson's Rule Integration (#04294D)

A curve is generated through 2 to 9 equally spaced points, using the cubic spline method. This method produces a curve fit that is much the same as one would draw freehand. Output options include single point interpolated values or a sweep of values over a user-defined range and increment size. An option is also provided to include numerical integration using Simpson's rule through the sweep. (224 lines, 7 pages)

Author: **Kenneth R. Dawson**
Alpine, California

And last, but not least, here are 27 programs by **Allan T. Seidcheck**, who, at last count, had well over 100 HP-67/97 programs accepted into the Library. Mr. Seidcheck is a retired engineer who lives in Pahoa, Hawaii and, literally, lays on the beach and writes programs with his HP-97.

All of the programs are typed; many have elaborate descriptions and drafting-quality drawings. They cover a broad range of practical, real-world mechanical engineering design problems. They feature consistent input and output formats for ease of use. Sample problems have more than just outputs typed on the page; also included is a discussion of the *significance* of the result, why or why not it is usable, and whether it is consistent with common design practices and off-the-shelf component availability.

No one program is exceptional; however, the *set* certainly provides a broad range of fast, consistent, well-documented solutions. These are sit-down-at-your-desk-and-design-something types of programs. Mr. Seidcheck has contributed a marvelous asset to the world of programmable calculators, and an invaluable tool for engineers—or even teachers—everywhere.

(#04234D) Size of Pully Setscrew. Given shaft diameter and speed, and horsepower to be transmitted, program outputs the torque developed in the shaft, and the setscrew diameter required. (49 lines, 4 pages)

(#04235D) Sizing Steam Engines for Desired Horsepower. Given the mean effective steam pressure, number of strokes per minute of the piston, the ratio of length of stroke to diameter of cylinder, and the desired horsepower, program outputs the required cylinder diameter and the length of stroke of a steam engine. (42 lines, 4 pages)

(#0436D) Indicated Horsepower of Steam Engine. Given the mean effective pressure, piston diameter, length of piston stroke, and engine flywheel speed, program outputs the indicated horsepower of a steam engine. (51 lines, 4 pages)

(#04237D) Hobbing, Splining, and Serrating Time. Given the hob diameter, feed, cutting speed, depth of gear tooth, spline, or serration, program outputs the hob rpm, hobbing time per piece, and hourly production rate for hobbing spur or helical gears, splines, or serrations. (103 lines, 5 pages)

(#04238D) Presswork Force for Piercing, Blanking, and Bending. Given the length of the cut or bend, the material thickness and its shear strength for punching or its tensile strength and the width of unsupported metal for bending, program outputs the required force for punching, or for 'U' or channel bends, right-angle edge bends, and V bends. (105 lines, 4 pages)

(#04239D) Square and Flat Plain Keys for Machine Shafts. Given the shaft diameter and rpm, horsepower transmitted, allowable shear and compressive stresses in the key, and the recommended key size from the table provided, program outputs the torque acting on the shaft, shear force acting on the key, dimension from the bottom of the keyseat to the opposite side of the shaft, and the required length of a square or flat plain parallel machine shaft key. (92 lines, 6 pages)

(#04240D) Finned-Tube Heat Exchangers for Diesel Engines. Given the rated brake horsepower of a four-cycle diesel engine and a value from the table provided, program outputs the required heat exchanger surface area and the number of finned tubes required, enabling the designer to select the tube diameter and length for a finned-tube heat exchanger to cool the jacket water. (59 lines, 5 pages)

(#04241D) Sizing Decanter-Type Separator Tanks. Given the liquid flow rate, densities of the two liquids and the time required for settling, program outputs the required tank volume (gallons), required tank dimensions (feet), total liquid depth (feet), height of the heavier liquid (feet), and height of the heavy-liquid overflow (feet), for a decanter-type separator tank using gravitational force for continuous separation of two liquids. (97 lines, 5 pages)

(#04242D) Bank of Highway or Railroad Track for Given Speed. Given the speed of the vehicle or train, tread or track gage, and the degree of curvature of the highway or track, program outputs the elevation of the outer wheel above the inner wheel of the vehicle or train and the angle of the bank to eliminate side-slip or flange pressure of the wheels. (89 lines, 5 pages)

(#04243D) Specific Gravity and API Gravity. Given either the specific gravity or API gravity of any liquid, program outputs the specific gravity, API gravity, Baume gravity, weight, pounds per cubic foot, and pounds per gallon of the liquid. (106 lines, 4 pages)

(#04244D) Horsepower Required to Adiabatically Compress Air. Given the number of cubic feet per minute of free air to be compressed and the absolute terminal pressure, this program outputs the horsepower required to adiabatically compress the air for one-, two-, three-, or four-stage compressors. (126 lines, 5 pages)

(#04247D) Trial Blank Diameters for Round Shells. Given the dimensions of the shell to be drawn, program outputs the trial blank diameter for twelve configurations of round drawn shells conforming to the sketches provided. (380 lines, 11 pages)

(#04248D) Equivalent Bending Moment and Ideal Torque for a Shaft. Given the diameter, maximum allowable bending stress, and the maximum bending moment and torque acting on the shaft, program outputs the equivalent bending moment, section moment of inertia, ideal torque, stress developed in the shaft, and maximum equivalent bending moment of the shaft. (81 lines, 4 pages)

(#04249D) Cutting Speed for Lowest-Cost Machining. Given the maximum feed for which an acceptable finish is obtained at a trial rpm, length of cut, labor and overhead cost, tool change cost, and number of pieces produced per tool change, the program outputs the optimization factor and the optimal cutting speed for the operation. (77 lines, 4 pages)

(#4250D) Wire-Rope Drum Analysis. Program calculates the combined stresses, bending stresses, and outputs the tread diameter, outside diameter, and inside diameter of a soft-cast iron wire-rope drum for a given load, rope type, and rope diameter. (101 lines, 5 pages)

(Continued)

(#4251D) Supporting Weight by Rope Wound About Pulley or Drum. Given the weight suspended, force exerted at free end of rope, and the coefficient of friction of repose from the table provided, program outputs the number of turns of a hemp-or-wire rope about a pully or grooved drum required to support the weight. (37 lines, 5 pages)

(#04252D) Selection of Roller and Ball Bearings for Reliability. Given the required operating life in millions of revolutions, the equivalent radial load on the bearing, and the required reliability factor, program outputs the required basic load rating of a roller or ball bearing, using the Weibull equation. (74 lines, 4 pages)

(#04253D) Toggle-Joint Mechanism Analysis. Given the lengths of the toggle arms and the force exerted on the toggle joint, program outputs the travel of the slide and the force output at the slide in 5-degree increments for design analysis of a toggle-joint mechanism. (149 lines, 6 pages)

(#04254D) Compounded Toggle-Joint Mechanism Analysis. Given the handle length, lengths of the toggle arms, and the force exerted on the handle, program outputs the travel of the slide and the force output at the slide in 5-degree increments, for design analysis of hand-actuated toggle-joint mechanisms. (196 lines, 7 pages)

(#04255D) Three-Wire Measurement of Screw Threads and Worms. Given the included angle, lead, number of starts, and the basic pitch diameter of the thread or worm, program outputs the lead angle, exact wire size, the basic measurement over the wires, one-half the included angle of the cutter or grinding wheel, and the included angle of the cutter or grinding wheel, for milled or ground threads or worms, using the Buckingham formula, which includes the effect of the helix angle. (74 lines, 5 pages)

(#04256D) Selection of a Rigid Flange-Type Shaft Coupling. Given the bolt-circle diameter, torque to be transmitted, allowable bolt shear stress, allowable hub bearing stress, diameter of the shaft, and the key thickness, program outputs the shear force acting at the bolt-circle radius, bolt diameter, number of bolts, shear stress in the bolts, minimum flange thickness, and minimum hub and key length of a rigid flange-type shaft coupling. (97 lines, 5 pages)

(#04257D) Universal Joint Power-Coupling Analysis. Given the input shaft rotative speed, the maximum angular misalignment of the output shaft, and factors from the table provided, program outputs the speed variation and maximum acceleration of the output shaft of a universal joint power-coupling arrangement. (51 lines, 5 pages)

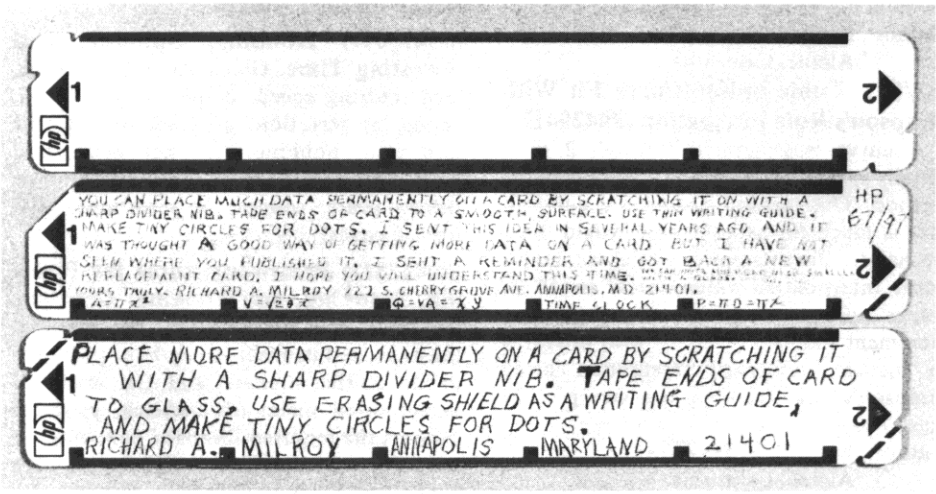
(#04341D) Cutting Elements of Flat Form Tools. Given the angles and steps of the workpiece and the clearance angle and top rake—if any—of the form tool, program outputs the angles and step dimensions as measured in a place perpendicular to the front edge of the tool. This program may be used for calculating the elements of skiving tools as well as flat or dovetail tools. (96 lines, 5 pages)

(#04342D) Cone Clutch Transmission of Power. Given the horsepower transmitted, the rpm, the angle of the cone contact surfaces with the axis of the clutch, the longitudinal length of engagement of the contact surfaces, and the coefficient of friction between the contact surfaces, program outputs the longitudinal force (spring pressure) required to hold the two faces of a cone friction clutch in contact without slipping. (59 lines, 5 pages)

(#04346D) Parabolic Cable Tension and Length. Given the span, cable sag, and uniformly distributed load the cable carries, program outputs the tension in the cable at mid-span and at the supports and the length of the cable. A cable carrying a load uniformly distributed along the horizontal assumes the form of a parabolic arc; for example, a suspension bridge cable. (55 lines, 4 pages)

(#04347D) Bend Allowances for Sheet Metal. Given the angle of the bend, inside bend radius, and the material thickness, program outputs the length of material required to make the bend (bend allowance). (40 lines, 5 pages)

(#04348D) Planetary Gear Mechanisms. Given either the pitch diameters or the number of teeth of the gears, program outputs the number of turns of the driver to one of the follower and the number of turns of the follower to one of the driver for ten cases of planetary gear mechanisms. Each case is diagrammatically illustrated and explained. (215 lines, 9 pages)



How Small Can You Write?

At one time or another, we all wonder how to get more information on the face of a magnetic card. And, from time to time, we have published various ways to write small or to use tiny "rub-on" lettering (which *can* come off in the card reader and cause many problems!).

But in all this time, we have not seen anyone surpass **Richard A. Milroy's** method of literally writing a book on a magnetic card. He sent this to us quite a long time ago, but it somehow never got the opportunity to get printed in KEY NOTES. But, as you can see, this method *does* work, and you can squeeze an awful lot of type on the face of a card.

Mr. Milroy uses an "erasing shield," and the sharp pointed end of a divider to scratch the letters on the white face of a magnetic card. To write *really* small, he employs a magnifying glass. And, as you can see, there isn't much doubt about how well this method works.

If you do not have an erasing shield, you can use a small lettering guide or similar device. And there are many sharp-pointed tools and objects that can be substituted for dividers. And to keep the card from moving while you etch the lettering on it, use masking tape on the outer edges of the card(s). Then make sure you clean off any tiny chips, so they do not get into the tiny slot in the head of the card reader.

Thank you, Mr. Milroy, for sharing this neat trick with our readers.

Efficient Use of HP-41C Status, Data, and WALL Cards

The card readers of the HP-67 and HP-97 calculators were improved versions of the one used in the first pocket calculator with a card reader, the HP-65. The added user-convenience features of the HP-67 and HP-97 machines were aptly described by calling these card readers "smart" card readers. The "smart" card reader provided the user with such features as recording either program or data, or even mixing the two on the same card. The reading of additional program steps under program control (automatically reading the card when needed if it was inserted into the card reader) and the ability to merge programs into memory are examples of the increased features of the HP-67/97 card reader. These card readers were especially "smart" because they automatically knew what type of card (data or program) they were reading, and if it was track one or track two.

The HP 82104A Card Reader is one part of the HP-41C Calculator System. The HP-41C card reader, like all HP-41C peripherals, adds more to the capability of the HP-41C than just adding the function of reading and recording cards. This card reader is certainly "smarter" than its predecessors, for its capability goes beyond the flexible reading and recording of programs and data. Table 1 briefly outlines the capabilities of the HP-41C card reader. This article discusses Status cards, Data cards, and WALL cards, with respect to getting the most from magnetic cards when using the HP 82104A Card Reader.

Table 1. HP-41C Card Reader Functions

Function	Remarks
a. Read 67/97 data and program cards.	Translates 67/97 contents to 41C compatible instructions, as required.
b. Record STATUS.	Angular modes, flags, stack, and alpha registers.
c. Record DATA Registers.	All registers, or as specified by WDTAX.
d. Record program.	Records local portion of memory.
e. Write all programs and data registers.	Records *entire* contents of calculator on cards.
f. HP-67/97 features.	Adds functions like RCLΣ and P≠S.
g. Verify.	Confirms valid read; provides track No. read, number of tracks of set, and also identifies if card is HP-67/97 program or data card.

STATUS CARDS

The "smart" card reader of the HP-67/97 recorded the flag, the display setting, and the angular mode. But the HP-41C card reader carries this concept further. A separate function, called "Write Status" (WSTS), has been added. When this function is executed, the display will show "RDY kk OF nn," where kk is the number of the next track to be written and nn is the total number of tracks required to record the status information.

Table 2. Status Card Organization

Track	Contents
1	Flags 00 thru 43. ΣREG location (first of six ΣREG's). SIZE. STACK and ALPHA register contents.
2	First 32 key assignments.
3	Next 32 key assignments (if required).
4	Remaining key assignments (65-68).

Table 2 implies that the contents of a single track can be read and that the "RDY kk OF nn" prompt can be cleared with the [←] (correction) key. This is indeed true. Suppose, for example, that a group of 32 functions is assigned to unshifted keys, followed by the remaining keys, so that all of these assignments would be recorded as noted in the table. Track 2 would contain the first shifted key assignments, track 3 the unshifted key assignments, and track 4 the remaining (mixed) key assignments. Any track can be read, and further reads can be terminated by pressing the [←] key. This applies to almost any combination of tracks. If all four tracks had been read, and a new read status session is started with only track 4 read, all previous assignments would be cleared and only those on track 4 would be present.

The feature of terminated-key-assignment card-reads clearing all previous assignments suggests a useful technique to avoid clearing each key or performing a "Master Clear." Make up a "Clear Assignments" card as follows:

1. "Master Clear" or remove all key assignments.
2. Assign "ASN" to key 15.
3. [XEQ] WSTS.
4. Feed track 1 in response to RDY 01 of 02.
5. Feed track 1 *again* in response to RDY 02 of 02.

This procedure records only track 2. To use the card, simply read (track 1), press [←], [E], ALPHA, ALPHA [E]. All assignments are cleared. [XEQ] PACK to recover the registers used for the assignments. A fully assigned keyboard could use 34 registers.

Another use for selective reading of Status cards is automatically setting the SIZE of the calculator for a program. Simply make the first track of the program-set a Status card that SIZE's memory. If there are programs in memory and the SIZE can't be set to the value recorded on the Status card, a brief "SZE ERR" message will be displayed and the SIZE will remain unchanged. When this happens, programs will have to be deleted to make room.

An added enhancement to using a Status card to set SIZE is to have an appropriate ALPHA message in the X-register. This six-character message may provide instructions such as "CONT." for continue reading cards, or "ALPHA," to prompt you to press the ALPHA key to read a longer (24 character) message. Possibly the number of additional tracks to be read could be displayed, or the program name. The procedure of using a Status card to set size saves 10 keystrokes. It also offers the advantages of setting flags and locating ΣREG, in addition to filling the stack and the ALPHA register.

The technique of recording only track 2 if 32 or less key assignments are needed makes maximum use of magnetic cards. It is probably a good idea to make a notation on the card to remind you that: "Track 1 is not recorded." Making efficient use of magnetic cards also applies to Program cards. Whenever a program is to be recorded on magnetic cards, it is good practice to [XEQ] PACK prior to recording the program. This procedure removes the NULLS the HP-41C places into program memory during editing. The unpacked NULLS are recorded and may require an additional track if not removed by packing.

The most important consideration in "mixing" tracks of a Status card-set is to not mix track 1 with other tracks unless the complete set is to be read.

DATA CARDS

The HP-41C card reader stores 16 registers on each track of a magnetic card. A Data card containing 17 registers of data would cause the experienced programmer, as a matter of good programming practice, to reevaluate the register usage to trim one register. This is especially important if the number of tracks for the Program/Data card-set is odd. Saving one register could save one whole card!

In many program usage situations, it is confusing to have both Program and Data cards. Decreased magnetic card usage and simpler user instructions often result if the "data" is entered as part of the program. Flag 11 (auto execution) is set when the program is recorded, and the first part of the program automatically executes to store the data into the registers. This method of combining data and program greatly simplifies program usage. Data cards, like status cards, may be read "as needed," with the

(Continued)

read operation terminated if the remaining track "numbers" are not needed. The data is stored in the registers as recorded on the card.

WRITE-ALL

Generally, the write-all (WALL) function of the HP-41C is used only when you want to record the entire contents of the calculator. This is most convenient when you interrupt a programming session and you wish to resume with the machine in the exact state it was in when you stopped. However, several characteristics of the WALL function should be kept in mind. Because the whole machine is recorded, all unused registers also are recorded. Therefore, for maximum efficiency of magnetic card usage, remove all unused memory modules before recording on cards. This is done by executing SIZE 064 for each unused module before removing the module. If this is not done, MEMORY LOST will result. Since four magnetic cards are needed to record each memory module, this procedure can significantly reduce magnetic card usage. The WALL card-read **must not** be terminated before all cards are read. (This is not true for Program, Status, and Data cards!) If one WALL card is terminated, the HP-41C will clear memory! For this reason all WALL cards should be clearly marked, because accidently reading one means that anything that was in the HP-41C will be lost without any means of recovery.

The increased memory capacity of the HP-41C naturally requires more magnetic cards to record programs and data. Understanding how the HP-41C card reader records Status, Data, and Program cards can aid in reducing the number of card tracks needed to do a specific task. This saves time, saves cards, reduces wear of the card reader, extends battery life, and makes HP-41C usage a little simpler.

A Special Program

Every once in a while, we receive a massive "set" of programs that cannot be handled in the usual manner by the Library. This is one of them: **#67000-99967, Electric Vehicle Automotive Performance Models,** and it is priced at $55.50.*

The program—actually a series of 17 interrelated programs—is on 129 pages and 21 magnetic cards. It is the work of **Phil Chapman,** of Pasadena, California, who originally wrote the programs for use at the Jet Propulsion Laboratory (California Institute of Technology) for electric vehicle studies funded by the U.S. Department of Energy. The abstract is as follows:

"This set is a series of automotive simulation programs that predict the performance of electric (and other) vehicles and electric vehicle batteries. Rolling resistance as a function of tire type, pressure, and temperature is considered, along with wind weighted drag coefficients. Simulation can be performed over the SAE J227a type of driving schedules, constant speeds, and wide-open-throttle conditions."

Written for use on the HP-67/97 calculators, these programs were developed over a 3-year period within the Electric Car Project out of necessity and Project requirements. They should provide the user with valuable insight into the performance of electric vehicles and electric vehicle batteries.

Although the programs are not intended as substitutes for the more complex computer-based vehicle performance simulators supported and maintained by the U.S. Department of Energy, some of the models were precursors to these more complex models.

The user should find these calculator programs helpful in research and development work, and casual readers will be able to familiarize themselves with the art of simulation and performance prediction.

Below are a list of the program titles. *Separate programs are not available.*

- Road Load to Single Battery Watts and Power Density
- Battery Models Ragone-to-Curve Fit Data
- Battery Coefficient Generator
- Battery Polynomial Solution
- Temperature-Compensated Battery Polynomial
- Temperature-Compensated τ
- Wind Weighting Factor
- Tire Rolling Resistance
- Motor/Controller Current Limit (P_D Max Determination)
- Electric Vehicle Simulator
- Battery Models Fractional Utilization and Modified 10-Point Power Profile
- Constant-Speed Simulator
- Wide-Open Throttle
- Coast-Down Power and Energy
- Peukert Development
- Battery Limits—Lead Acid EV106
- Percent Gradeability at Speed

We thank **Phil Chapman** for making this work available to the Users' Library and to the many readers of KEY NOTES.

* *U.S. dollars. All orders for this program must be sent to the Users' Library in Corvallis (address on back cover). Orders from anywhere outside the U.S. must include a negotiable check (or money order), in U.S. dollars, drawn on a U.S. bank. Also, please include an additional 10% ($5.55) for special handling and air mail postage. Thus, the total cost for orders outside the U.S. is $61.05.*

Editorial

Some of you, notably **Leroy Klein** of Corydon, Iowa and **John W. Knight III** of Shreveport, Louisiana, saw an error in a correction (!) in the last issue. On page 3, column 3, in the center of the column, the first entry under "the smaller wire." should have been:

.035 [R/S] (→N) → 19.66 00***
[B] (→S_S) → 186.3 03***

Somehow I missed that when I proofread the original copy. Thanks for bringing it to my attention.

If you live outside the United States, don't fail to read the **"Ordering Programs"** paragraph on page 3. All programs in KEY NOTES are now available to readers outside the United States. And in future issues, we hope to improve even that service.

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 do guarantee that every letter 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.

Software Changes

If you have early copies of the following two HP-41C documents, you should make the following corrections in your copy. Later copies have an addendum card, or the corrections have been incorporated in the finished product.

HP-41C Circuit Analysis Pac

A note regarding the format of node designations should be added to the GNAP user instructions on page 11, as follows:

Note: The grounded node of a passive branch must be the TO node.

HP-41C Users' Library Solutions, Heating, Ventilating & Air Conditioning 00041-90140

The program, "Psychrometric Properties," needs two corrections. On page 40, make a note that two (not one) Memory Modules are required. Then, on page 46, there are four incorrect lines. The correct lines are:

204 3.61633 E9
206 5.24506 E8
261 3.61633 E9
263 5.24506 E8

Notice that these values were somehow interchanged. We are grateful to the author of this program, **Donald H. Madsen,** for calling this to our attention.

The Wizard of Programming . . .

Among the most-ordered programs in the Users' Library are "games." And easily one of the most popular of these is "Pinball Wizard (#00321D)." That program, plus another excellent games program called "Bell-Fruit (#00218D)," are the products of none other than **Craig A. Pearce,** a name we're sure you have seen here before.

His "Bell-Fruit" slot-machine game originally was written for the HP-65 and was a very popular game in the HP-65 Library. Then, when the HP-67/97 calculators arrived, Mr. Pearce rewrote and improved "Bell-Fruit" for these later calculations. Not being content with that, he went on to write "Pinball Wizard," which was the seventh most popular program in the Library in 1978. But, the best was yet to come, because his "Wizard of Pinball (#00361C)" for the HP-41C is not just a revised HP-67/97 program; it is entirely new, having been rewritten to take advantage of the HP-41C's many new features.

If you have seen any of the above programs, you can attest to the fact that they are fine examples of the man-machine interface. For example, you can become absorbed for hours with "Wizard of Pinball" and actually experience the feeling of being a decided *part* of the machine in your interaction with the keyboard, the audio tones, and the printed output and/or calculator display.

Mr. Pearce's "Bell-Fruit" game also served as a sort of basis for the "Slot Machine" game that appears in the *Games Pac* for the new HP-85 Personal Computer, although that particular version is radically revised for the computer. But it did take Mr. Pearce to create the concept and, for that, we owe him this recognition.

As a matter of fact, we decided—with his permission—to do a profile on this unique calculator owner because, although his participation is somewhat extreme, he does represent the growing involvement in electronic machines that make life easier, more fun, more profitable, or just plain more interesting.

Mr. Pearce lives in Berwyn, Illinois, is a graduate of Morton West High School and the University of Illinois (Chicago Circle Campus), and is 28 years old. In 1975, while still in college, he went to work as a Remodeling Estimator for Metropolitan Management Company, and the job eventually led to full-time employment. He was recently promoted to Building Superintendent of a new 28-story building that contains about 800,000 square feet of office space. So you might say he has considerable use for some special calculating tools.

And Mr. Pearce *does* have and *does* rely on calculators! His first was the HP-45, which he bought during his second year in college. At that time, he heard about the "Programmable" HP-65 but felt he didn't "need" such a machine. Until he bought the *HP-45 Applications Book,* that is! Then, when he realized what *could* be done with keystroke programming, he succumbed to the temptation of owning the *fully* programmable HP-65. Thus began his long and ongoing relationship with Hewlett-Packard.

In no time at all, Mr. Pearce became member #311 in the "HP-65 Users Club," an independent users group that is now called "PPC," a term he helped to coin.* He was also instrumental in founding the Chicago chapter of that Club, and he contributes articles and columns to the Club newsletter, *PPC CALCULATOR JOURNAL,* as well as to other newsletters such as *The Recreational Programmer.* Mr. Pearce also has authored an excellent article on the HP-67/97 calculators; it was printed in the June 1978 issue of *BYTE* magazine.

The HP-65 also sparked his interest in computers, and he began with the Altair 8800 microcomputer, then moved on to the Health H8, an Apple II, and a Vector MZ system. Tied to these are his DECWriter and SOROC terminal and six disk drives! Plus, in the near future, he hopes to be running a 32K HP-85 Personal Computer both at home and at work.

From the HP-65, Mr. Pearce went on to own the HP-21, HP-25, HP-34C, HP-38C, HP-41C, HP-55, HP-67, and the HP-97 calculators. He also owns an HP-01. He can, and regularly does, program and use all of his calculators, which is an astonishing feat in itself.

Up until he had his first program accepted in the Users' Library, he never realized that what he wrote (programmed) might actually be of interest to anyone else. That first program, "Tug-of-War (#02417A)," for the HP-65, started him on his writing career. Since then he's had at least 18 programs accepted into the HP-65 Library, at least 9 into the HP-67/97 Library, and 2 into the newer HP-41C Library. Not as many as others have done, perhaps, but they *are* contributions to the art. His programs are exquisite examples of organization, clarity and legible documentation. As far as "games" are concerned, his "Bell-Fruit" program was the first one that seemed to duplicate a "real machine." That was not easy to do in the older 100-step HP-65 memory.

There you have Craig Pearce, calculator collector-programmer-user *extraordinaire.* You never can tell what he will do next. In fact, when asked, he said, "What the future holds for me is uncertain, but I can say that I will continue to program all of my systems and hope to bring, through my efforts, some enjoyment to others." And we want to bring some of that to you, by offering these programs to anyone in the world. The abstracts appear below. But, before ordering them in any area outside the U.S., check first the paragraph, **"Ordering Programs,"** that appears on page 3.

(67/97) Bell-Fruit (Slot Machine) (#00218D)

This is a much-improved version of the HP-65 "Bell-Fruit" program. This program will simulate a Mills brand, 10-cent slot machine, both in standard payoffs as well as in precisely duplicating the same odds that any particular combination of symbols will occur. It includes automatic recall of winnings by using only one key, delayed-action tumbler display, and prestored seed for quick start-up. (112 lines, 6 pages)

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

For either HP-67 or HP-97 use, this program simulates an actual pinball machine, including two flippers, out hole bonus, thumper bumpers, slingshot kickers, special star roll-overs, bonus advance star roll-overs, top roll-overs, kick-out holes, free ball drop targets, free-game scoring, spinner gate, optional tilting possibility, and either conservative (standard) or liberal (easy) scoring options. The calculator keeps track of games, amount spent, number of balls to play, total score, etc. (222 lines, 8 pages)

(41C) Wizard of Pinball (#00361C)

This program simulates some of the new electronic pinball games, including 2X, 3X, and 5X outbonus, point-advancing kick-out holes, thumper bumpers, spinner gate, star roll-overs, lane roll-overs, alpha-targets, drop targets, free ball, one to four players, 5 ball games, high-score bonus, 3 free game thresholds, full alpha-display on scoring, and sounds (tones). A bookkeeping routine

(Continued)

keeps track of cash spent on games (25 cents per game). And flippers are included. (534 lines, 7 cards, 23 pages, 3 modules) Notice that a minimum of three memory modules are required for this program. Also, for convenience, a card reader would aid in reloading the program.

* *PPC is the acronym for Personal Programmers Club, a volunteer, nonprofit, independent, worldwide group of Hewlett-Packard personal calculator and computer users.* PPC CALCULATOR JOURNAL *is the Club newsletter. PPC is not sponsored nor in any way officially sanctioned by Hewlett-Packard. For information about PPC, send a self-addressed 9" × 12" (23 ×31 cm) envelope with first-class postage for 2 ounces (57 grams) to:*

PPC CALCULATOR JOURNAL
2541 W. Camden Place
Santa Ana, CA 92704

Book Reviews

One of the rewards of being a member of HP's calculator Division is the ability to get to meet people who are so impressed by our products that they take the time to feature those products in books. The most recent example is **Mortimer Rogoff,** who has written a really impressive book, *Calculator Navigation.*

This book has had an evolution paralleling that of our handheld computing products. Mr. Rogoff first visited us in 1974, when we were still located in California, to talk about writing a book on navigation using the HP-65. Just as he was about to send final copy to his editor, we introduced the HP-25. So Mr. Rogoff revised many of his programs to run on the new HP-25, and was all ready to go again when we introduced yet another calculator, the HP-67 and its printing companion, the HP-97.

When he saw the incredible increase in calculating power represented by the HP-67/97, Mr. Rogoff once again postponed publication of his book and incorporated the new calculators, eventually discarding the HP-25 and HP-65 altogether. The calculators included in the version of *Calculator Navigation* that finally was published are the HP-67, HP-97, and HP-41C, plus some calculators from other manufacturers.

The topics covered in the book are coastwise navigation, sailing, celestial navigation, and Loran. Mr. Rogoff introduces a statistical approach to many of the classical navigational techniques. Thus, the small-boat navigator will be able to greatly improve the quality of his instruments. Many of the statistical techniques have been proposed before, but only the advent of the handheld calculator has made their use practical.

Another significant contribution to the practice of navigation is a rigorous or nearly rigorous solution to the problem of determining one's latitude and longitude from Loran C time differences. This is not a trivial problem, yet Mr. Rogoff's programs can be used to obtain positions that are more accurate than those determined from Coast Guard charts.

If you care at all about navigation, you should track down a copy of this book and look it over. It's hard to believe you won't want it after you see it.

The book contains 417 pages, is hard-bound, and lists at $24.95.* Look for it at your local bookstore or order it directly from:

W. W. Norton & Company
500 5th Avenue
New York, NY 10110 U.S.A.

Next we have a book, *Synthetic Hydrograph Computations on Small Programmable Calculators,* written by **Thomas E. Croley II,** who is with the Iowa Institute of Hydraulic Research, at the University of Iowa. This book presents the computation procedures used in a few of the popular techniques for synthesizing hydrographs. Rather than to attempt a comprehensive coverage of all synthetic hydrograph techniques, a few of the "classical" or more general techniques are dealt with. Those techniques that have already appeared for use on small programmable calculators are not duplicated herein. Programs are presented in each section for the HP-19C, -25, -33E, -65, and -67/97, plus calculators of other manufacturers.

The book contains 236 pages in a unique hard-cover (but loose-leaf!) binding, and it lists at $12.* You probably won't find it at the bookstore, so order it from:

Institute of Hydraulic Research
The University of Iowa
Iowa City, Iowa 52242

Our next review is for *Pocket Programmable Calculators in Biochemistry,* by **John E. Barnes** and **Alan J. Waring.** Both of these authors have excellent credentials, so you can't go wrong on this book if the subject is of interest to you. John Barnes has a Ph.D. in Molecular Biology from Johns Hopkins University and is now a Research Biochemist at E. I. duPont de Nemours, Inc. Alan Waring has a Ph.D. in Biology (plant biochemistry) from the University of California (Los Angeles) and is now an Assistant Professor at Hahnemann Medical College in Philadelphia, Pennsylvania.

The book has 363 pages and lists at $15* for the soft-bound edition or $25* for the hard-bound edition. It was written for the HP-67/97 calculators and for a few from another manufacturer. An appendix at the back of the book presents HP-41C compatibility information. Chapter are:

1. Aqueous Solutions of Small Molecules
2. Macromolecules in Solution
3. Sedimentation
4. Ligand Binding and Kinetics
5. Thermodynamics in Biochemistry
6. Spectroscopy
7. Isotopes in Biochemistry

and there are 5 appendices.

If you can't find this book in the U.S. at your bookstore, you can order it from:

John Wiley & Sons
1 Wiley Drive
Somerset, NJ 08873
Tel: 201-469-4400

and in Canada from:

John Wiley & Sons (Canada)
22 Worcester Road
Rexdale, Ontario
Canada M9W 1L1

And the last book is one many of you who are not conversant with programming will want. It is *Programmable Pocket Calculators,* by **Henry Mullish** and **Stephen Kochan.** It covers the HP-55, -65, -25, -25C, -19C, -29C, -67, and -33E, plus calculators from other manufacturers. It contains 254 pages, is soft-bound, and lists at $9.95.*

The purpose of the book is to examine in detail these programmable pocket calculators and to point out their architecture, special features, and programming techniques designed to maximize their use. It does not assume that the reader has any previous knowledge of programming. Every program for each calculator is incorporated in a schematic showing *precisely* how to enter the program and to put the calculator to work.

If you can't find it at your bookstore or computer specialty store, order it from:

Hayden Book Company
50 Essex Street
Rochelle Park, NJ 07662

* *U.S. dollars. See note at bottom edge of cover. If you order a book from the publisher, be prepared to pay shipping costs, usually at book-rate postage. Outside the U.S., it might be better to have your local bookstore order the book for you. They usually have contacts and can get it easier than you can.*

"25 Words" (More or Less!)

There's quite a *smorgasbord* of routines and subroutines in this issue—as you will see. We try to include something for everyone, and for all levels of expertise. If you submitted a contribution and it wasn't printed, don't be dismayed; quite often it will be in the next issue. Of course, there is no practical way to include *all* of them. But we try our best. Maybe an upcoming issue could be 75 percent "25 Words." We'd bet you'd like *that*! Keep your fingers crossed, and we'll see if we can do that for you—neatly segregated by calculator model.

Our first contribution for this issue is from **Nai Chi Lee,** who keeps his HP-41C in Singapore, which also happens to be his hometown.

(41C) There are a few points I discovered from my HP-41C that should be of some value to other users. First, according to the Owner's Handbook, the basic HP-41C has 63 registers of program memory. Wrong! It is actually 63 and 4/7 registers. That is, 445 bytes. This is important for those who try to find out the number of bytes in their program by counting the registers and extra bytes left. In my case, I only realized the existence of these 4 "extra" bytes when I tried to save a program that was thought to be exactly 224 bytes, and the calculator asked me for the third side of the card. *(See explanation, below. Ed.)*

(41C) Next, the local labels (A to J, a to e) require only 2 program bytes, while other ALPHA labels (K to Z, and special characters) need at least 5 bytes.

(41C) And, last, if there are k identical bytes repeated N times throughout the program, the number of bytes saved by a subroutine for the k bytes is

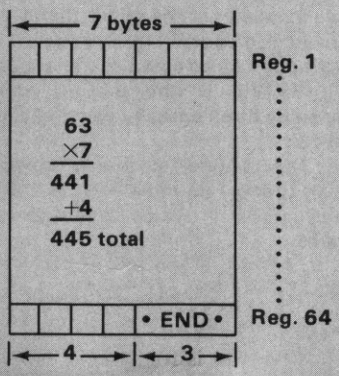
$$(N-1)(k-3)-5$$

For example, if N = 2 and k = 9 bytes, you save only 1 byte by using a subroutine. This is, of course, assuming that you use a label 00 to 14 for the subroutine. If you use, say, LBL T instead, you will waste exactly 3 bytes.

The following table shows the initial allocation and the maximum number of registers that can be allocated to data storage or to program memory.

Calculator Plus	Maximum Data Storage Registers	Initial Register Allocation		Maximum Program Memory Registers
		Data Storage	Program Memory	
No Memory Modules	63	17	46	63 (445 bytes)
1 Memory Module	127	81	46	127 (893 bytes)
2 Memory Modules	191	145	46	191 (1341 bytes)
3 Memory Modules	255	209	46	255 (1789 bytes)
4 Memory Modules	319	273	46	319 (2237 bytes)

(Let's clear up the 441 versus 445 total bytes problem for the last time. There really *are 445 bytes available in a* basic *HP-41C. The diagram shows why. There are actually 64 registers, as you can see, but the last one is not totally usable, because of the permanent END statement. That's why it was stated that there are 63 in a basic HP-41C. The table should also clear up some other questions. Thanks, Mr. Lee. Ed.)*



Many people had problems with **Richard Sperling's** "effective interest" routine in the last issue. This was brought to our attention by a letter from **Roy A. Bitter** of Ft. Wright, Kentucky, and then by more people from all over the Globe! If you change line 013 from ÷ to × and line 016 from × to ÷, you'll find the routine easier to use—or understand. However, on closer examination, we found we could rewrite the routine. So here it is, again, for those who couldn't apply it.

(67/97/41C) If you pay an income tax, this routine will calculate the net cost of borrowing, taking into account the amount of interest you can deduct from your income tax.

```
001  *LBLA
002    %
003    -
004   PSE
005    %
006   RTN
007   R/S
```

For example, you want to borrow $950 at 14.35% interest for one year, and your tax bracket is 38%. Key in 950, [ENTER], 14.35, [ENTER], 38, [A]. When you press [A] the display will show "8.9" and, after a pause, "84.52" will appear. The first number is your "effective" interest and the second your net cost of borrowing the $950.

Remember, this is just a quick, handy way to determine approximate costs. It does not accurately calculate for direct reduction loans, compound interest, and so on. But it is far better than nothing, it makes you more aware of net costs, and it is a handy, short routine you can include in financial programs. And we thank all of you who wrote to us about this routine.

Now let's see what is going on in Glasgow, UK, which is the home of **Chilton R. Inglis**—and his HP-41C.

(41C) This routine, although longer than the "CHARS" program in the *HP 82143A Printer Owner's Handbook* (page 23), has the advantage of presenting the entire HP-41C character set in a compact tabular form, indexed with the numerical values used by the ACCHR function. Flag 25 is set and tested to exit a loop on the 128th character.

```
01♦LBL "CHARS"          23 X<>Y
02 CF 29                24 INT
03 CF 00                25 ARCL X
04 SF 01                26 ACA
05 SF 25                27 CLX
06 FIX 0                28 LASTX
07 ADV                  29 " "
08 SF 12                30♦LBL 01
09 "**HP-41C**"         31 ACA
10 PRA                  32 ACCHR
11 ADV                  33 FC? 25
12 " STANDARD CHARA"    34 GTO 02
13 "┣CTER SET"          35 ISG X
14 CF 12                36 ISG Y
15 PRA                  37 GTO 01
16 XEQ 02               38 GTO 00
17 CLA                  39♦LBL 02
18 .127                 40 PRBUF
19♦LBL 00     41 "      0 1 2 3 4 "
20 FC?C 01    42 "┣5 6 7 8 9"
21 ADV        43 PRA
22 .009       44 .END.
```

```
**HP-41C**

STANDARD CHARACTER SET

    0 1 2 3 4 5 6 7 8 9
  0 ♦ × x̄ ← α β Γ ↓ Δ σ
 10 ♦ λ μ ¿ ↑ ‡ θ Ω δ Å
 20 å Ä ä Ö ö Ø ø Ü ü ß
 30 £ ¥   ! " # $ % & '
 40 ( ) * + , - . / 0 1
 50 2 3 4 5 6 7 8 9 : ;
 60 < = > ? @ A B C D E
 70 F G H I J K L M N O
 80 P Q R S T U V W X Y
 90 Z [ \ ] ↑ _ ' a b c
100 d e f g h i j k l m
110 n o p q r s t u v w
120 x y z ← | → Σ ├
    0 1 2 3 4 5 6 7 8 9
```

(Very clever, Mr. Inglis. You'll notice, however, that I added a "CF 29" as line 02. If you don't clear that flag, you will not have the neat tabular form shown here. Try it; you'll see what happens. Refer to pages 230, 231 in the HP-41C handbook for details about flags 28 and 29. Ed.)

For a change of pace, here is a contribution that does not require pressing keys. It's from **Stanley R. Brockman** of Wheat Ridge, Colorado.

(41C) A function and a program both having the same name can be executed from the keyboard if the function is assigned to a key before the program label by the same name is keyed into memory. (See John Gafford's comment, V. 4, No. 1, p. 7 of KEY NOTES). The program can then be assigned to

(Continued)

another key or [XEQ] "...". Actually, the same thing can be done with two or more programs having duplicate names, by simply assigning the labels to separate keys as each label is keyed into memory. The HP-41C keeps the assignments straight. However, I'm not sure why anybody would wish to duplicate names in this manner.

Because the calculator is basically a mathematical tool, we though you'd like an input from someone who uses it as such. He is **J. F. Weaver,** a Professor (Mathematics Education) at the University of Wisconsin in Madison, Wisconsin. Here are two contributions from him.

(65/67/97) Given two counting numbers *a* and *b,* Peter Luschny's eight-step routine for finding their greatest common divisor, or gcd (May 1979, Vol. 3, No. 2, p. 10), seems to terminate only when the latter of the two conditions of the Nicomachus algorithm ("continually take the less from the greater until reaching *a unit* or *two equal numbers*") is satisfied. I believe that the routine below, executed on an HP-67/97 as *a* [ENTER] *b* [A], will terminate when either the first or second condition is satisfied, although my routine may "mess up" Mr. Luschny's lcm (least common multiple) routines on pages 10 and 11.

```
001  *LBLA      007   X=Y?
002    -        008   RTN
003  LSTX       009   R↓
004   X≠Y       010  X≠Y?
005   ABS       011  GTOA
006     1       012   RTN
```

(41C) Despite the advent of the handheld calculator and the push toward the metric system of measurement, there are (and will continue to be) times in school mathematics when work is done with "common fractions" rather than "decimals." The following little routine uses the HP-41C's "MOD" to good advantage when changing the form of a common fraction to "lowest terms" (utilizing the Euclidean algorithm to calculate the highest common factor (hcf) of the fraction's terms.)

Given n/d (when n and d are positive integers), change to n'/d' such that n' and d' are relatively prime.

```
01*LBL "CFLT"      15 GTO 00
02*LBL "NO"        16 RDN
03 SF 00           17 FC?C 00
04*LBL "YES"       18 STOP
05 ENTER↑          19 /
06 ENTER↑          20 STOP
07 R↑              21 X<>Y
08 ENTER↑          22 LASTX
09 R↑              23 /
10*LBL 00          24 STOP
11 MOD             25 LASTX
12 LASTX           26 RTN
13 X<>Y            27 .END.
14 X≠0?
```

To run the program, input n, ENTER, d. If you wish to display the hcf of n and d enroute to calculating n' and d', [XEQ] "YES." Press [R/S] and see n' and press [R/S] again to see d'. If you do not wish to see that, press [XEQ] "NO" and see n'. Then press [R/S] and see d'. But, now, if you change your mind and wish that you *had* displayed the hcf, simply press [R/S] at this point and you'll display the hcf. I leave it to the user to decide upon the program's validity in the event that n or d is not a positive integer.

If the input instructions were changed to n, ENTER, ENTER, d, the routine could be shortened by three lines, by deleting lines 05, 06, and 07.

Note: The routine, of course, covers the condition that in the initial n/d, n and d are relatively prime; in which case, the routine generates:

hcf = 1, n' = n, and d' = d

Although the HP-41C has "alpha" capability, it is a long way from being a typewriter. But you *can* easily write messages on it wi… submitted by **Hans J. Wües…**

(41C) This is … with ease. You m… a line and as ma… enter the routi…

and see "TEXT?" in the display, then start keying in your message. When 24 characters are keyed, a tone sounds, and you can decide whether to hyphenate the word or delete a letter or two—or just to press [R/S], and print the line you just formed. When finished, exit the loop with one space (after your last [R/S]).

```
01*LBL "TEXT"      11 ASTO X
02 CLA             12 CLA
03 "TEXT ?"        13 X=Y?
04 AON             14 GTO "EXIT"
05 PROMPT          15 PRBUF
06 ACA             16 GTO "TEXT"
07 AOFF            17 RTN
08 ASTO Y          18*LBL "EXIT"
09 CLA             19 .END.
10 "⊢ "
```

A Day Late? Early?

HP's "Calendar Functions" program in the *HP-41C Standard Applications* book appears to be valid for the period March 1, 1900 through February 28, 2100. I notice that your examples in the book are limited to that span, and that no claim is made for validity as a "perpetual" calendar. However, I also notice the absence of a caution in regard to the period of validity.

In the unlikely event that this is "news," an explanation follows. Your program is written on the assumption that every fourth year is a Leap Year. This assumption is correct for the year 2000, but not correct for 1700, 1800, 1900, 2100, 2200, and 2300. Hence, your program produces an error of 1 day per century, or fraction thereof, outside the 2-century validity span.

Regards, **James E. Sutton**
Redwood City, California

(You are right, Mr. Sutton. The "Calendar Functions" program should include atop …the note: …from M… to February …If thi… …ook, you can …ve the li… …n page 14.

HP KEY NOTES
June/July/August 1980 Vol. 4 No. 2

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

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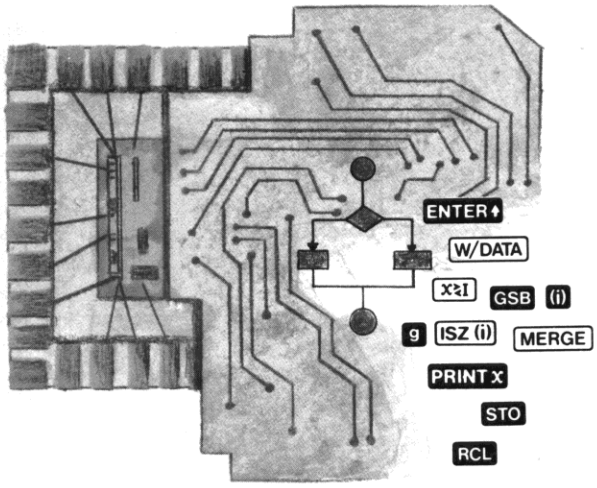


Featuring, this issue:

September—December 1980 Vol. 4 No. 3

HEWLETT PACKARD

HP Key Notes

A *Very* Special HP-41C ...

Hewlett-Packard calculators have been used for just about everything imaginable, but the following news release presents one of the better applications from the many we hear about. It is being printed here for two reasons: to let all of you know about it in hopes of helping someone else, and to show our appreciation for the unselfish dedication of a certain college professor in Pennsylvania. Here's the release:

GREENVILLE, PA.—Beeps and bleeps in electronic games tell youngsters of all ages the score, but these sounds coming from a calculator give a blind Thiel College coed an opportunity to be a winner.

For **Peggy Butler**, a senior sociology major from the Pittsburgh suburb of Manor, the ability to use a highly sophisticated calculator with ready access to statistical data opens doors to career fields which previously have been closed.

Peggy developed vision difficulties soon after birth, and by the time she was in elementary school was legally blind. She is a graduate of the School for the Blind, Pittsburgh, and is assisted in getting around Thiel by her pilot dog, Cheyenne.

But developing such an instrument has not come easily and has been a labor of love on the part of one of her instructors, **Dr. Mervin Newton**, associate professor of mathematics at the western Pennsylvania liberal arts college.

Dr. Newton has spent more than 300 volunteer hours in the last year in programming a Hewlett-Packard HP-41C to perform statistical and scientific functions to enable Peggy and other blind students to have the same facilities in mathematics and statistics to complete their courses as their sighted counterparts.

The specially programmed calculator enables Peggy to graduate with a high level of skills, enhancing her vocational opportunities. For example, in her field Peggy could be a research sociologist on her own and would not need someone else to do the statistical analysis for her.

The calculator would enable her to "read" mathematical tables more easily than if they were in Braille. In fact, using Braille tables would be extremely cumbersome, for each table or page of printed numbers would yield four or five Braille pages. With the number of tables needed, Braille would be unworkable because of the sheer volume and the time necessary to reference each number.

In addition to developing Peggy's programs in sociology, Dr. Newton is working on a financial version which would be applicable for students interested in banking. Having these skills a blind student could become a loan officer because financial functions that are required to use tables would be readily available by the calculator.

Dr. Newton estimates he will have another 100 to 150 hours to develop these business programs.

What motivates a person to put in this kind of time? "Well," Dr. Newton explains, "it's my job to help people learn, and when they need extra help because of handicaps, I'm willing to assist them. And besides, I'm a calculator nut. It's my hobby, and I enjoy trying to get the maximum output from each machine. I collect calculators like other people collect stamps."

Thiel and its personnel have attempted to provide reading and counseling services for its blind students and have had at least one such person on campus annually for the last decade.

"Because of the costs, blind students face critical problems in securing sophisticated technical equipment which would significantly help them. Blind persons are a distinct minority group, and the number of blind

During an interview with Valorie Norman (right) on TV channel 33's "Good Morning Youngstown" show, Peggy Butler (left) and Dr. Mervin Newton discuss the calculator programmed for blind students. With them is Peggy's pilot dog Cheyenne.

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

Library Corner

All of the programs highlighted in KEY NOTES are available worldwide. However, *before you order any, be sure to read the paragraph below:* **"Ordering Programs."**

USERS' PROGRAM LIBRARY EUROPE NEWS

Because of the present long lead time that is necessary in publishing any publication of the magnitude of KEY NOTES, there is still quite a gap in time from when we print until you read KEY NOTES in Europe. This lost time is gradually being eliminated, but we are still at the mercy of the time it takes to physically clear Customs and import-export details on each end of the shipping function. Once in Europe, it also has to be distributed through the maze of postal services and many borders in the European area. However, we are making progress, and by the next issue, we will cut the present delay in half; that should be good news for all of you.

Also, remember that, now that you can acquire programs listed in KEY NOTES, these *are* available at the Users' Program Library Europe, in Geneva. You do not have to—and should not—order them from Corvallis.

CORVALLIS LIBRARY NEWS

Addendum 1 to the November 1979 *Catalog of Contributed Programs* has been mailed and by now should have been received by our subscribers. Now we are in the process of putting together the data and information for a complete reprinting of the *Catalog*, which is scheduled to go to the printer on December 1.

A long-overdue mailing to our Library subscribers outside the U.S. has just been completed. The package includes *Addendum 1* to the *Catalog* and the last two KEY NOTES (March 1980 V4N1 and August 1980 V4N2). We *will* establish a more regular mailing schedule for our friends in other countries, and wish to express our appreciation of their patience.

ORDERING PROGRAMS

HP-67/97 and HP-41C programs mentioned in KEY NOTES are now available from both the Library in Corvallis and the Library in Geneva. **Readers in Europe should order from Geneva** (address on back cover) to get quicker service. Readers elsewhere should order from Corvallis, where programs cost $6* each, and each program includes documentation and a prerecorded magnetic card (or cards). Whenever possible, use the Users' Library Order Form in your *Catalog of Contributed Programs* to place orders for programs you see in KEY NOTES. If you do not have an order form or if you are ordering from Europe or Asia, a plain piece of paper with your name and address and the program numbers you desire is certainly adequate. **Make certain that your address is legible and complete.**

Mail your order and a check or money order to the Corvallis address shown on the back cover of KEY NOTES. Don't forget to include your State or local taxes. Or, in the U.S., you can place your order by calling toll-free: 800-547-3400, except Alaska and Hawaii (in Oregon call 758-1010).

Here's a helpful hint for customers outside the U.S.: We have found that your orders are handled in a more efficient and timely manner if you will send, *attached to your order*, an International Money Order, a Foreign Draft or the equivalent, or a check. *Any of these must be in U.S. dollars, drawn on a U.S. bank*, otherwise they will be returned to you, which involves a long delay for you. Much time is wasted and orders are held up in trying to match orders and checks that are sent in separately, or written on checks for non-U.S. banks and in foreign currency. Another option for you is to use such major credit cards as American Express, VISA, or MasterCard.

Orders *not* delayed by the above problems can normally be shipped within 48 hours after they are received in Corvallis.

LIBRARY SUBSCRIPTIONS

In the United States, the fee for a one-year subscription to the Users' Library is $20.* If you live outside the U.S., the fee is $30* because of considerably higher postage and handling charges. KEY NOTES is presently free in the U.S., but in areas outside the U.S. you must be a member of the Library in order to receive it. The only exception is the free one-year subscription presently offered to most purchasers of the HP-41C.

NEW PROGRAMS

Here are some recent submittals to the Corvallis Users' Library. All of the programs in this issue are available worldwide, *but before you order, be sure to read (above):* **"Ordering Programs."**

* *U.S. dollars. Orders from anywhere outside the U.S. must include a negotiable check (or money order), in U.S. dollars, drawn on a U.S. bank. All orders from anywhere outside the U.S. must include an additional 10 percent for special handling and air mail postage. (For example, an order for two programs = $6 × 2 = $12 + $1.20 = $13.20 total.) If you live in Europe, you can order directly from Geneva, but make certain you make payment as required by the Users' Program Library Europe; the above $6 fee is good only for orders to the Corvallis Library.*

(41C) Mastermind—9 Colors (#00436C)

This program plays a nine-color version of the popular "Mastermind" game. It uses a simple random-number generator to establish the four-color target (can have duplicate colors). The user then tries to discover the target with successive trials. The program will score each trial with an "X.Y" system, where: X is the number of colors in their correct locations and Y is the number of colors correct but *not* in their right locations. A score of 4.0 is a win, a score of 0.0 is a totally incorrect trial. (Enhanced from an HP-65 program by D. Crouse of Allison Park, PA.) *Required accessories: None* (103 lines, 5 pages)

Author: **Charles S. Hodge**
El Toro, California

(41C) Blind Numerical Operations (#00499C)

This program will enable Blind people to "read" the numerical display. This is accomplished by the calculator supplying the correct number of audio tones for each digit. Special audio signals indicate decimal and/or negative numbers. The original number is returned unaltered to the display (except for SCI and ENG displays, which are returned unaltered only when they will not fit the normal FIX display). *Required accessories: None.* (84 lines, 6 pages)

Author: **Mike O'Regan**
Nottingham, United Kingdom

(41C) Aerodynamic Properties of a Finite Wing (Prandtl) (#00506C)

This program calculates the span-wise load distribution and associated aerodynamic coefficients for high-aspect-ratio wings. A 10 control-point, horseshoe vortex approximation to Prandtl's lifting line theory is used. The program is restricted to symmetrically loaded unswept wings with linear taper and twist and to incompressible flow fields. *Required accessories: Math Pac I and two Memory Modules.* (366 lines, 13 pages)

Author: **John Orosa**
University of Florida

(41C) Navigation Package (#00511C)

This program solves celestial sight of any heavenly body and gives line of position. It contains an almanac for sun and stars. A nautical almanac is required for the moon and planets. The program also solves Great Circle problems and Dead Reckoning sailings. Although it uses 722 lines, only 8 storage registers are used. The program is easy to operate, with prompting and automatic execution. *Required accessories:*

Two Memory Modules; Printer and Card Reader optional. (722 lines, 22 pages)
Author: **Bill Kohlmoos**
Ely, Nevada

(Navigation? In East Central Nevada? Well, Ely is at 6,421 feet in altitude, so I suppose you can see the stars very well! Regardless, Mr. Kohlmoos has done a good job, despite being 550 miles from the Pacific Coast.—Ed.)

(41C) Yacht Racing Rules Judge (#00520C)

The program uses a decision tree to determine which yacht should be disqualified in any "right-of-way" situation. Multi-boat situations are not directly covered but may be resolved by solving for two adjacent yachts and then iterating. The program will assist both race protest committees and students of NAYRU rules. Required accessories: *Three Memory Modules; Printer and Card Reader desirable.* (367 lines, 12 pages)
Author: **Lawrence M. Kazanowski**
Walled Lake, Michigan

(41C) Banner (#00530C)

This program greatly facilitates making special characters for the printer, and it will cause them to be printed at the normal size or in "banner" form. In banner form, characters are printed vertically along the paper; that is, when the characters exit the printer, they are facing downwards. Each "dot" is printed as a double-wide character 31, a sort of checkerboard square. You may also label columns. The size (length) of the banner is limited only to the number of current storage registers allocated. *Required accessories: Printer; program should be run with one Memory Module.* (214 lines, 9 pages)
Author: **David Hayden**
Rocky Hill, New Jersey

(97) Perspective Plottings for Architecture and Engineering (#04419D)

Given the three-dimensional coordinates of a set of points, this program computes and prints the respective coordinates for a perspective projection on a vertical plane, corresponding to a given position of the view point. (222 lines, 17 pages)
Authors: **Antonio Costa & Celia Zatti**
Belo Horizonte, Brazil

SOME SPECIAL PROGRAMS

Occasionally, programs submitted to the Library are put in a category of "Special Program," by virtue of length, value, etc. The two programs that follow are "Special," and both are labors of love by their authors.

Back in November of 1979 (Vol. 3 No. 4) we published the abstract for **#67000-99973, Full Poker—5-Card Draw**, by **John C. Nelson** of Des Moines, Iowa. This masterpiece of documentation was 47 pages, 7 magnetic cards, 1,147 lines, and included even a cross-referenced flow diagram. It sold for $22.50,* and many an HP-67/97 owner thought it worth the price. But, to get to the point, below the abstract in KEY NOTES was an editorial note that started: *Here is a good challenge for someone with an HP-41C* .... Well, someone *did* convert poker to the HP-41C, and we are happy to print the following abstract.

This "special" program is titled, **Poker—5-Card Draw #67000-99966**, and the price is $22.50.* The author of *this* epic is **Norman J. Gordon** of Los Altos Hills, California. His HP-41C version of poker consists of 945 lines, 9 magnetic cards, 20 pages, and all of the wonderful features of the HP-41C, in particular alpha prompting. Here's the abstract:

(41C) You play a fully automatic game of Five-Card Draw-Poker, with full prompting for all phases of ante, betting, drawing, raising, staying, etc. You play *against* the calculator, which can be assigned as aggressive a personality as you wish. *This is a full simulation*, including a bluffing capability. Be aware of one important detail: the calculator does not cheat! *Accessories required: Three Memory Modules and a Card Reader.*

Our second "special" was initially developed for the HP-65 but was adapted and later improved for the HP-67. It is actually a collection of programs that were adapted from many sources, including HP's Navigation Pac, and all of them related to "Search and Rescue (SAR)," having been originated while the author was attending the National Search and Rescue School at the U.S. Coast Guard Training Center, Governors Island, New York. This special program encompasses 811 lines, 10 magnetic cards, and 53 pages, of which, three pages explain exactly what the "pac" is, what it does, and how to use it. As you now suspect, it is a monumental and well-documented effort. It was contributed by **Terence M. Bills**, presently at the USCG Base in Ketchikan, Alaska. It is titled: **Search and Rescue Pac #67000-99970**, and the price is $26.50*.

Here is the abstract:

(67/97) The SAR PAC system of programs is designed for rapid solution of Search and Rescue position, area, and coverage problems in the oceanic environment. The SAR PAC develops all solutions without the use of maneuvering boards or other graphic aids, and it is designed for use by SAR planners and units. Programs that make up this pac are: Wind Current Factors; Wind Current Vector; Vector Addition; Position Shift by Vector; SAR Datum; Position Error/Search Area; SAR Decision Aid; Search Planning; Sector Search; and Speed-Time-Distance. *They are NOT available separately.*

U.S. dollars. See **"Ordering Programs" on page 2 before you order these Special programs. These programs are available only from the Corvallis Library.*

"Petals Around the Rose"

No, we're not using calculators to grow flowers. But, then, a few of you already do know what the title means. For those who don't, here's the story behind "Petals Around the Rose," at least as told by the author of this HP-41C program, **Edward M. Keefe** of Ankeny, Iowa, who writes absolutely remarkable appendages to his fascinating programs.

"Once upon a time ... during World War II, General Montgomery called his staff together and declared that he would grant a weekend pass to any and all officers who could come up with the correct answer to a simple guessing game.

He produced five dice and proceeded to roll them. Each time, he queried, "How many petals are there around the rose?" He assumed that all of his officers, being highly educated men, would "crack the puzzle" in short order. But, as the story goes, at the end of an entire weekend of tiring dice rolling, no one had cracked the puzzle. Since that day, very few people have actually solved the puzzle (except for several hundred precocious children, a handful of mathematical geniuses, and some adults who claim to have psychic powers). Those who have successfully solved the puzzle have since banded together in a society known as the Order of the Rose. There is only one rule for this noble society and that is the rule of OMERTA—silence!—secrecy! No one may reveal the method by which she or he has solved the puzzle and what is the significance of the phrase "Petals Around the Rose."

I, personally, have seen grown men and women driven to much drink after many hours of trying to guess the significance of the five, frustrating dice and the cabalistic and oft'-repeated phrase "Petals Around the Rose."

I have also since realized that, for those who tend to be introspective and like to "watch" their brain at work, this little puzzle provides an interesting, but somewhat erstwhile, illustration of the rudiments of the scientific method in process."

Well, that's the story; here's the abstract:

(41C) Petals Around the Rose (#00479C) ($6.00*)

The HP-41C "rolls" five dice (watch them dance across the display!). You are to guess the number of "petals around the rose." The HP-41C will tell you if your guess is right or wrong. After 10 incorrect guesses it will give one hint. And, after three correct guesses in a row, it will dub you a "knight or lady" of the rose. *Accessories required: One Memory Module.* (145 lines, 7 pages)

** U.S. dollars. This is a regular Library program, and it is available from both Geneva and Corvallis. See **"Ordering Programs"** on page X.*

HP-41C Flags—Part 1

Because of its length, this article was split into two parts. Part 1 covers general flag concepts and flags 00-29 except flags 12, 13, and 21. Part 2 will cover all remaining flags, and will be published in the next issue of KEY NOTES.

Flags are often confusing to the beginning programmmer, and they are frequently inefficiently used. The HP-41C not only offers the programmer more flags than previously available on any personal programmable calculator, but also more powerful flags and new flag instructions. Before we explore the flags on the HP-41C, lets describe and define the flag concept in general.

Dalton operates a package delivery service. During the morning run he picks up packages from his customers, and during the afternoon he delivers them. To save time he asks his customers who have packages to be picked up to place a brightly colored sign in their window. As he drives his route, he looks for his signs in his customers' windows and only stops if a sign has been placed in the agreed location.

The example above illustrates the flag concept. The sign is the flag. When the customer places the sign in the window he "sets" the flag. When he removes the sign he "clears" the flag. When Dalton drives by he looks at the window to see if the sign is present (flag set) or not (flag clear). In doing this he tests the flag. He then takes one of two actions. He stops if the sign is present (flag tests set) or he continues if it is not (flag tests clear). It is important to realize that the customers' actions are independent of Dalton's. The customer may change his mind (and the sign) several times during the day as to whether he wants Dalton to stop. As long as he has the sign up when Dalton drives by he will have his packages picked up.

The flag does not take a stack or data register. A flag is a memory that stores the information *set* or *clear*. The flag test instruction is a form of conditional branch instruction that directs one of two courses of program execution. An instruction sequence that implements the ideas of Dalton's Delivery Service is shown below. Flag 05 is used.

```
01 FS? 05
02 STOP
03 Continue
```

The Flag Set test, FS?, follows the memory aid rule "do if true." If the flag tests true—that is, it is set—do the following instruction. If the test is not true—that is, the flag is clear—skip one line.

The HP-41C has four, simple, general-purpose flag instructions. They are:

SF nn—Set Flag nn
CF nn—Clear Flag nn
FS? nn—Flag Set test nn
FC? nn—Flag Clear test nn

where nn is a two-digit flag number (nn may range from 00 to 55, with certain restrictions). The Flag Clear test is the logic inverse of the Flag Set test in that the next instruction line is executed if the flag is clear (tests true) rather than set. This type of general-purpose flag is a simple flag. Programming, however, like life, is not always simple, as Dalton soon found out.

Dalton was pleased with his flag,—er, sign—idea until one day he stopped to pick up some packages and his customer said, "Sorry you stopped Dalton, I forgot to take down the sign." It soon became obvious to Dalton that he should take down the sign when he entered the building, so he immediately adopted this practice. Now, he would know *that his customer intentionally put up the sign for a package pick-up.*

The flag operation that Dalton's new procedure performs is test, then clear the flag. Two new flag instructions on the HP-41C perform this type of operation. They are:

FS?C nn—Flag Set test, then Clear flag nn.
FC?C nn—Flag Clear test, then Clear flag nn.

These new and more powerful instructions are illustrated in figure 1. The problem illustrated is one in which you want to execute a routine twice, using a flag to control program execution.

```
SF 05          SF 05
LBL 01         LBL 01
  :              :
FC? 05         FS?C 05
GTO 02         GTO 01
CF 05            :
GTO 01
LBL 02
```

Figure 1. Execute Routine 01 twice. Routine on left uses simple flags, routine on right saves five bytes by using "test then clear" flag instruction.

The routine on the left in figure 1 illustrates a dilemma for the efficiency conscious programmer. If the flag test is true, the programmer has only one program line in which to do what he/she wants to do, then continues execution with the next program lines. Very often the instruction that follows the flag test is a GTO or XEQ instruction because of this.

Consider this application: In a game program, flag 05 is set to indicate that any score obtained would not be added to register 01 if the player makes the wrong move; otherwise the player's score is added. Assuming the score is in the X-register, the flag test would be:

```
FS?C 05    Normal use of flags, only one
CLX        program line executed if true;
ST + 01    continues with this line.
```

This application is an excellent example of using a flag instruction. Suppose, however, you only wanted to subtract 10 from the score instead of giving no score for a wrong move. This requirement is not met with a single flag test, and you may be tempted to use a subroutine. However, the following instruction sequence is memory efficient and simply tests the flag twice to gain an extra "test true" program line.

```
FS? 05     Testing flag twice gains an
10         extra program line.
FS?C 05    A subroutine may use more
—          memory than the two-byte flag
ST + 01    test to perform the same
           operation
```

The HP-41C has 56 flags available to the user. These are of two types: General Purpose and Dedicated. The general purpose flags are used in program the same way Dalton used his signs. The dedicated flags are used to control the calculator or its peripherals. Table 1 lists all 56 flags with number, name, and action taken if set. The HP-41C may change the status of a flag under certain conditions, and this information is given in the **Status at Turn-on** column.

The table is divided into two parts: **FULL-USE FLAGS** and **TEST-ONLY FLAGS**. The full-use flags, except the printer flags, are discussed below. All remaining flags will be covered in the next issue of KEY NOTES.

Flags 00-04 These first 5 of the 11 general-purpose flags show their set status as annunciators 0-4 in the display. These flags are useful for editing purposes, warnings, and prompts. If the clear flag instruction follows the set flag instruction too closely, the display will not have enough time to turn on the annunciator so that the eye can see it. Three to five program lines between them is usually adequate. A good training exercise is to write a short program that repeatedly sets flags 00-04 in sequence and then clears them in reverse (or same) order.

Flags 05-11 These seven flags, like flags 00 to 04, are general-purpose flags implementing the function Dalton performed with his signs. Their concept is illustrated in the examples above.

Flag 11 If set, flag 11 will cause program execution to start where the program pointer is when the HP-41C is turned on. Once turned on, the HP-41C clears the flag (see table 1), so the program should include an SF 11 instruction if automatic execution is desired. A playful trick that illustrates the features of flag 11 is to key the following into a friend's HP-41C.

```
LBL E       Press "E" in USER mode.
SF 11
OFF
GTO E       Program execution starts here
              at turn-on.
```

The same routine may be recorded on a magnetic card. If flag 11 is set when it is recorded, program execution will start immediately at the beginning of the program when the program is read back in. Perhaps the following routine, recorded with flag 11 set, would be handy to have around for your overly curious HP-41C friends. Mark the card: "Do Not Read This Card."

NOTE

WALL cards record the program pointer. If a set of WALL cards, recorded with flag 11 set, is read in, program execution starts *at the recorded program pointer.*

```
LBL 14
CF 27       Clears USER annunciator.
CF 21       Prevents printer from printing.
TMEMORY LOST
AVIEW
STOP
```

Flag 14 Set flag 14 to write on a "clipped-corner" card. The flag need only be set once for a multi-track write operation. Flag 14 is cleared when the write operation is completed or terminated using the correction ← key. This flag allows all recorded magnetic cards to have their corners clipped for "accidental write" protection.

Flags 15-20 These flags are reserved for future use, but may be used as general-purpose flags. Note that they are cleared when the HP-41C is turned off. In your program documentation, be sure to note that they are being used.

Flag 22 Numeric input from the keyboard sets flag 22. Numeric input may be detected by testing flag 22, as illustrated by the following demonstration routine.

```
01 LBL E    Starts routine (in USER Mode).
02 CF 27    Turns off USER mode for clean
              display.
03 CF 22    Insures flag not set by previous
              entry.
04 TINPUT?
05 AVIEW    Asks for input.
06 PSE      Waits for numeric input.
07 FS? 22   Tests flag 22.
08 BEEP     Signals calculator detected
              input.
09 GTO E    Continue wait loop (display
              blinks).
```

The HP-41C will only accept inputs during the PSE statement.

Flag 23 This flag is similar to flag 22 with the exception that ALPHA input sets the flag. The routine above may be used to demonstrate flag 23 by changing line 07 to FS? 23, by adding AON following line 03, and by changing line 03 to CF 23. Because the routine turns on ALPHA, any key except R/S will set the flag.

Flag 24 If a numerical calculation produces a number too large or too small, that is, overflow (± 9.999999999 99), program execution will stop and an error message "OUT OF RANGE" will be displayed. This is also true for manual operation. If flag 24 is set, the error message will not be displayed, and a value of "all nines" will be used as the "answer." Program execution will not stop.

Flag 25 This popular and often-used flag is always cleared, when an improper operation is performed. This is a general error flag that may be used to detect if an error occurred. The illustrative routine below calculates the factorial of a number and displays N > 69 is this condition occurs. Try programming this without using flags and you will probably use more memory.

```
LBL A
SF 25
FACT        N > 69 causes error, operation
FS? 25        not performed, flag 25 cleared.
STOP
TN > 69
AVIEW
STOP
```

(Continued)

Table 1. HP-41C Flags

FLAG NO.	FLAG NAME	IF SET (OR SET BY)	STATUS AT TURN-ON*
		FULL-USE FLAGS	
00-10	General Purpose	00-04 annunciators.	M, 1
11	Automatic Execution	Program execution starts when HP-41C is turned on.	C
12	Printer Double Wide	Prints all double wide.	C
13	Printer Lowercase	Alphabetics in lowercase letters.	C
14	Card Reader Overwrite	Writes on cards with clipped corners.	C
15-20	Future use		
21	Printer Enable	Flag 55 usually set.	2
22	Numeric Input	Numeric data entry.	C
23	Alpha Input	Alpha data entry.	C
24	Range Error Ignore	Range error is ignored.	C
25	Error Ignore	Operation not performed, flag cleared.	C
26	Audio Enable	Tones audible.	S
27	User Mode	USER mode.	M, 1
28	Decimal Point	Radix is decimal point.	M, 3
29	Digit Grouping	Comma separates groups of three digits.	M, 3
		TEST-ONLY FLAGS	
		Set = Yes, Clear = No; "NONEXISTENT" if set or clear is attempted	
30	Catalog	Executing "CATALOG"	C, 4
31-35	Peripheral	Connected peripheral.	NA
36	Number of Digits	8 of 9 digits displayed.	M, 1
37	Number of Digits	4, 5, 6, or 7 digits displayed.	M, 1
38	Number of Digits	2, 3, 6, or 7 digits displayed.	M, 1
39	Number of Digits	1, 3, 5, 7, or 9 digits displayed.	M, 1
40	Display Format	FIX display; SCI if both clear.	M, 1
41	Display Format	ENG display; SCI if both clear.	M, 1
42	Grads Mode	GRAD mode; DEG if both clear.	M, 1
43	Radians Mode	RAD mode; DEG if both clear.	M, 1
44	Continuous On	(XEQ ON) Won't shut off in 10 minutes.	C
45	System Data Entry	System data entry.	
46	Partial Key Sequence		C, 4
47	Shift Set	"SHIFT"	C, 4
48	Alpha Mode	ALPHA mode.	C
49	Low Battery	Low battery.	M
50	Message	Display contains status/error message.	C, 4
51	SST	Single-step.	C, 4
52	Program Mode	PRGM mode.	C, 4
53	I/O	I/O device is ready.	NA
54	Pause		NA, 4
55	Printer Existence		2

***NOTES:**
C = Cleared.
M = Maintained by Continuous Memory.
NA = Not applicable.
S = Set.
1 = "Master Clear" clears flag.
2 = Flag 21 is set to match flag 55 at turn-on.
3 = "Master Clear" sets flag.
4 = Always tests clear.

NOTE

It is always wise to clear F25 (FS?C 25) after use to ensure that other improper operations do not occur unnoticed. Try it!

Operations that use data registers that are "NONEXISTENT" because of incorrect size may make good use of flag 25. Instead of stopping with "NONEXISTENT" in the display, they may display "SET SIZE NNN" etc.

Flag 26 This flag "turns off" the TONE and BEEP instructions. Each TONE takes about ¼ second, and this time may be "saved" when flag 26 is cleared.

Flag 27 This flag controls USER mode. Include a CF 27 in your routines if you have assigned functions to numeric keys to avoid conflicts of "numbers versus functions."

Flag 28 Users in the United States separate the integer and decimal parts of a number with a decimal point radix. Users in Europe often prefer a comma for the radix. For a decimal point, set flag 28; for a comma, clear flag 28.

Flag 29 Often commas are used to group digits to the left of the radix in groups of three. If flag 28 is clear and flag 29 is set, the grouping is done with decimals and the radix is a comma. The number 123456.7891 (U.S. convention, radix is decimal) would be displayed as shown below for all combinations of flag 28 and 29.

Remarks	Display	Flag 28	Flag 29
European, no grouping	123456,7891	clear	clear
European, grouped	123.456,7891	clear	set
U.S., no grouping	123456.7891	set	clear
U.S., grouped	123,456.7891	set	set

Flag 29 has an important use with AVIEW. If you want numbers displayed as integers without a decimal point, use FIX 0 with flag 29 cleared before ARCL and AVIEW instructions.

All flag instructions are two bytes and may be used as indirect instructions. Proper use of the HP-41C flags can save memory. The examples given for the flags discussed were intended to illustrate their characteristics. In our next issue we will continue with the printer control flags and the TEST ONLY flags 30-55.

We Get Letters

Every once in a while we like to show you a letter about our products, because we know that you are convinced they are the best. And, let's face it, we like to brag about them because we *are* proud of our calculators. They have survived all sorts of abuse, but here is a new wrinkle!

Gentlemen:

I am a physicist, working at the Raman Research Institute, Bangalore, (*India*).

I have been a user of one of the HP handheld calculators for some time. Recently, there was an unintentional demonstration of the inherent ruggedness of this calculator.

One weekend, by mistake, I left my calculator, without its protective case, on top of my desk, and with my second-floor office window open. Over the weekend, the office was ransacked by a herd of monkeys, and several of my things, including the HP-27 without its protective case, were thrown out of the window—a drop of about 20 feet—onto a bed of thin grass but otherwise hard soil. The calculator still works perfectly.

Yours sincerely,
Radendra Bhandari

Is the HP-65 Dead?

No! And here's a contribution to prove that it still lives on, faithful as ever. It is from **Charles Carrier** of Long Beach, California, and it is actually a routine that adds to and improves one of the *Standard Pac* programs.

HP-65 Amortization Schedule. This routine generates a direct repayment (mortgage) loan schedule. The STD-12A card is used to input data, and the payment that is calculated (rounded) should compare to that actually assessed. (Any discrepancy should be resolved!) Because it can be recorded on the same card (-12A), merely turn the card end-for-end and pass it through the HP-65 again. (On the HP-65, only one edge—or track—was recorded on prerecorded cards.)

LBL	÷	1	RCL 3
D	STO 2	STO	×
f	LBL	+	STO
TF 1	2	1	+
GTO	0	RCL 1	5
2	STO 1	DSP	—
STO 4	STO 5	0	RCL 3
*RCL 3	RCL 6	R/S	—
STO 6	f	DSP	CHS
*RCL 2	SF 1	.	R/S
*RCL 7	LBL	3	GTO
*RCL 5	1	RCL 4	1
×	STO 3	RCL 2	

*STD-12A card register/data

R_1 N	R_5 E Int. Paid
R_2 i/100 n	R_6 PV_0
R_3 $PV_{current}$	R_7 n**
R_4 PMT	R_8 PMT_0**

N = Payment Counter
**Not used in running program.

If appropriate, key in the new payment amount. Press the [D] key and, in the running program, the first R/S is the payment number (DSP 0), followed by the current PV (principal value). After a payment number is displayed, RCL 5 gives the total interest paid up to that point. Also,

"Roll" Your Own Bar Code!

Because **John T. Orr** of Spokane, Washington did such a neat job of compiling his letter, we decided to photograph his letter and reproduce it here for you. We don't advocate that you rush down to the store and buy a typewriter like Mr. Orr's, but we *do* advocate the incredible ingenuity of our readers. Thanks, Mr. Orr, for sharing your discovery with KEY NOTES' readers.

Dear Editor:

At least one typrwriter, which does not use a daisy wheel print element can produce bar code readable using an HP-41C wand!

I use an Olivetti Lexikon 94C, with an "OCR" typing element(ball), and set the horizontal spacing at 18 characters per inch. The shifted "6" key produces a vertical bar 1/36" wide followed by a 1/36" space, so a Ø is made with one keystroke. The "½"-"¼" key produces a 1/18" bar usable as a 1, however the following space must be inserted by pressing the space bar and the back space key(either one first). This method makes a narrow bar code which is difficult to read with the wand, however a wider bar may be be produced by shifting down a half space, and repeating the key sequence.

"BEEP"

Doubt if this meets the HP standards for bar code--However it does work with my wand and HP-41C!

Sincerely,

perform other calculations as needed here. Then press [R/S] to continue.

In case you do something wrong, you can get back to "square one" by pressing [D] again. Also, with half the program memory, three registers, and four user-definable labels left, individual needs or applications can be readily accommodated.

(Thank you, Mr. Carrier, for this HP-65 input. It has been a while since I've seen one. Actually, most HP-65's are still going strong; it is only the inputs that are dead—or at least scarce.—Ed.)

The Pause That's Misleading

No matter how carefully one checks a book that contains information about complex machines, it seems that uncanny, inexplicable errors slip by. Sometimes the error is just *one* word, and in this case, it is a word that means just the *opposite* of what we wanted to say.

If you have a very early printing of the *Owner's Handbook and Programming Guide* for the HP-41C, you might have a copy that contains an error on page 147. In the next-to-last paragraph on that page, the sentence—in error—reads: "*Pressing any other keys during a pause, that is, any keys not associated with data entry, causes the pause to terminate the program and program execution halts.*" The last word in that sentence should be "*continues*," not "halts."

We thought we had caught that error, but evidently some copies of that handbook printing got into shipping boxes. Several people have written to KEY NOTES lately to inform us the error exists. Just change that one word, and you'll have a true statement.

Agronomists Wanted

We don't often print this type of letter, but we feel there is some merit in doing so *this* time. It just might result in getting more food to the world's poorer people. Herewith:

"I am an agronomist and a teacher at the Buenos Aires National University. I have an HP-67 and am looking for agronomy programs; that is, in addition to those listed in the HP-67/97 Users' Library. I'd like to contact other agronomists around the world. Please publish this letter in the next KEY NOTES, and this might lead to a greatly enriched "Agriculture" section of the Library."

Sincerely,
Daniel Leiva

Tacuari 572
(1706) *HAEDO*
Pcia de Bs. As.
REPUBLICA ARGENTINA

"I Owe It All To My HP"

If you have been a longtime reader of this newsletter (now in its seventh year!), you should recognize the person on the left in the photograph. (Reference: HP-65 KEY NOTE, V1N5p8, V2N2p6, V2N3p8.) Formerly on the White House staff, he is **Dr. Gus W. Weiss, Jr.**, who is just one of the "celebrities" who believes in and thoroughly uses an HP card-programmable calculator. In this case, Dr. Weiss applies his calculator to solving many of the vexing problems and challenges that confront the United States in these troubled times.

When we heard about Dr. Weiss winning another of the many awards he has received for his outstanding service to his Country, we asked him to send us some details and perhaps a photo. Here is his reply.

Dear Henry:

Enclosed is my promised photo with **Admiral Stansfield Turner**, Director of Central Intelligence, showing me receiving the Intelligence Medal Merit of the Central Intelligence Agency. The ceremony took place on 18 August 1980, and the award was for economic and scientific intelligence.

Just now, I am special Assistant for Space Policy in the Office of the Deputy Under Secretary of Defense for Policy Review (Admiral Daniel J. Murphy), having come to defense from the White House in October 1977. I'm still going full-bore with my HP-67 (which I used on something as complicated as the reentry of SKYLAB), even though I've graduated to a full-system HP-41C. It has become my traveling ENIAC.

I still enjoy KEY NOTES, with all the tips, and am getting plenty of mileage out of the Users' Library.

Regards to all,
Gus W. Weiss, Jr., Washington, DC

(Congratulations, Dr. Weiss! I'll bet that a lot of readers think the title of this article is an exaggeration. However, I know *it isn't; that's why I chose it. Also, it is very comforting to know that an HP-41C, in good hands, is helping to make this a better world in which to live. Thanks again, Dr. Weiss, for the photo and letter.—Ed.)*

It's "That" Time Again!

If you don't live in the U.S. (most of you do), you can skip this article. It concerns the yearly duty each income-earning person in the U.S. is subject to: paying Federal Income Tax to the I.R.S. But it can be somewhat easier to compile your taxes if you use your HP-41C calculator, so we put together a *Users' Library Solutions Book* called *1980 Taxes*. The part number is 00041-90338 and the price at your HP dealer is $12.50.* Bar code is included in this book. Among the programs are:

- Alternate Minimum Tax—Joint Returns.
- Maximum Tax—Joint Returns.
- Single Taxpayers Income Averaging—Tax Table A and Schedule Z.
- Married Individuals Income Averaging—Tax Table B and C, Tax Rate Schedule Y.
- Head of Household Income Averaging—Tax Table D and Tax Rate Schedule Z.
- New Jobs Credit.
- Estates and Trusts Tax Rate Schedule, State Death Taxes Credit Table, Estate and Gift Tax Table.
- Corporate Tax Schedule.

(Continued)

By the time you read this, the book should be available at your HP dealer. Or you can order directly from Corvallis; however, an added handling charge of $3.50 (see **Editorial**) will increase the price of the book to $16.00.* Be sure to include any State or local taxes (on the $16 price).

And, don't forget the best part: the book is tax deductible!

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

Book Reviews

Books are reviewed or announced in KEY NOTES only as a service to our readers. A review here does not represent an endorsement by Hewlett-Packard. If you are unsure about the contents of a book, we suggest you first check with a local bookstore; if that fails, write to the publisher. Availability problems also should be addressed to the publisher, not to KEY NOTES.

CALCULATOR CALCULUS, by **Professor George McCarty** was first reviewed four years ago in HP-65 KEY NOTE, the predecessor of *this* newsletter. Since then, the book has been revised, and a new, soft-bound edition has been released. It covers such subjects as: Squares, Square Roots, and the Quadratic Formula; More Functions and Graphs; Limits and Continuity; Differentiation, Derivatives, and Differentials; Maxima, Minima, and the Mean Value Theorem; Trigonometric Functions; Definite Integrals; Logarithms and Exponentials; Volumes; Curves and Polar Coordinates; Sequence and Series; Power Series; Taylor Series; Differential Equations; and an appendix that covers "Some Calculation Techniques and Machine Tricks." Also included are "Reference Data and Formulas," and a Bibliography and an Index.

So, in 254 pages (5.3 by 8.5 inches; 13.5 by 21.6 cm) there is an enormous amount of information. Yet, the step-by-step methods, worked-out examples, simple exercises, and practical problems allow you to cut right through the normal confusion encountered in this subject. The author explains each idea with calculator examples instead of formal proofs. It is a *useful* book, and it is very clearly written and easy to read.

Dr. McCarty received his Ph.D. in mathematics at UCLA. He has taught at the University of Chicago and Harvey Mudd College (California) and is now at the University of California at Irvine.

The book lists for $14.95* plus $1 for postage and handling (or $3 by AIR), U.S. or foreign. California residents must add 90¢ sales tax. If you order it, the address is:

EduCALC Publications
Box 974 (KN)
Laguna Beach, CA 92652 U.S.A.

And remember: for professionals, the cost is tax-deductible. Plus, the publisher offers a firm money-back guarantee.

SYNTHETIC PROGRAMMING ON THE HP-41C, by **Dr. William C. Wickes**, is a new book that just came off the press on November 21. It is in 8.5 by 11-inch (21.6 by 28 cm) format, is 96 pages, and is saddlestitch bound, with a "stiff" cover (much the same as our "Library Solutions" books).

If you own an HP-41C, and you like to have fun with your calculator, or you like to learn how to better use it, you will be interested in this book. "Synthetic Programming" is the art of HP-41C programming using "new" HP-41C functions and text characters not described in the *HP-41C Owner's Handbook and Programming Guide*. The "new" functions are created in program memory, or assigned to user keys, by "exotic" editing of standard functions. The techniques will work on any HP-41C and do not involve any modification of the calculator.

The book describes the complete theory and application of synthetic programming, starting from scratch. You *do* need to be familiar with the HP-41C owner's handbook, but you *do not* need any other calculator or computer experience. All of the information in the book was derived from actual experimentation with the HP-41C. The author is a calculator user—just like you.

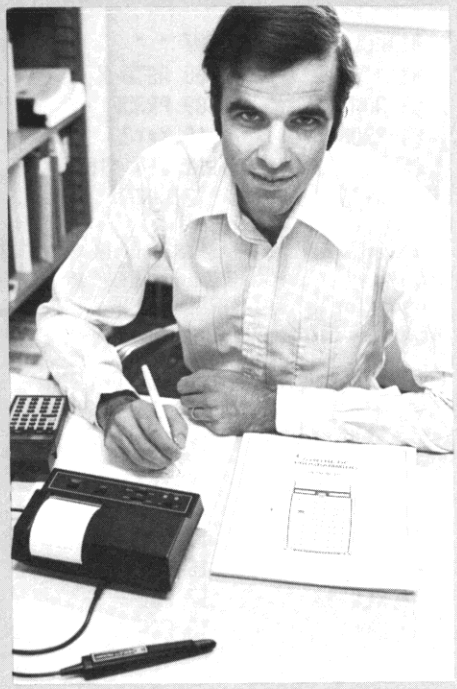
No HP-41C peripherals are required (although any peripheral is helpful, just as for normal programming). However, temporary use of a Memory Module is necessary to get started for the first time.

Virtually any HP-41C program can be enhanced with the use of synthetic functions and texts. Thus, the book should appeal to any HP-41C owner who does his or her own programming. To help you along, the book contains listings of 25 programs (bar code is provided for the longest routines). And, when you learn synthetic programming, your HP-41C will become an even "friendlier" machine than it was before.

Is the book for everyone? We don't honestly know, but we do know that, before it was published, it was reviewed by both novice and expert programmers, and it didn't scare either group. It boils down to this: If you enjoy using your HP-41C and want to get *even more* out of it, you'll like this book.

Here is the Table of Contents:

The author is this remarkable book started with an HP-45 and "graduated" to the programmable world of the HP-65, HP-67, and now the HP-41C. He is currently Assistant Professor of Physics at the University of Maryland (in College Park) and uses his HP-41C for such esoteric things as research in the application of quantum electronic devices, solving problems in astrophysics and cosmology, and solving the puzzle of Rubik's cube. He's married, has two children who are both budding "calculator freaks" [*his term, not mine—Ed.*], likes sailing and two-man volleyball, was born in California in 1946, and was selected as an "Outstanding Young Man of America, 1979" by the U.S. Jaycees. Mr. Wickes received his B.S. degree in physics from UCLA in 1967 (graduated Magna cum Laude; elected to Phi Beta Kappa and Sigma Pi Sigma). His M.A.



(1969) and Ph.D. (1972) are from Princeton University, where he stayed as assistance professor until 1977. And, as you *easily* can imagine, his name has been turning up lately in the newspapers.

As we said earlier, the book just came off the presses November 21, so if you want one, order it directly from the publisher:

Larken Publications
P.O. Box 987
College Park, MD 20740 U.S.A.

The price is $9* plus $1* postage and handling to U.S. addresses; overseas air mail orders should remit $11.50.*

THE CALCULATOR AFLOAT, subtitled: "A Mariner's Guide to the Electronic Calculator," was written by **Captain H. H. Shufeldt, USN (Ret.)** and **Kenneth E. Newcomer**, and we are particularly proud to bring *this* book to your attention. Captain Shufeldt is an old friend of HP and Ken Newcomer was one of the original HP applications engineers who developed some of the original *Application Pacs* (he is now an engineer in our Research and Development Laboratory).

Captain Henry H. Shufeldt is a retired aircraft carrier captain who is responsible for many articles and books on navigation. He is co-author of the twelfth edition of Dutton's *Navigation & Piloting* which for many years was the standard text for maritime academies worldwide.

Ken Newcomer became acquainted with Captain Shufeldt when he was learning the science and practice of navigation so as to develop the HP-65 Navigation Pac. He was studying Shufeldt's *Slide Rule for the Mariner* when he had an opportunity to visit the East Coast for an IEEE show, so he took enough time to visit Captain Shufeldt and to demonstrate what *calculators* could do in navigation.

It was at the Captain's suggestion that Ken submitted his first scientific paper to the Institute of Navigation, and it was the Captain who insisted that they could collaborate on a book. Their book proposal had already been turned down by one publisher when the Naval Institute Press approached the Captain about reprinting the slide rule book. He suggested that they print a new updated version instead and they agreed.

Ken has visited Captain Shufeldt's Maryland home only four times, but through those visits and their correspondence and telephone calls they have become fast friends. Each continues to be impressed with the abilities and accomplishments of the other. They have an idealized grandfather-grandson kind of relationship that both of them enjoy.

Of the many specialties that benefit from the existence of handheld computing power, the practice of navigation stands paramount. Almost no other discipline is as dependent on complicated trigonometric formulae. Until the advent of handheld calculators, however, most mariners were totally dependent on cumbersome tables of trigonometric and logarithmic functions for evaluating navigational equations. Such difficult-to-use tables made navigating somewhat tedious.

With the advent of the handheld calculator, however, mariners have been able to evaluate the navigational formulae many times more rapidly than they could before. The only drawback has been a lack of sources of equations suitable for calculator evaluation (many texts still "simplify" procedures using logarithms). Now, with *The Calculator Afloat*, nearly all formulae of interest to navigators are optimized for use with calculators. The use of elementary statistical functions for improved measurement accuracy is stressed, and an accurate perpetual almanac for the Sun, and 57 selected navigational stars are included.

This new book provides neophyte calculator users with the information they need to select a suitable calculator for navigation. There is a description of nearly all of the mathematical functions found on calculators, as well as clear instructions showing how to evaluate expressions on any calculator, whether algebraic or RPN.

In addition to presenting useful formulae and discussing calculator operation, this book presents explanations of many navigational techniques and includes numerous historical sidelights.

The Calculator Afloat lists for $16.95* and may be ordered through your local bookseller or from:

Book Order Department
U.S. Naval Institute
Annapolis, MD 21402

Direct orders should include an additional $2.50* for postage and handling.
For orders outside the U.S., send your order to:

Book Promotion Manager
Naval Institute Press
Annapolis, MD 21402 U.S.A.

and you will be billed when the book is shipped. You probably will be charged extra postage.

** All prices are in U.S. dollars. See note at bottom edge of cover. All orders from outside the U.S. should include an International Money Order, a Foreign Draft or the equivalent, or a check, and any of these must be in U.S. dollars, drawn on a U.S. bank.*

Editorial

KEY NOTES SCHEDULE

The year 1980 is rapidly waning as I write this column, and heavily on my mind is an overriding conclusion: there will not be a "Number 4" issue of Volume 4 of HP KEY NOTES. There are many reasons for this but, predominantly, the *real* culprit is inflation. Also, world unrest has caused numerous distribution difficulties, and many times we were forced to reship entire shipments of KEY NOTES to make sure all of you received your copies. All of these problems take large chunks of time, so something had to give, and the schedule was the loser.

But dont't despair! There *is* a solution to the problem. Next year (1981) we will produce KEY NOTES every four months instead of quarterly. Each issue will contain 16 pages; so, in effect, you still will be receiving 48 pages a year, as you have in the past. The first "new" issue will be mailed in February, and the subsequent issues are scheduled for June and September. If dates change, we will inform you in KEY NOTES.

HP-41C BAR CODE

If you own a wand for the HP-41C and use clear plastic sheets to protect bar code that has been photocopied, be aware that some types of plastic cause a reaction when in contact with the black material used in some photocopiers. What happens is, the page "sticks" to the plastic, and the imprint on the paper transfers to the plastic. It is okay to use these clear sheets to read bar code and protect it, but don't store your photocopied sheets in or under such plastics.

While I'm on the subject of Wands, here is an answer to the many questions in your letters: No, the HP-41C wand will not read the bar code on grocery store items.

(Continued)

LETTERS TO KEY NOTES

And, speaking of letters, here is some advice. (Reminds me of the famous American humorist, Will Rogers, who said, "Nobody likes vice, least of all advice!") When you address letters to KEY NOTES, you should refrain from including anything not associated with the newsletter. Questions about the calculator or its operation should be addressed to "Customer Support," and questions about the Users' Library should be sent to the address on the back cover. I cannot answer all the *usual* mail, so you'll get much faster service by writing to the proper service.

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 do guarantee that every letter 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.

PARDON MY ERROR

In the last issue, I stated that the book, *Synthetic Hydrograph Computations on Small Programmable Calculators* was available in "a unique hard-cover (but loose-leaf!) binding." Unfortunately, the copy I had was a review copy and not the published version. The book *actually* sold in an 8.5-by-5.5-inch (21.6 by 14 cm) hard-cover cloth binding. My apology to the author, **Thomas E. Croley II** for that misinformation about his book.

NEW HANDLING CHARGE

Our Order Processing department has advised me that all factory orders will now be charged a fixed $3.50* handling charge. We regret that this is necessary, but there is no way we can continue to handle single, separate orders without a charge. Remember that in the Continental U.S. you can call our toll-free number 800-547-3400 (in Oregon call 758-1010) and ask for your nearest "Full-Line Accessory Dealer." It is quicker to get calculators, accessories, and software from your local HP dealer than to order from here and, besides, you save the handling charge. Also, as the dealers' business increases, these dealers will stock even *more* products and accessories, making them more available to you than ever before.

"EXECUTION" TIMES

It appears that enough of you would like to know more about "execution times" to make it worthwhile to print an article about the subject. This is not as easy as it might seem to be, because there are many, many variables. Also, Hewlett-Packard does not publish a complete specification for execution times because there is no known way to insure where, how, and when the calculator will be used when it leaves our hands. And since we back our products 100 percent, we do not make claims we cannot guarantee. However, in an upcoming issue, probably Volume 5 Number 2 (June 1981), we'll print an article that should help you with the subject of "execution times."

BEST WISHES TO ALL

Once again it is the time of year to thank all of you for your support of KEY NOTES, for your participation, for your patience, and for your nice comments about the newsletter. On behalf of Hewlett-Packard, I wish all of you a happy, safe, and joyous holiday season; a prosperous New Year; and many happy hours of productive programming.

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

"25 Words" (More or Less!)

We know that you read and enjoy this column because it elicits more mail than any other part of KEY NOTES. (*And speaking of mail, don't fail to read the* **Editorial** *column.—Ed.*) Some readers have even requested that we devote the entire newsletter to this type of information. Well, *that's* not practical nor probable, but you *will* find this column greatly expanded in ensuing issues.

Our first contribution is from **Gregory L. Smith** of Phoenix, Arizona. Many people liked the "TEXT" routine in the last issue, and many wrote about it. But Mr. Smith's routine was easily the shortest.

(41C) I found the "TEXT" routine submitted by **Mr. Wuest** (Vol. 4 No. 2) both interesting and useful). However, by applying better use of machine characteristics, by using some slight changes in logic, and by even moving some steps around, I produced a revised version that requires 33 percent fewer bytes of memory and should execute more quickly. The only functional difference between the two versions is that my routine advances the paper one line when exiting the program, a feature I find quite acceptable.

```
01♦LBL "TEXT"     07 " "
02 "TEXT?"        08 ASTO X
03 AON            09 PRBUF
04 PROMPT         10 X≠Y?
05 ACA            11 GTO "TEXT"
06 ASTO Y         12 AOFF
```

From Arizona we next visit the "City of Brotherly Love" (Philadelphia, Pennsylvania) for a contribution from **Thomas Benjamin Miller**.

```
01♦LBL "STKDISP"  10 XEQ 00
02 X<> L          11 "Z="
03 "L="           12 XEQ 00
04 XEQ 00         13 "T="
05 R↑             14♦LBL 00
06 X<> L          15 ARCL X
07 "X="           16 AVIEW
08 XEQ 00         17 PSE
09 "Y="           18 RDN
```

(41C) This routine displays the contents of the stack. In addition, the contents are labeled. Included are the registers L, X, Y, Z, and T.

(Very good, Mr. Miller; however, watch out for that AVIEW at line 16. It causes a halt if flag 21 is set and there is no printer attached to the HP-41C. Maybe it would be best to add CF 21 right after line 01—Ed.)

From Pennsylvania, let's travel to Switzerland to see what a *new reader* of KEY NOTES has to contribute. The city is Bottmingen and the HP-41C owner is **Alfredo Mariani**.

(41C) As a new member of the Users' Program Library Europe I received HP KEY NOTES (March 1980) for the first time and I was very delighted about the presentation of the many useful hints and tricks. So I presume the following routine might be of general interest, too, for it mops up the contents of any number of registers desired; the remaining registers are left untouched for further use. As an additional benefit, the stack registers are cleared at the same time.

```
01♦LBL "MOP"      07 ISG 10
02 .009           08 GTO 01
03 STO 10         09 0
04♦LBL 01         10 STO 10
05 0              11 TONE 9
06 STO IND 10     12 RTN
```

While we're in Europe, let's see what **Manfred Mickoteit** of Koblenz, Germany, is doing with his HP-41C. And we promise that this is the last "SIZE" routine we'll print.

(41C) Many thanks for sending HP KEY NOTES, Vol. 4 No. 1, dated March 1980. The included tips are very helpful for programming. AFter testing them, I found, that the

"SIZE" routine printed on page 7 doesn't work below size 10, and at zero. Here is my modified version of the "SIZE" routine.

```
01↑LBL "SIZE?"    17 CLX
02 .4001          18 RCL IND Y
03 ENTER↑         19 FS? 25
04 SF 25          20 ISG Y
05↑LBL 00         21 FS? 25
06 ISG Y          22 GTO 01
07 CLX            23 RDN
08 RCL IND Y      24 FIX 0
09 FS? 25         25 INT
10 GTO 00         26 "SIZE="
11 CLX            27 ARCL X
12 10.0001        28 AVIEW
13 -              29 FIX 4
14 ENTER↑         30 RDN
15 SF 25          31 RTN
16↑LBL 01
```

(What is this strange fascination with "SIZE" routines? I've received several dozen variations to correct the shortcomings of the routine in Vol. 4 No. 1, and every one of them was different. Herewith, to save much time and space, I declare a moratorium on "SIZE" routines.—Ed.)

As long as we're visiting Germany, why not stop in on **Klaus Werner Hoenow** in Hamburg, and see what he's contributed to "25 Words."

(41C) Tabulating two or more columns of numbers with the printer might be problematic: if the quantity N of digits before the decimal-point varies, the columns won't be right-justified. Using the subprogram ACXR instead of ACX will solve this problem, if the maximum quantity of digits before the decimal point (plus leading blanks) is stored into the Y-register and the number to be printed is stored into the X-register before executing ACXR.

```
01↑LBL "ACXR"     12 INT
02 CF 29          13 X<=0?
03 RCL Y          14 GTO 01
04 2              15 ST- Y
05 -              16↑LBL 01
06 RCL Y          17 RDN
07 RND            18 SKPCHR
08 X=0?           19 RDN
09 GTO 01         20 RND
10 ABS            21 ACX
11 LOG            22 RTN
```

Meanwhile, back in Middleton, Wisconsin, **Dr. Norbert L. Schmitz**, and Engineering Consultant, has a neat hint for HP-41C users. It is:

(41C) As a supplement to HMS and HR routines, the following 29-byte routine converts angles (or time) expressed decimally as DDD.ddd to or from DDD.MMmmm (degrees, minutes, and decimal minutes). For celestial navigation programs using sextant data in degrees, minutes, and tenths, FIX 3 (line 06) is useful. Lines 06, 03, 05, and 07 can be omitted if flag 1 is always cleared before executing the DD (decimal degrees) routine.

```
01↑LBL "DMT"      10 FRC
02 SF 01          11 ST- Y
03 GTO 00         12 .6
04↑LBL "DD"       13 FC?C 01
05 CF 01          14 1/X
06 FIX 3          15 *
07↑LBL 00         16 +
08 FIX 3          17 RTN
09 ENTER↑
```

In Blackburn, Australia, there is at least one HP-41C owner who doesn't need a stopwatch. He is **Graeme Leith**, and here is why he doesn't.

(41C) Have you spent all your money on your new HP-41C and now can't afford a stopwatch? That was my dilemma, so I simply wrote this super-accurate routine for timing on the HP-41C.

```
01↑LBL "S-WATCH"  06 .000055
02 "CURRENT TIME" 07 HMS+
03 PROMPT         08 VIEW X
04 FIX 4          09 GTO 00
05↑LBL 00         10 RTN
```

When using the routine, the response to "CURRENT TIME" is just that. Key in the time in HH.MMSS and press R/S. This is accurate to hundredths of seconds. If the "watch" runs too fast, slightly increase the number in line 06. Do the opposite if it runs too slowly. Because the HP-41C uses a crystal-locked system, all HP-41C's should work identically, thus eliminating the need for fine tuning. (But just in case ...!)

(Your "timer" works, all right, but not all HP-41C's "work identically," Mr. Leith. They do NOT contain a crystal; they use an oscillator, and it will not guarantee "times" or accuracy to hundredths of seconds. You can *fine-tune the routine to be quite accurate but, again, we want everyone to know that, as a timer, the HP-41C will never give the Rolex people—and many others—sleepless nights. Simply put, the HP-41C was designed to be the world's best calculator system, not a stopwatch. That you* can *make it keep fairly accurate time is only "icing on the cake."—Ed.)*

Now for some HP-67/97 routines! And to start off, we have this contribution from **Edwin J. Borrebach** of Monroeville, Pennsylvania, a town just east of Pittsburgh.

(67/97) I just got around to reading Vol. 3 No. 2, page 6, and saw **David L. Smith's** routine of 18 lines to check long division and show the remainder. How about these 11 lines, to be run in DSP 0?

```
001  *LBLA      007   R↓
002    ÷        008  LSTX
003  LSTX       009   FRC
004   X≷Y       010    ×
005   INT       011   R/S
006   PSE
```

When a letter starts, "I enjoy KEY NOTES very much, especially the "25 Words" column," how can we refuse to read it? We can't. We didn't. Here is a contribution from that letter-writer, **Karl-Ludwig Butte** of Fulda, West Germany.

(67/97) There is a very useful instruction in BASIC, the ON X GOTO ...—instruction; for example, ON X GOTO 110, 120, 130. If X = 1, the program continues with statement 110. If X = 2, it continues with statement 120 and so on. To simulate this on the HP-67/97, use the subroutine shown below. Be sure, however, that the I-register contains 0 at any start of the subroutine. The subroutine compares the value in the X-register with the contents of the I-register. The program then branches to that label that is equal to the value in the X-register. This value should be between 0 and 19 to address the possible labels.

It is also possible to exchange the ISZ I instruction in line 002 with DSZ I to use the back-step function of GTO(i) if there is a negative value in the I-register. In that case, the X-register also has to contain a negative value.

```
001  *LBLA      005   GTOi
002   ISZI      006    R↓
003   RCLI      007   GTOA
004   X=Y?      008    RTN
                009    R/S
```

(One more thing: if X≤ I when the routine is called, the program will never stop running.)

From Howell, Michigan comes this neat input from our old friend, **Douglas K. Parrish**. It seems he's becoming "chained" to his calculator!

(67/97) I have a contribution to "25 Words." Whether it's ever been done, I don't know. But here it is. The handbook (pages 68, 69) is somewhat vague about constant arithmetic and its application to subtraction and division. Addition and multiplication present no problems, but the other two processes do. Consider them solved! Try these:

Subtraction

1. k (Press constant, k, to be chain-subtracted.)
2. CHS
3. ↑, ↑, ↑ (Press ENTER three times.)
4. n_i (Press base number from which k is to be subtracted.)
5. +, +, ... (Press + the desired number of times.)

Division

1. k (Press constant, k, to be chain-divided.)
2. 1/x (Press reciprocal.)

(Continued)

3. ↑, ↑, ↑ (Press ENTER three times.)
4. n_i (Press base number into which k is being divided.)
5. ×, ×, ... (Press × the desired number of times.)

In Voerde, West Germany, **Christian Franke** had had his HP-41C only three weeks when he was prompted to send *two* good ideas to KEY NOTES.

(41C) If you make "normal" keyboard calculations with large numbers in SCI or ENG 9 mode, you cannot see the last two digits of the mantissa, which are "hidden" behind the exponent. So, you might want to have a "VIEW MANT" function. Here is a short one, using only the ALPHA register.

```
01 LBL "MANT"     04 PROMPT
02 CLA            05 END
03 ARCL X
```

Assign it, for example, to "shifted" ENTER (= CATALOG) like it is on the HP-34C, and you get a convenient way to see the entire number without losing any register (except ALPHA).

(41C) Some of you familiar with the HP-67/97 might regret that it is impossible to record the status together with the program on a magnetic card. In fact, *it is possible*! If a program, for example, needs a cleared flag 0, FIX 2, and RAD mode, key it in as follows:

```
01 CF0      05 LBL "PROGRAM"
            (beginning of program)
02 FIX 2    :
03 RAD      :
04 RTN      END
```

The routines furnished in **"25 Words"** are contributed by people from all walks of life and with various levels of mathematical and programming skills. While these routines might not always be the ultimate in programming, they *do* present new ideas and solutions that others have found for their applications. You might have to modify them to fit *your* personal application.

(Continued from page 1)

college students is even smaller," Dr. Newton explains. "As such, it is not commercially possible to develop the specialized hardware which would be so helpful to them.

"If we were to have asked a commercial firm to develop the program used by the calculator, it would have cost some $30,000, and that becomes prohibitive for most individuals or even institutions," he said.

An example of what has been done is the talking calculator, but that does not have the flexibility which the HP-41C possesses in the area of mathematics.

Now that Dr. Newton has developed his programs, he has met with the American Association for the Blind to determine if the instrument could have broader usage. Dr. Newton and Thiel also have attracted the interest of the Lions club, which promotes vision conservation.

Just Before We Went to Press ...

... we decided to hold the newsletter a short time so that we could tell you about this announcement of new products and significant price reductions. The new products were introduced on January 7 at the Consumer Electronics Show at Los Vegas, Nevada, and the price reductions became effective January 1, 1981.

NEW PRODUCTS

Heading the list is the **HP-41CV Alphanumeric Full-Performance Programmable With Maximum Continuous Memory,** and it is priced at $325.* That's a long name ... but so is its capacity! Built into it is five times the memory of a standard HP-41C; the equivalent of the HP-41C and four HP 82106A Memory Modules! Specifically, the HP-41CV contains 319 storage registers versus 63 in the HP-41C. And *all* of the memory is *Continuous,* which is a definite advantage for advanced programmers who want to store a lot of programs. Plus, with all this built-in memory, you now have all four ports free to use for peripherals. And, before you ask, no, you cannot add more Memory Modules, because the HP-41CV is already at full capacity.

Next on this list is the new **HP 82170A Quad Memory Module** for the HP-41C, which is priced at $95.* This one Memory Module is the equivalent of four HP 82106A Memory Modules. When installed in a standard HP-41C, it makes the HP-41C the equivalent of an HP-41CV, and allows three ports to be used for peripherals. You cannot, however, use single-density modules if the Quad Memory Module is used. But you *can* use standard single-density modules if the Quad Memory Module is removed from an HP-41C.

Finally, there are two new systems. The **HP-41 System I** is an HP-41CV and Card Reader combination for $495,* and the **HP-41 System II** is an HP-41CV and Card Reader and Printer combination for $840.*

You can examine these new products in more detail at your nearest HP dealer, who will be glad to answer any questions you might have.

LOWER PRICES

Three calculators have been reduced in price. They are:

- HP-32E Scientific With Statistics, from $70 to $55.*
- HP-33C Programmable Scientific With Continuous Memory, from $110 to $90.*
- HP-41C Alphanumeric Full-Performance Programmable With Continuous Memory, from $295 to $250.*

Also reduced in price were the HP-41C Application Pacs. All pacs formerly $45 are now $30,* and all pacs formerly $75 are now $45.*

The last reduction is for the HP 82120A Rechargeable Battery Pack. Its price was reduced from $40 to $30.*

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

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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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