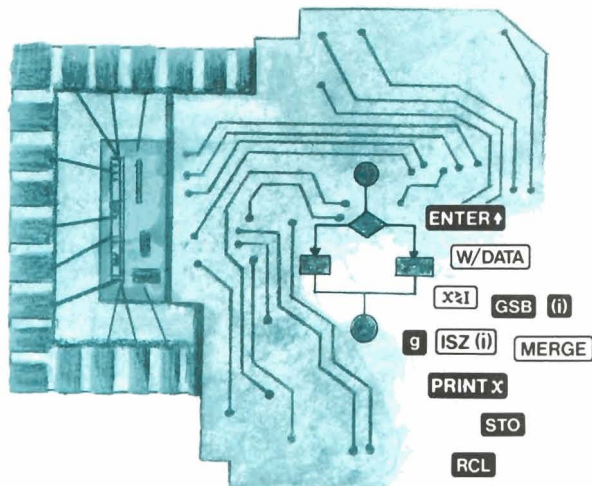


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May-August 1981 Vol. 5 No. 2



HP Key Notes



In Five Years . . .

It is almost exactly 5 years since this division of Hewlett-Packard moved to Corvallis. On the cover of HP KEY NOTES Volume 1 Number 1, we printed a photograph of our first building. At that time, there also was another building being started.

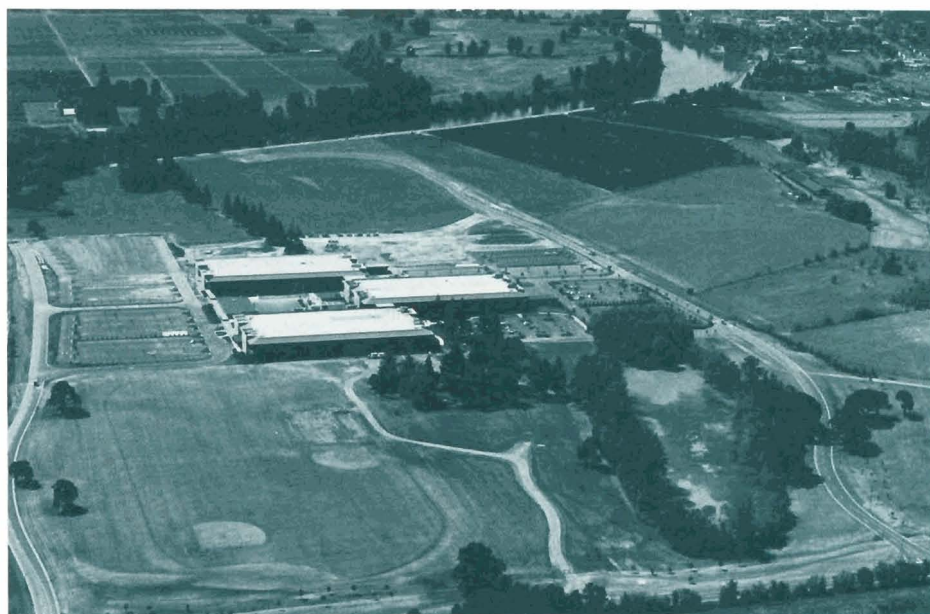
On the cover of Volume 3 Number 2 (May 1979), we printed an aerial photograph of the 140-acre Corvallis Division site. At that time, there were two completed buildings with a total of 416,000 square feet of floor space.

Since then, the HP-41 calculator system was introduced, and the highly successful new Series 80 Personal Computers were developed and introduced. So we started a third building, and it is due for completion approximately by year's end. Also, because most present conference rooms have been absorbed by the search for floor space, we have started a one-story cafeteria-conference building. And the fourth building is in the planning stage.

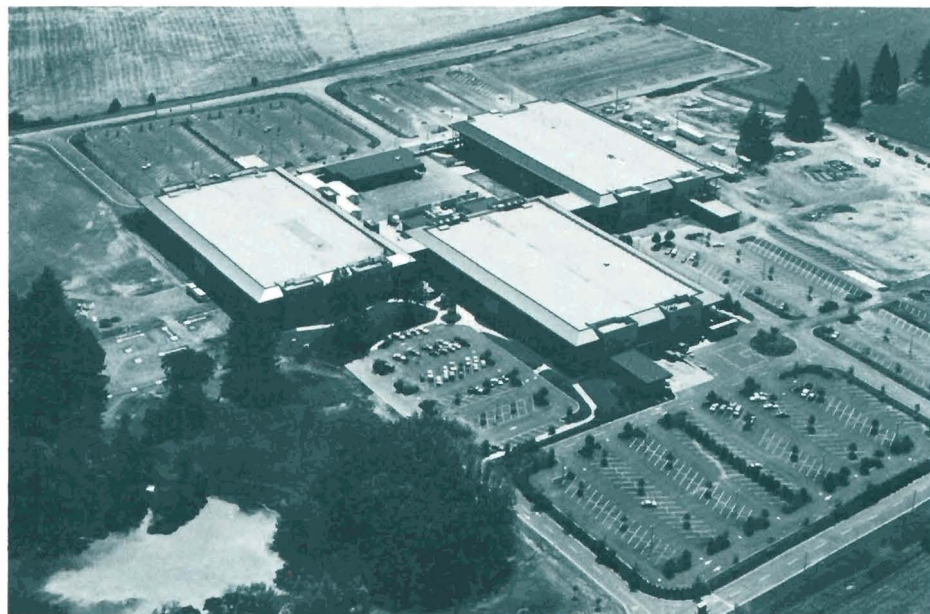
It is amazing how much floor space is required to make small, complex instruments like calculators and personal computers. But our customers thoroughly like our products and purchase them in ever-increasing numbers. Thus, to satisfy our clientele, we must expand.

In the close-up photograph, between the lake and the building on the left, you can see the preliminary foundation work for the new cafeteria-conference building.

The Corvallis site is just north of downtown Corvallis, which can be seen at the top right corner of the upper photo. The river in the background is the Willamette, and it borders the east side of the site. We are about 81 miles (130 km) south of Portland and 40 miles (64 km) north of Eugene, and it is about 53 miles (85 km) to the Pacific Ocean. Corvallis is at latitude 44°34' north and longitude 123°17' west.



Hewlett-Packard's Corvallis site. That's a 5-acre natural lake at lower right, and at left rear is the newest building.



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."

SUBMITTING PROGRAMS

To maintain the high quality of the programs submitted to and accepted into the Users' Library, we encourage you to closely follow the *Users' Library Contributors Guide for the HP-41, HP-67 and HP-97*. Complete and orderly documentation is essential to ensure the acceptance of a contributed program to the Library.

In the last issue of KEY NOTES (Volume 5 Number 1) we promised to publish some new guidelines for submitting programs. Well, we have done better than that; we have created a new column called "In the Key of HP." This ongoing column will address the things that we look for when we are determining the acceptability of a program that has been submitted to the Users' Library. Also in this column, we will present some extremely useful ideas and techniques that we have developed here at HP, and we will answer some of the more common questions that we encounter nearly every day.

Up to now, every program submitted to the Library had to include a magnetic card (or cards). We have a good reason for this; without a card or cards, it would take far too long to review and check all the many program submittals. Also, there is always an increased chance for errors when someone keys in handwritten keystrokes.

Since the advent of the HP 82153A Digital Wand for the HP-41, we can now accept HP-41 program submittals that have bar code instead of magnetic cards. However, the bar code you submit with a program must be reproducible.

The management of the Users' Library reserves the right to reject programs which, in its opinion, do not represent a significant contribution, are not clearly or sufficiently documented, or are not otherwise appropriate for the Library.

LIBRARY SUBSCRIPTIONS

In the United States and Canada, the fee for a one-year subscription to the Users' Library is \$20.* If you live outside the U.S. and Canada, the fee is \$30* because of considerably higher postage and handling charges. Upon becoming a member of the Users' Library, you will be placed on the mailing list to receive the *Catalog of Contributed Programs* and all of the updates. Plus, you will presently receive four coupons for free programs, each program valued at \$6.* It doesn't take an HP-41 to realize that this is a good deal! And, as an added incentive, a free one-year subscription to HP KEY NOTES is included in your initial membership to the Users' Library, no matter where you live in the world.

Also, it will please you to know that once you are a member of the Users' Library,

your succeeding renewal subscriptions in the U.S. and Canada are only \$10,* and outside the U.S. and Canada they are only \$15.*

IF YOU WERE A MEMBER ...

You would be receiving a tremendous bargain from now until December 31, 1981. During that time, the Corvallis Users' Library is offering—**FOR MEMBERS ONLY**—a 25-percent discount on all orders for six or more programs. You would also get 48-hour turnaround time on orders received by mail or by our toll-free telephone number. And you would get same-day service on orders telephoned *directly* to the Library. Plus, with the next *Catalog Addendum*, you would get—**FREE**—complete documentation with bar code for the HP-41 game program, "Reversi."

And there are many more benefits of Library membership, whether in Corvallis or Geneva. You should reconsider this opportunity if you have turned it down in the past. The Corvallis Library, for example, now has the equipment, facilities and a larger staff to handle all your varying needs. Plus, in the near future, the Library will offer even *more* services.

Think about it again. For the price of membership, you presently get four free programs of your choice. That, alone, is worth more than the membership fee. And in the future, we will be making more special offers *for members only*. But the greatest advantage of Library membership is being able to choose from a very large collection of software that is all ready to serve you in *your* application. The savings in time and effort are worth much more than the small membership charge.

ORDERING PROGRAMS

HP-67/97 and HP-41 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). Also, for HP-41 programs, this price includes bar code. 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, South America, or Asia, a plain piece of paper with your name and address and the program numbers you

*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 fee for special handling and air mail postage. (For example, an order for two programs = $\$6 \times \$2 = \$12 + \$1.20 = \$13.20$ total.) If you live in Europe, you should order KEY NOTES programs directly from the Geneva UPLE, but make certain you make payment as required by Users' Program Library Europe; the above \$6 fee is good only for orders to the Corvallis Library.

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 or Geneva 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 from Alaska and Hawaii (in Oregon call 503-758-1010).

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. *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.

Usually, orders *not* delayed by the above problems will be shipped within 48 hours after they are received in Corvallis.

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."** And, remember that where additional Memory Modules are listed as necessary to run a program on the HP-41, you do not need them if you are using a Quad-RAM or the HP-41CV.

(67/97) Lunar Day Converter (#04536D)

Using the Lunar day and the hour of the moon this program calculates lunar brightness and stellar magnitude for use with the program *Astrophotography Exposure Guide* (following). It will also convert lunar brightness to stellar magnitude. When the field of view of the telecamera system is less than the diameter of the moon, this program will convert brightness and magnitude to reflect the area covered by the field of view. (211 lines, 8 pages)

(67/97) Astrophotography Exposure Guide (#04551D)

Using this program, and knowing the stellar magnitude, telecamera *f* number, film ASA, elevation angle, and filter factor, one can determine approximate exposure times, along with times corrected for reciprocity. Individual changes can be made to any of the inputted datums for easy comparisons and changes in exposure times. By bracketing exposure times to compensate for atmospheric conditions, the astronomer can quickly determine exposure times that will ensure a good picture. This

program corrects for black and white film reciprocity from 0.5 to 400 seconds, given the corrected exposure times up to 1-1/2 hours. (224 lines, 13 pages)

(41) Lunar Day Converter/Astrophotography Exposure Guide (#00771C)

This program combines the two preceding (67/97) programs. It automatically prompts for data and it works with the printer. *Required accessories: Three Memory Modules.* (250 lines, 839 bytes, 18 pages)

The author of the preceding three programs is **James P. Patterson** of Cambridge Bay, N.W.T. Canada

(67/97) Shape Factors Calculations (I) (#04553D)

This program finds, by direct evaluation of the formula, the shape factor for the following systems: (a) Two plane rectangular surfaces perpendicular to each other and having one common edge; (b) Two equal parallel rectangular surfaces in opposite location; (c) Two plane circular surfaces with common central normal. Inaccurate reading of graphs is avoided by using this program. (117 lines, 8 pages) *(This program will be of interest to solar engineers—Ed.)*

Author: **Jorge A. Pita**
Quito, Ecuador

(67/97) Combined Footing Analysis (#04514D)

This program analyzes a combined footing, such as that used in an A-frame foundation, giving the factor of safety against overturning, soil pressure distribution under the footing, and maximum moment in the footing slab between the piers. (695 lines, 26 pages)

Author: **Joseph S. Lucca**
Elmhurst, Illinois

(41) Plot of Two or Three Functions on One Graph (#00732C)

This program extends the capability of plotting on the HP 82143A printer, thus enabling up to three functions of x to be plotted on one graph. The program works in a way similar to the PRPLOT function of the printer prompting for function name and limits of x and y axes. *Required accessories: HP 82143A Printer, one Memory Module.* (183 lines, 350 bytes, 6 pages)

Author: **John L. Gilby**
Jagersrust, South Africa

(41) Means (Statistics) (#00844C)

This program solves for the arithmetic mean, geometric mean, harmonic mean, root mean square, standard deviation, mean deviation, coefficient of variation, and Z-statistic. All outputs are clearly labeled by use of the HP-41 alphanumeric capabilities. *Required accessories: One Memory Module.* (209 lines, 448 bytes, 9 pages)

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

(41) Sieve Analysis and Soil Moisture Content (#00674C)

This program can be used to determine the cumulative percent retained, percent finer, and sample loss, given the total sample weight and the weight retained on each screen. It also can be used to determine the weight of water, the weight of dry soil, and the percent moisture, given the wet and dry sample weights and the dish weight. *Required accessories: None.* (120 lines, 283 bytes, 7 pages)

Author: **Mike E. Brazie**
Golden, California

(41) Interpolation and Numerical Integration by Akima's Local Process (#00679C)

This program applies Akima's process to finding a set of local interpolating polynomials that best fit the curve that would be drawn through a set of arbitrarily spaced points by eye, and it also integrates the result. Akima's process introduces no false extremes or inflections. *Required accessories: None.* (161 lines, 273 bytes, 7 pages)

Author: **J. F. G. Darby**
Parkville, Australia

(41) Data Input (Store) and Review (#00693C)

Numeric and/or alphanumeric data may be stored in a user-specified series of data registers. Error correction is available for the most recent datum input. Register numbers are provided in a PROMPT message. Any or all data registers may be reviewed without a printer. The review will display the register number and its contents. The user specifies the data display format. Also included is a routine that performs the same function but saves 9 registers by eliminating some of the prompts. *Required accessories: None.* (70 lines, 154 bytes, 6 pages)

Author: **Barbara G. Lawrence**
Balboa, Republic of Panama

(41) Time Sharing (#00690C)

Up to four people can use the calculator without interfering with each other's calculations. Businessmen in conference or students doing homework together will find this program useful. The stack and storage registers 1, 2, and 3 are available for each user. All that is needed when changing hands is for each new user to press their user key—A, B, C, or D. Otherwise, the calculator functions as normal. *Required accessories: one Memory Module (only required if statistics registers are used).* (130 lines, 204 bytes, 9 pages)

Author: **Neil M. Hunter-Blair**
Bangkok, Thailand

THE CAVES

Do you sometimes feel as though the walls are closing in around you? Do you ever crave a life full of intrigue and adventure? Well, this HP-41 program will not solve your problem with the walls, but it will take you on an imaginary adventure full of excitement and intrigue.

"The Caves" is a recently submitted program that is the dedicated work of **James R. Surber** of Omaha, Nebraska. And, at \$6* it is a real bargain from your Users' Library—especially if you enjoy games programming. For that paltry sum you get 30 pages of excellent documentation plus some pages of bar code. The program consists of 8 magnetic cards, 578 lines, and 1704 bytes.

Included in this bargain are illustrations and an example called "The Story of the Caves." The story begins: "Once upon a time there was a wizard who set out to make his name in the wonderful world of wizardry and thus earn a fabulous fortune. The titillating trail that awaited him was the awesome task of travelling through the world of "The Caves." And if that, alone, doesn't capture your interest, read through the following abstract.

(41) The Caves (#00900C)

"The Caves" is an adventure game in which the player moves about in a series of 67 interconnected caves to pick up nine items to total 1200 points without being "killed" by the various hazards. If you like games, mazes, and puzzles with magic, you will love "The Caves."

This is a full-memory-capacity program but, because of the size, it may be totally entered by the card reader or the Wand, even if your system has individual memory modules. (The fourth module must be in place to start the game.) The printer is optional and uses flag 13 in the program. This causes the warnings and wizard's words to be in lowercase print. "Auto off" is used if death occurs.

The game is simple to operate in that the display or the overlay gives you any necessary information. The board is easily imaged in the mind, or a list of 1 to 67 caves on paper is all that is needed to help remember hazardous caves.

The game has chance, skill, and goal orientation in it to keep the player interested and active. Hazards and valuables are interconnected to the equipment present, and it takes skill to move through the caves. Loss of equipment, non-warned hazards, and random selection of caves without warning play the role of chance in "The Caves." Goal orientation is just getting through alive and scoring.

Some ideas and parts of the program were taken from the *Games Solution Book* by Hewlett-Packard. I would also like to thank **Scott Sowders** for his help in the game "The Caves." *Required accessories: Four Memory Modules (or Quad RAM, or HP-41CV).*

* U.S. dollars. See note at bottom edge of front cover. Also, overseas orders for this program must include a 10-percent postage charge. See "Ordering Programs" on page 2.

HP Computer Museum

www.hpmuseum.net

For research and education purposes only.

Do You Really Know Your HP-67/97?

When KEY NOTES contained only 12 pages, it was difficult to find the necessary space to print all the longer articles we received. Now, however, it is easier to plan for such articles, and we are happy to present this one for all our HP-67/97 owners. And, although written some time ago, it is still good information.

This test is the contribution of William M. Kolb of Marlboro, Maryland. It was printed before in the *PPC Calculator Journal*, the newsletter for the PCC Club.* Longtime readers of KEY NOTES will remember Mr. Kolb from his contributions in V2N4p10 and V1N3p4 (both out of print and no longer available).

Mr. Kolb developed this self-assessment test to help the members of his local Chapter of PPC determine if they were taking full advantage of their PPC's (personal programmable calculators). There is no scoring criteria. The purpose of the test is to teach you something about your own abilities and not those of others. The suggested answers involving programs, however, are worth studying for additional programming insight. These particular solutions were not selected for their brevity, but because they illustrate straightforward approaches using certain features of the calculator. And, although the questions are for the HP-67, nearly all of them apply to the HP-97.

HP-67 SELF ASSESSMENT TEST

Are you getting the most out of your PPC? The following self-test will help you find those areas where additional study can improve your programming ability. Allow yourself about 2 hours to finish. Do not use your calculator to check the answers until you are finished. Answers are on page 8.

1. NOP is a "dummy" instruction used as a filler step on some calculators. The HP-67 does not have a NOP key. Give an example of an HP-67 program that requires a NOP.
2. There are two ways to double a number in the X-register: (a) $\boxed{2}$, $\boxed{\times}$ and (b) $\boxed{\text{ENTER}}$, $\boxed{+}$. Other than speed, what is the principal difference?
3. If the I-register contains 15.00, what is the result of the instruction GTO (i)?
4. What are the contents of the stack registers after the following keystrokes: CLX, ENTER, 1, CHS, ENTER, CHS, 2, CHS, 3?
5. After single-stepping through the following program in RUN mode, will flag 3 be set or clear? LBLA, CF3, 0, F3?, \div , RTN. Is there any difference between single-stepping or running this program?
6. What is the value of LSTx after executing the following: π , D \leftarrow , CHS, 1, STO+0, CLX?
7. Under what flag conditions will the following program branch to LBL 0: F0?, F3?, F3?, GTO 0, R/S?
8. What stack register prints first after the command to print stack?
9. Write a four-step program to rearrange the stack from XYZT to YZXT.
10. Assume that the stack is arranged as follows: X=1, Y=2, Z=3, T=4. What does the stack contain after the following keystrokes: +, $\boxed{X \geq Y}$, STO+0, ENTER, LSTx?
11. The function $X < Y$ does not appear on the HP-67; write a program to test for $X < Y$.
12. Where will program execution stop when A is executed from the keyboard?

001 LBL A	011 LBL 1	021 LBL 2	031 LBL 3	041 LBL 2
002 GSB 1	012 GSB 2	022 GSB 3	032 GSB 2	042 RCL 1
003 RTN	013 RTN	023 RTN	033 RTN	043 RTN

13. If step 042 in the previous question is changed to GSB 2, where will execution stop?

14. List ten different conditions that will cause the display to show an error message.
15. Write a program that returns the integer remainder when an integer in the Y-register is divided by an integer in the X-register.
16. Does the program from the previous question consider round-off errors; i.e., the remainder when four is divided by three is one and not 0.999999999. Will the program work for DSP 0 through DSP 9 in both SCI and FIX modes? Will the program work properly for negative values of X and Y?
17. What is the result of the following instruction sequence: 90.9090, H \leftarrow , H.MS \leftarrow ?
18. What is in the X-register after the following keystrokes: 30, ENTER, 20, +, 10, %, LSTx, +?
 - (a) 5.10
 - (b) 15.00
 - (c) 25.00
 - (d) Insufficient data
19. Write a program in 15 steps or less that loads register 0 through 25 with the numbers 0, -1, -2, -3, ..., -25.
20. You must load the first 8 registers with data from a magnetic card. With the exception of the I-register, no other registers are to be altered. Which keystroke sequence is correct?
 - (a) 8, $\boxed{X \geq I}$, W/DATA
 - (b) 8, STO I, MERGE
 - (c) 7, $\boxed{X \geq I}$, MERGE
 - (d) 7, STO I, W/DATA
21. If side two of the magnetic card is accidentally read before side one in the previous question, what are the contents of the first 8 registers? Assume that the magnetic card contains data identical to that generated in problem 19.
22. Write a program that computes the sum of the terms $2^n/n!$ from $n=1$ to $n=100$. Note that $n!$ is equivalent to $1 \times 2 \times 3 \times 4 \times \dots \times n$.
23. You must merge a program called SORT with the program currently in memory. SORT is to begin at step 200 of the current program. Which is the current keystroke sequence?
 - (a) 200, STO I, MERGE
 - (b) 199, STO I, MERGE
 - (c) GTO, 200, MERGE
 - (d) GTO, 199, MERGE
24. How many program steps will be loaded from SORT in the previous problem if SORT contains 115 steps?
25. Describe three ways flag 3 can be set. Is there another?

* (Founded in June 1974, PPC is the world's first and largest organization dedicated to Personal Programmable Calculators. The Club is a volunteer, non-profit, loosely organized, independent, worldwide group of Hewlett-Packard personal programmable calculator users. PPC Calculator Journal is a monthly publication published by PPC to disseminate user information related to applications, programs, hardware innovations, programming techniques, problems—any information related to the selection, care, use, and application of Hewlett-Packard personal programmable calculators. PPC is not sponsored, nor in any way officially sanctioned, by Hewlett-Packard.—Ed.)

For more information about PPC and a sample issue of the Club's newsletter, send a self-addressed, large (folded) envelope (9 × 12 inches; 23.8 × 30.5 cm) with first-class postage for 2 ounces (56.7 grams) to: PPC Calculator Journal; 2545 W. Camden Place; Santa Ana, California 92704 U.S.A. If you live outside the U.S., make sure you include a legible address label and international postal coupons for 56.7 grams (2 ounces). A letter is not necessary and will only slow the response.

HP-41 "Bush Computer"

No matter where you roam on planet Earth (and sometimes even in outer space!), you will find our ubiquitous HP-41 being confronted with all sorts of challenges ... challenges that it very swiftly turns into opportunities to save much time, material, and money. And in the spirit of the foregoing statement, you will find the HP-41 turning into a "bush computer" for Australia's Division of Forest Research, a part of their Commonwealth Scientific and Industrial Research Organization (CSIRO).

Just before we put the last issue "to bed," we received a letter and a photograph from **Dr. Wilfred J.B. Crane**, a Senior Research Scientist for CSIRO Forest Research. Dr. Crane also sent a press release that we think will be of interest to the many foresters who own HP programmable calculators. Here it is.

COMPUTER GOES BUSH

A computer carried on a belt could soon be saving Australian foresters, biologists, ecologists, fire fighters, and field researchers hours of calculation time, according to Dr. Wilfred Crane, CSIRO Forest Research.



Using the HP-41 "in the bush." We are not sure if that is **Dr. Crane** in the photo, but we presume it is.

Most foresters still use complex tables and slide rules to calculate such things as fire danger, tree girth, volume, growth rates, royalty and stumpage charges, fertilizer and spraying rates, thinning and cutting schedules, and pay.

"But computer technology now makes it possible to carry a hand-sized computer into the bush on one's belt, programmed and personalized to any requirement and taking only seconds to come up with answers," Dr. Crane said.

"Whether you call these things computers or calculators is a moot point, but I call them computers because they have all the facilities of a computer including a memory exceeding 2K, or two thousand bytes (bits of information); he said.

The computers are simple to operate and can be used by anyone who can read. Programming does not require special knowledge of any computer 'languages' and the instruments can be individually 'set' for a person or tasks. And the basic cost puts these 'bush computers' within reach of many foresters.

Dr. Crane believes bush computers will have many uses for foresters. "For assessing, research, log tallying, or any data collection, the machine can become a field book. Data can be entered, edited in the field, and then read out on cards if the data exceeds the capacity of the memory," he said.

Dr. Crane predicts that bush computers will be used for a wide range of purposes in the field: identifying plants, soils, and animals; measuring stream flows and estimating fire dangers; measuring trees and forests; locating roads; surveying; and even remembering radio call frequencies.

Dr. Crane uses a Hewlett-Packard HP-41CV and has written a number of programs for his work with CSIRO Forest Research. He has already had an enthusiastic response to them from colleagues working in State forest services, and hopes that more will contact him for exchange of information and ideas.

Thank you, Dr. Crane, for this contribution to KEY NOTES. We have many foresters here in the U.S. who are active programmers for their HP-65/67/97/41 calculators. Perhaps we can soon count on having your programs in the Users' Library.

Library Contest Announced

The Corvallis Users' Library is celebrating its increase in staff, facilities, and better service by announcing a **Program Submittal Contest**. Over the years, many of you have asked for or suggested such a contest, and we have finally reached the point where we can make you an offer you simply can't refuse.

Contribute your best HP-67/97/41 program(s) to the Corvallis Users' Library before December 31, 1981, and you will become eligible to win some exceptional Hewlett-Packard products. Each month, for four months from September through December, three programs will be chosen on merit by a review committee. Prizes will be awarded as follows:

September 30, 1981—3 WINNERS!
October 30, 1981—3 WINNERS!
December 31, 1981—3 WINNERS!

and each of these 12 winners will choose either an **HP-41CV Calculator** or an **HP 82143A Printer**.

On January 15, 1982, we will choose three winners for the **Grand Prizes**, and those three Grand Prizes certainly will be grand! Each of these three lucky contest winners will receive an **HP-85 Personal Computer!**

We know you will agree that this contest is worth entering. All the prizes will be awarded, and all winners will be notified by mail and announced in a future issue of **KEY NOTES**.

You do not need to be a Library member, and you may enter as often as you wish, but there are some rules you must follow or your submittal will not be accepted. The rules are:

- All programs must include at least the minimum documentation required by Hewlett-Packard standard Library submittal forms (and outlined in the *Contributor's Guide*). Forms from the Geneva Library will be accepted.
- All programs must be accompanied by either magnetic cards or bar code, and the bar code must be reproducible.
- All submitted programs must be in English.

Programs will be judged by the Corvallis Users' Library. They will be judged on:

1. Completeness of documentation.
2. Technical programming accuracy.
3. Usefulness (utility/technical capability).
4. Ease of use.

The decisions of the judges will be final. As programs are chosen as winners, we'll highlight them in **KEY NOTES**.

Here is your chance to put your calculator and your expertise to work. You have to admit that the prizes are enticing.

For submittal forms or for more information, contact the Corvallis HP-67/97/41 Users' Library at the address on the back cover. Or call them on (503) 757-2000, but remember that this is not a toll-free number.

More Software = More Solutions

There is no such thing as *too much* software. The more the better!

Recognizing this, Hewlett-Packard is implementing a program to encourage the development of software by qualified suppliers. The goal is to have an increasing flow of software from which you, the end user, can choose solutions to your problems.

Actually, similar programs have been successfully operating in Hewlett-Packard for some time, including one on the Series 80 Personal Computer line from Corvallis.

The software will be developed and must be supported by the supplier. If accepted under the program, Hewlett-Packard will help merchandise the software and make available its dealer network to do the actual selling.

One concern, of course, is quality. Even though the software products are not HP

(Continued)

supported, Hewlett-Packard wants their customers to get what they pay for. It is expected that "HP PLUS" will meet this requirement. This acronym stands for: Program for Locating User-proven Software. It is a common theme for all such programs in Hewlett-Packard. What it means is that software must be sold to and used by several customers before being accepted into the HP Software Supplier Program.

More software for more applications will be coming. But right now, HP is interested in contacting potential suppliers. Interested parties should write:

HEWLETT-PACKARD
1000 NE Circle Blvd.
Corvallis, OR 97330
Attn: Dept. 5341

Software Additions and Corrections

Here's a contribution from **John S. Chipman** of Minneapolis, Minnesota. Those of you with the *High-Level Math Users' Library Solutions* book for the HP-41 might want to add it to your book. Those of you who don't have this solutions book will find the routine useful.

The gamma-function routine listed in the *High-Level Math* book for the HP-41 is based on approximations and is valid only for $x \geq 1$. In many applications, one needs to compute $\gamma(x)$ only for x equal to a positive integral multiple of 0.5 (including $x=0.5$). Readers of KEY NOTES might be interested in the following little routine that gives exact results for $x=.5, 1, 1.5, \dots, 70.5$ and uses 69 bytes.

01*LBL "FRGAMMA"	22 X=Y?
02 ENTER↑	23 GTO 04
03 ENTER↑	24 ST* 00
04 *ILLEGAL X*	25 1
05 X<=0?	26 +
06 GTO 01	27 GTO 03
07 INT	28*LBL 04
08 X=Y?	29 PI
09 GTO 02	30 SQRT
10 RDN	31 RCL 00
11 2	32 *
12 *	33 RTN
13 ENTER↑	34*LBL 01
14 INT	35 RVIEW
15 X*Y?	36 STOP
16 GTO 01	37*LBL 02
17 1	38 1
18 STO 00	39 -
19 R↑	40 FACT
20 .5	41 END
21*LBL 03	

The many applications of the HP-41's MOD function have yet to be realized. One application of MOD is helpful in converting a negative angle, or an angle greater than 360°, to its corresponding positive angle in the range from 0° to 360°. For example:

KEY STROKES	DISP
165 <u>CHS</u> <u>ENTER</u>	-165.00
360 <u>XEQ</u> <u>ALPHA</u> <u>MOD</u> <u>ALPHA</u>	195.00

Bob Flye of Longview, Washington, pointed out that this application of the MOD function shortens some of the programs in the *Surveying Users' Library Solutions* book. In the program "TRVAA" on page 69, lines 64 through 72 can be replaced by 360, MOD. In the program "AACMP" on page 72, lines 83 through 87 can be replaced with 360, MOD. And, in the program "AACDL" on page 73, lines 130 through 134 can be replaced with 360, MOD.

HP-41 AVIATION PAC

An addendum card is now being included with the *HP-41 Aviation Pac* to print out the following three conditions. If you did not get such a card with your Pac, add this information to your book.

1. In the FLIGHT PLAN program, adequate flight parameters must be allowed for mid-flight descents. If the leg length specified is shorter than that needed to complete the descent, subsequent calculations will be incorrect. (This condition can be detected by an increasing, instead of the expected decreasing, altitude.) This warning does not apply to the final descent.
2. When using the FLIGHT PLAN program, a single-leg flight must be divided into a two-leg flight to calculate the descent heading correctly.
3. Before using the FLIGHT MANAGEMENT program, flag 21 must be cleared, unless you are using a printer.

HP-41 SECURITIES PAC

If the following addenda do not appear in your copy of the *HP-41 Securities Pac*, add the information to your book.

1. In the BONDS program, the price and yield of a 360-day bond held for exactly 6 months is incorrect. The correct price may be determined by adding the calculated price and accrued interest (X and Y registers respectively). The yield cannot be determined by keystrokes alone.
2. The calculated high and low break-even points in OPTION are incorrectly labeled; the high break-even is first, and then the low break-even.

In the Key of HP

Most of the ideas presented in KEY NOTES are contributed by you, and they demonstrate the ways in which you approach solutions to programming problems. This new column will address some of the common inconsistencies that the Users' Library frequently finds in user-submitted programs. Also in this column, we will answer some of the common questions that you ask, and we will present some ideas that we think you will find useful.

In this first column, **John Laux**, a Technical Adviser in the Users' Library, discusses labels, because labels used in HP-41 programs submitted to the Users' Library are often a source of confusion. This article outlines the proper way to use labels when submitting a program to the Users' Library.

WHAT'S IN A LABEL

A label is a marker that is used to designate a useful section of a program. To access or reuse the labeled section, all you need to do is key in GTO "label" or XEQ "label" and the HP-41 will search for—and perhaps execute—that section. In many of the previous scientific programmable calculators, it was necessary to keep track of the line number associated with every entry point or subroutine in a program so that they could be used for future access. But, unfortunately, the line numbers changed whenever a line was deleted or inserted. Now, labels eliminate the inconvenience of keeping track of line numbers. Labels in the HP-41 also help the programmer by visually defining the boundaries of pertinent routines. For example, when the HP 82143A Printer prints a program in NORM or TRACE mode it prints it in blocks, and each block is a labeled routine.

The HP-41 has two major types of labels: global labels and local labels. Global labels exist to make *inter-program* jumping (jumping past an END) possible. Local labels are used when jumps are made *within* a program.

GLOBAL LABELS

A global label is defined by the function "LBL" followed by a string of up to seven ALPHA characters. The only characters that cannot be used in global labels are the decimal point (.), the comma (,), and the colon (:). The single letters A through J and a through e define local ALPHA labels (see the section: "Local Labels").

Global labels are most useful as program delimiters. A global label at line 01 is the best way to name your program; the placement of the label here is advantageous both because it is easy to find and because it is most often the best place to enter a program. Generating a meaningful global label is not difficult because it consists of up to seven ALPHA characters of your choosing!

Another valuable function of global labels is their use in global subroutines. Program segments that are labeled with

global labels can be called from other programs. Useful subroutines can be globally labeled to provide universal access (access from any point in program memory).

The universal accessibility of global labels means that every time a global label is called (by GTO or XEQ), the HP-41 searches the entire program memory starting at the .END. until it finds that label. (Refer to: "Additional Notes on Labels.") This can be a relatively long process. For this reason, it is most efficient to use local labels on segments of a program that are called only by their resident programs.

Another reason it is wise to be conservative when using global labels is their costliness in terms of space. The global label declaration, alone, takes four bytes of program memory, and each character in the label takes one byte. Therefore, the minimum length of a global label is five bytes and the maximum is eleven bytes. Eleven bytes is more than one-and-one-half registers! Contrast this with the fact that the minimum length of a local label is one byte and the maximum length is only two bytes. It is clear that global labels should only be used to give a routine or program universal accessibility.

An attractive feature of global labels is assignability. Once a global label has been used in program memory, that label can be assigned to a key in the same manner in which any function in the HP-41 can be assigned. The reassigned key becomes XEQ "MATRIX"—or whatever global label you have chosen. Assignability is one of the reasons that a global label is so long; the location of the key assignment is stored with the label.

LOCAL LABELS

Local labels are shorter than global labels mainly because they are defined by either a 2-digit number or by one ALPHA character. There are a total of 115 different local labels. Local labels are grouped into three categories, each category having a different use.

The first category is the short-form local label. The short-form local label gets its name from the fact that it is the shortest definable label; that is, one byte. Numeric labels 00 through 14 are short-form local labels.

The second category of local label is the long-form local label. This label gets its name from the fact that it uses 2 bytes of program memory. Numeric labels 15 through 99 are long-form local labels.

Long-form and short-form local labels each have corresponding GTO statements. The short-form GTO statement is 2 bytes long and the long-form GTO statement is 3 bytes long. On the first execution of a local short- or long-form GTO statement, the HP-41 searches the present program for the label and, upon locating the label, stores the jump distance to that label in the GTO statement. During succeeding executions of

the GTO, the HP-41 does not have to search for the label because it knows exactly how far to "jump." This saves execution time! The short-form GTO statement can store jump distances of up to 112 bytes in either direction. The long-form GTO statement can store jump distances greater than the full capacity memory length of the HP-41, therefore it is not limited in this respect. Numeric XEQ's are always long-form; they require 3 bytes of program memory and they always store the jump distances to corresponding labels.

The criteria you should use for selecting short-form or long-form local GTO/LBL pairs is jump distance. If you use only long-form local labels, then your program will run fast because the jump distance will always be stored. But, if the jump distance is less than 112 bytes, you can get fast operation, and save program space, by using short-form GTO/LBL pairs. (You can determine jump distance by summing the byte requirements for each instruction between the GTO and its LBL. Appendix D in the owner's handbook lists byte requirements.)

The third category of local label is the local-ALPHA label. The letters A through J and a through e define local-ALPHA labels. These labels are identical in function to the long-form local label except that if a local-ALPHA label is used in a program, and the HP-41 is positioned to that program, then the key that corresponds to that label (A for LBL A) is automatically assigned to that label in USER mode. This is convenient for such things as accessing input routines or re-initializing a program without having to key in XEQ "label" or make a global key assignment. This is also convenient in that, with each new program, a new set of automatic key assignments becomes available.

IN A USERS' LIBRARY PROGRAM:

Library procedure and customer convenience demand at least one global label in a program. All submitted programs must have one or more global labels, and we prefer a global label at line 01. Global labels demand complete documentation; you must expand on why each global label was used and where the user will be after executing that global label.

Because of the difficulties associated with using superfluous local-ALPHA labels when there are an abundance of alternative local numeric labels, such unnecessary labels will not be acceptable. Local-ALPHA labels demand superb documentation; expand on why each local-ALPHA label was used and where the user will be after execution of that local-ALPHA label. Local-numeric labels do not require such extensive documentation.

Programs that require global label key assignments will not be accepted. Key assignments are a convenience feature; it should be left to the user to decide which key assignments are desirable. Mandatory

key assignments can hopelessly confuse people who are used to their own key assignments.

POSITIONING THE HP-41 TO A PROGRAM

A local label is accessible only when the HP-41 is positioned to the program in which that local label is found. If this program has a global label in it, then positioning is easily done by executing GTO, followed by the global label.

The catalog function is a convenient means of scanning the contents of program memory for the programs that you have written. What you see when you execute **CATALOG** [1] is a sequential listing of all of the global labels you have used in programs and all of the END's between those programs.

Occasionally, you will write a program that contains only local labels. Local labels do not appear when you execute **CATALOG** [1]; so, the only thing that would appear to indicate the presence of a program with only local labels would be the END corresponding to that program. Positioning the HP-41 to a program that contains only local labels is done by using the catalog function. Simply key in **CATALOG** [1], press **R/S** at the desired program, and clear the display by pressing **←**. Or, press **CATALOG** [1] and **R/S** immediately, then use **SST** to position the HP-41 to the desired program.

ADDITIONAL NOTES ON LABELS

1. When a global label is defined, the distance from that global label to the first preceding END is stored with it. This storage facilitates not only the running of the catalog but also the programmatic search for global labels. When a global label is sought, the first place the calculator looks is the permanent program end (.END.). At this location, the position of the preceding END or global label is stored. With this information, the calculator jumps to the END or global label, repeating the sequence until the desired label is found. Note that although this is an internal time-saving procedure, the search for global labels happens every time a global label is called; therefore, it is considerably slower in repetitive routines than the direct jump process of the local label.
2. Since the global label search is backward from the permanent program end (.END.) to the first program in memory, if two identical global labels exist in memory, then only the label closest to the end of memory will be accessed upon execution of that global label. If you wish to access the other program with the identical global label, then you may do so by positioning the HP-41 to that program using the CATALOG function as explained in the last section under "Positioning the HP-41 to a Program."

(Continued)

3. Since the setting and clearing of USER mode is programmable (SF 27 and CF 27 respectively), the setting of flag 27 should be performed at any time that the use of local-ALPHA labels are "required" by the program. Do not use local labels on segments of your programs that you do not want automatically assigned to the keyboard.
4. In contrast to the reverse search pattern for global labels, local labels are searched for from the point of call forward. This allows the flexibility to use more than one local label with the same number if one or more short forward jumps are needed.

LABELING A SUBROUTINE

Whenever a subroutine is called by its resident program, and you choose to use a global label on this subroutine to make it universally accessible, also consider placing a local label right after the global label. This extra label will use a maximum of two bytes of program memory, but, it saves bytes in the long run! The reason this local label will save bytes is that every GTO or XEQ statement that would call the global label from the resident program can call the local label instead. GTO and XEQ statements calling a local label use less memory than those calling a global label. Also, with a local GTO/LBL pair, you are taking advantage of the rapid-jumping capabilities of the HP-41 (see the section: "Local Labels"), and you are avoiding the relatively long global label search every time you call the subroutine from its resident program (see the section: "Global Labels").

Answers to HP-67 Test

Numbers in parentheses after an answer refer to page numbers in the HP-67 or HP-97 owner's handbook.

1. NOP can be used in a program when DSZ or ISZ are used purely as counters. For example: ... DSZ, NOP, RTN. Sometimes an alternative, however, is to repeat the non-branch option: ... DSZ, RTN, RTN.
2. LSTx will be different for the two cases. (67 = p.67; 97 = p.58)
3. GTO LBL a. (67 = p.240; 97 = p.215)
4. $X = -23.00$, $Y = 1.00$, $Z = -1.00$, $T = 0.00$. CHS does not affect stack lift.
5. Single-stepping will cause an Error signal; running the program will not.
6. Pi. LSTx can often be used as a temporary register. (67 = p.323; 97 = p.294)
7. When flag 0 is set and flag 3 is clear, or when flag 0 is clear and flag 3 is set.
8. The T-register. (67 = p.56-57; 97 = p.47)
9. R_t , $X \geq Y$, R_t , R_t . (67 = p.54-56; 97 = p.48-50)
10. $X = 100$, $Y = 3.00$, $Z = 3.00$, $T = 4.00$.
11. $X \leq Y$, $X = Y$, F0? Flag 0 must be clear (any unused flag would do). If you tried $X \geq Y$ you must be sure x is in the right register before proceeding.
12. The program will stop after executing the RTN in step 013. Note that step 032 sends the program to the next occurrence of LBL 2. (67 = p. 206-207; 97 = p. 185-186)
13. The program will loop indefinitely because a RTN is never encountered.
14. See appendix C in the owner's handbook. (67 = p.320-321; 97 = p.291-292)
15. $X \geq Y$, ENTER, ENTER, R_t , \div , LSTx, $X \geq Y$, INT, x, -
16. No program is completely debugged except for the data you've tried. Check your program with the following in SCI 9 mode: $(-4/-3) R = -1$; $(-4/3) R = -1$; $(4/-3) R = 1$; $(4/3) R = 1$.
17. 91.3130; time is normalized so that minutes and seconds will always be less than 60.
18. Correct answer is (b). (67 = p.90-91; 97 = p.82)
19. LBL A, RCL 1, STO(i), 2, 5, CHS, $X = Y$, RTN, DSZ, GTO A. Watch your initial and final conditions so that $R0 = 0$ and $R25 = -25$.
20. Correct answer is (c). (67 = p.288; 97 = p.260)
21. $R0 = 0.00$, $R1 = -1.00$, ... $R7 = -7.00$. Primary data will always be loaded ahead of secondary data regardless of which side is read first.
22. The following solution is based on the property that each succeeding term in the series is twice the previous term divided by $n+1$. LBL A, EEX, 2, STO 1, EEX, LBL 0, ENTER, +, RCL 0, EEX, +, STO 0, \div , STO+1, DSZ, GTO 0, RCL 1, RTN. The answer is 6.38906.
23. Correct answer is (d). (67 = p.275; 97 = p.248)
24. There are 25 steps loaded into memory from 200 to 224. (67 = p.277; 97 = p.250)
25. Three ways to set flag 3 are: entering any digit from the keyboard; reading a data card; and SF3. Flag 3 also can be set with magnetic card header information. When constants are stored as program steps, single-stepping will cause flag 3 to be set as well. (See also: problem 5, where SST produces an Error condition while RUN does not.)

Magnetic Card Erasure

We often get letters concerning the possibility of accidental erasure of a magnetic card for the HP-65, HP-67/97, or HP-41 calculators. And since so many readers ask so many questions about this subject, we decided to bring you a definitive article on the subject.

Usually, there are two forms of energy that might significantly affect the recording on a magnetic card. These are magnetic fields and heat. Dirt also can affect the recording.

DIRT

When a magnetic card does not work properly, the first thing to do is check it for dirt, body oil from your fingers, and so forth. Clean the bottom side of the card with mild soap and water or with alcohol and then try it again. Usually, it will work all right after a cleaning.

MAGNETIC FIELDS

All magnetic materials have an intrinsic property called coercivity. This property is measured in units, called Oersteds, that define the intensity of a magnetic field that is required to demagnetize or erase the material. For example, a material with a coercivity of 100 Oersteds will be erased by a magnetic field with a magnitude of 150 Oersteds, but a material with a coercivity of 300 Oersteds would not be erased by the same field. Since a magnetic card has a coercivity of approximately 265 Oersteds, erasure of information stored on the card would occur only if a field approaching that value were to penetrate into the card.

Where might a field of such intensity be found that could cause accidental erasure? The fact is, a field of this magnitude is very rare. The Earth's magnetic field has a strength of approximately 0.6 Oersted. The field from an electric hand drill under full load is on the order of 10 Oersteds at the surface of the drill case. A magnetic card

pressed against the body of the drill would be in no danger of being erased.

The magnetic fields surrounding heavy power wiring can be intense directly at the surface of the wire, but at the point where contact with the wire can be made (through insulation or conduit), fields will not be capable of erasing a card. If a line cord were laid directly across a card and then short-circuited, the short-circuit field intensity could possibly erase the portion of the card in the immediate areas of the line cord. The electron beam in a television picture tube is deflected magnetically. The fields directly around the deflection yoke of a TV set could erase a card; the fields outside the TV cabinet are much too low to have any effect.

It can be stated without reservation that magnetic fields surrounding ac-operated equipment and appliances in both the home and in an industrial environment are not capable of erasing a magnetic card. The same, however, is not true of permanent magnets. Improvements in permanent

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magnet materials in recent years have led to increased use in a wide variety of applications ranging from pencil holders to refrigerator door latches. These small magnets have surface intensities as high as 1500 Oersteds. If, for example, a card were to touch a magnetic door latch, information might be lost from the portion of the card that came in direct contact with the magnet. Magnets that are sewed into towels or drapes or those that are used to secure notes to metal bulletin boards are also of sufficient strength to cause erasure of recorded material at their area of contact. Other objects in common use would include magnetic key chains and flashlights that have magnets affixed to their cases. Even small permanent magnets could be very troublesome if it were not for one very helpful factor—the factor of distance.

A magnetic field falls off in intensity approximately as the square of the distance from the magnet. In other words, if one doubles the distance at which a field is measured, the intensity will be only one-fourth as great as at the shorter distance. From this we see that distance is what really protects a card from accidental erasure. While the field intensity of a magnet may be sufficient to erase a card placed in contact with it, a spacing of just an inch (2.54 cm) can often totally protect the card.

It can be seen that the mere presence of a magnet in the same room with the card would not be the cause of any concern, and the magnet would not be capable of doing any harm.

A magnetic field can be partially shielded by a box made of soft iron, but this would be an expensive and cumbersome way to attempt to protect a card from accidental erasure. Since a spacing of just about an inch or two (2.54 to 5.08 cm) will protect a card from even the strongest commercially available magnet, distance becomes a more certain and more easily applied method of protection.

Cards do not have the ability to "conduct" the magnetism applied by a permanent magnet from one card to another. There is no chain reaction effect.

HEAT

Excessive heat, such as that which may be generated by a fire, can damage magnetic cards. In general, however, the damage is purely physical and not magnetic in nature. High temperatures can soften or otherwise change the characteristics of the card.

Materials that normally exhibit magnetic properties tend to lose their magnetic abilities when their temperature is increased. The point at which this occurs varies with different substances. As a practical matter, one does not need to worry about exposing a card to elevated temperatures as long as those temperatures do not affect the card physically. The environments in which humans normally function will not harm a magnetic card.

OTHER FORMS OF ENERGY

The world is full of electrical and magnetic phenomena such as lightning discharges, radio transmissions, static electricity, and high-power radar beams. Of all of them, only lightning discharge could possibly cause accidental card erasure and then only if the discharge occurred within a few inches of the card. (*And it probably would do more damage to you than to the cards!!*)

A magnetic field of several thousand Oersteds may exist directly in front of a radar antenna, but the field intensity drops to below the critical level only a few yards away. However, the burning hazard to humans within this high-intensity area is so great that precautions are taken to keep the immediate area in front of the antenna well clear of personnel and other objects.

ANTI-HIJACKING DEVICES

These devices are used in airline terminals to detect concealed weapons that may be carried aboard aircraft and in stores and libraries to detect unauthorized removal of merchandise and books. There are two basic types in use.

Most of the equipment in use at various airports throughout the nation could be classed as passive devices. They are designed to detect subtle changes in the Earth's normal magnetic field. The shape of the Earth's field is distorted by metal objects, and their presence will cause a change that can be sensed by the detection unit. These units do not generate a field of their own and, therefore, cannot erase or otherwise harm magnetic cards.

A second type of detector is classified as an active device. Usually a doorway or walkway is surrounded with a moderately intense magnetic field. While such a field will not totally erase a card, it could reduce the amplitude of the recording on it. Most of the detection systems operate with a field less than 20 Oersteds, and one could carry recorded cards through such a field without affecting the recording.

Unless you are sure that the detection device is of the passive type or a low-power active type, care should be exercised when transporting recorded cards through detection stations. It would be advisable to inform the attendant operating the unit that you are carrying recorded cards. If there is any doubt as to how it will be affected, request that they not be passed through the monitor and ask instead that they be visually inspected. The extra few minutes that this might take may be a worthwhile investment to preserve a recording.

X-RAY INSPECTION

From time to time we hear of packages that have been subjected to X-ray inspection during shipment. After subjecting cards to quantities of X-radiation far in excess of what would be expected for routine package examination, no incidence of signal decay or erasure has been found.

Petroleum Fluids Pac Released

There is probably not a country in the world that has been unaffected by the so-called "energy crisis." Certainly, "oil" is now one of the best-known words in any language. Knowing that, Hewlett-Packard decided to contribute to helping the world energy crisis by developing an HP-41 Pac for the petroleum industry. The Pac we chose to produce is for reservoir engineers; it is **NOT** a drilling Pac. Here, then, is Hewlett-Packard's first software package designed for the petroleum industry.

The Petroleum Fluids Pac has 18 programs to calculate fluid properties for petroleum fluids (gases, oil, and water or brine), as follows:

FOR GASES:

- Z Factor
- Isothermal Compressibility
- Formation Volume Factor
- Viscosity
- Pseudocritical Temperature and Pressure From Gas Gravity
- Gas Properties From Composition

FOR OIL (Above or below the bubble point):

- Isothermal Compressibility
- Formation Volume Factor
- Viscosity
- Gas-Oil Ratio
- Bubble Point Pressure
- Two-Phase Formation Volume Factor

FOR WATER (Including salinity and gas saturation corrections):

- Isothermal Compressibility
- Formation Volume Factor
- Viscosity
- Gas-Water Ratio

OTHER PROGRAMS:

- Rock Compressibility
- Total Isothermal Compressibility

The most significant feature of this new Pac is the Unit Management System, which is a simple, powerful approach to handling both the computational and dimensional aspects of reservoir engineering problems. With this feature, when you are prompted for an input, you key in the number you want to use. If the number has units different than the expected default units, you merely spell out in the ALPHA register the units you want. It's that simple! The Pac will take care of all of the problems of dimensional consistency for you, and it will calculate results in whatever units you specify. And, best of all, you have a virtually unlimited set of units from which to choose.

Another extremely important feature of the Pac is its modularity. In addition to the 18 programs listed above, the Pac has a library of 54 subroutines for input, output, and fluid property calculations. This

(Continued)

library of subroutines allows you to easily write programs to solve difficult reservoir engineering problems (such as material balance) in a fraction of the time and program space required without the Pac.

All 18 programs, the Unit Management System, and the 54 subroutines are documented in a comprehensive 200-page manual that includes annotated program listings. Also included in this Pac is a detailed 10-page Quick Reference Guide.

But, as impressive as all of this may seem on paper, it has to be experienced to be appreciated. We spent a lot of time with petroleum industry consultants to make sure that we were going in the right direction with this important Pac. The author even attended such industry-related functions as the Offshore Technology Conference. And, last but not least, many industry professionals were queried by the author before the Pac was finalized. So drop by your nearest HP Dealer after September 1, and try a "hands-on" demonstration. And if you are in the petroleum industry, we'll be amazed if you don't take the 00041-15039 Petroleum Fluids Pac home with you.

The price? Well, because this is a larger-than-usual Pac, it is more expensive than some previous Pacs. And because prices vary because of shipping, import duties, and so on, you will have to contact the dealer in your area for pricing information.

Routines, Techniques, Tips, Et Cetera ...

The routines and techniques furnished in this column (formerly "25 Words") are contributed by people from all walks of life and with various levels of mathematical and programming skills. While the 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.

In Berlin, Germany, Diethard Skatke came up with this routine that works on the HP-41, the HP-67, HP-67, and many other HP scientific programmables. We have it coded here for the HP-67 or HP-97.

(67/97) Here's another version of the A/B = C/D ratio routine shown in V3N4p12b. It uses only 10 lines, and it does work quite well—as do the other versions we have printed in KEY NOTES.

Start by entering the data into the stack, At, Ct, Dt, B. The unknown should be entered as zero (0) in the appropriate position.

001	*LBL0	006	→P
002	R↓	007	R↓
003	X=0?	008	TAN
004	GTO0	009	÷
005	R↓	010	RTN

Sunshine is sometimes a scarce commodity here in Corvallis, Oregon, but in sunny Livermore, California, Jim Carley is keeping his mind on other commodities.

(67/97) The piece in "25 Words" on Richard Sperling's "Effective Interest Cost" (V4N1p5c) was a little confusing in that the amount and rate of interest were mixed. However, the program itself shows that amount is correct for entry. Using the same entry and operating instructions, the following routine will do the job in 10 steps instead of 17. The operating instructions from Richard Sperling's routine are: 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.

Enter the interest and tax rates—this should read amount of interest and income tax rate—as whole numbers; that is, enter 12 percent as "12," and a 50-percent tax bracket—Wow!—should be entered as "50."

001	*LBLA	006	÷
002	%	007	EEX
003	-	008	2
004	PRTX	009	x
005	X→Y	010	RTN

(We've had a lot of "interest" in this particular routine. In fact, I rewrote it in only six lines in V4N2p11a. Evidently Mr. Carley never saw that routine—Ed.)

This next contribution is one *mean* routine! It was sent to us from David L. King of Grand Junction, Colorado. We think he means to give us the means to get some weighted means.

(67/97) The following routine will calculate "weighted" means on an HP-67/97. It makes use of the summation routine. To run it, enter the data sets by pressing the "straight" average number, [ENTER], the "weight," and then press [E]. After entering all data sets, press [D]. This will print the "straight" and "weighted" means and clear the registers for the next set of data.

001	*LBL E	010	x
002	ENT↑	011	X→Y
003	R↓	012	FRTX
004	x	013	÷
005	R↑	014	PRTX
006	X→Y	015	CLRG
007	Σ+	016	P→S
008	RTN	017	CLRG
009	*LBL D	018	RTN

(The straight means that Mr. King refers to is actually the average of the weights. If you don't need to know the average of the weights, delete line 12—Ed.)

Next, we bring you a clever routine contributed by Pedro Henrique Perez de Moura of Porto Alegre, Brazil. He has found a unique use for three of the Display Format Flags.

(41) Here is a routine for decimal-to-binary conversion. It converts integer decimal numbers up to 16777215 and puts the corresponding binary number in the ALPHA register. The little "trick" in this routine is the transformation of single-digit octal numbers to three-digit binary numbers by fixing the number of decimal places displayed by the calculator indirectly to the octal digit and then testing the three display format flags 37, 38, and 39. These flags are set in a binary representation of the places displayed (see page 231 of the owner's handbook). The routine uses just one label and no memory registers. It destroys the stack, but occupies only 58 bytes. But, best of all, the conversion is fast; the worst case takes only 6 seconds.

01+LBL A	17 FC? 38
02 OCT	18 "I-0"
03 ENTER↑	19 FS? 38
04 LOG	20 "I-1"
05 INT	21 FC? 39
06 STO Z	22 "I-0"
07 10↑X	23 FS? 39
08 /	24 "I-1"
09 CLA	25 FRC
10 ISG Y	26 10
11+LBL 00	27 *
12 FIX IND X	28 DSE Y
13 FC? 37	29 GTO 00
14 "I-0"	30 FIX 2
15 FS? 37	31 AVIEW
16 "I-1"	32 END

Now, let's travel to Germany to see what Hendrick Wolper of Clausthal-Zellerfeld is doing with his HP-41.

(41) This short routine gets "down" the exponent that occurs in the SCI format. It is very useful for rounding-routines and similar programs.

01+LBL "EXP"	06 +
02 ENTER↑	07 INT
03 ABS	08 100
04 LOG	09 -
05 100	10 END

While we are visiting Germany, let's stop by Bingen am Rhein and see how Johannes P.C. Holdecker is using his HP-41.

(41) When changing from the HP-38E/C to an HP-41, perhaps you may miss the %T function. If you think that other KEY NOTES readers are interested in this function, here is a short version of it for the HP-41.


```
01+LBL "%T" 05 100
02 ENTER↑ 06 *
03 RCL Z 07 END
04 /
```

(In case you are not familiar with the HP-38E/C, %T calculates the percent that X is of Y—Ed.)

Now, here is a routine from Axel Harvey, who lives in Quebec, Canada. It works well with positive input.

(41) Long Division. One may need to know the decimal expansion of a quotient to a greater number of places than a calculator can provide. This routine uses long division to print-out as many decimal digits as necessary. Enter the numerator in register Y and the denominator in X, then execute the "LONG" routine. A pause occurs after each line of output; have a finger on a neutral key (I prefer SST) before the pause, and execution will stop with flag 29 reset and printer buffer clear.

```
01+LBL "LONG" 23 RCL 03
02 STO 03 24 MOD
03 X<Y 25 10
04 STO 02 26 *
05 CLA 27 STO 02
06 PRX 28 RCL 03
07 X<Y 29 /
08 PRX 30 INT
09 / 31 ARCL X
10 INT 32 ISG 00
11 FIX 0 33 GTO 03
12 ACX 34 ACA
13 PRBUF 35 1
14+LBL 01 36 SKPCHR
15 CF 29 37 CLA
16 .003 38 ISG 01
17 STO 01 39 GTO 02
18+LBL 02 40 ADV
19 .004 41 SF 29
20 STO 00 42 PSE
21+LBL 03 43 GTO 01
22 RCL 02 44 END
```

Quebec, Canada, is a beautiful place, and it must provide a prime atmosphere for a hard-working mind! Why? Well, here's another contribution from Axel Harvey.

(41) Pseudo-Random Subroutine. Here is a process for a series of apparently random numbers, all between zero and 1. It requires two seeds, the first seed in R01 and the second in R02. The first seed may be any number greater than zero, the second any number greater than 10^{-9} . The first seed influences the resulting series considerably; a difference of a quarter of a percent in the value of the first seed can change the whole series except for the first two or three digits of the first number output. The second seed also

can vary series considerably—a difference of 0.01 in absolute value can be significant—but only if it is less than 1. If it is greater than or equal to 1 it will have no influence on the series. The value 167 in line 8 may also be changed, but its effect is much more gradual; a difference of 50 or so may not make any difference for the first dozen terms of a series. I recommend that this value be kept between 100 and 200. If it is too small, there will be many pairs of adjacent numbers beginning with the same digit; if it is too big, there will be many numbers with trailing zeros.

```
01+LBL "X" 08 167
02 RCL 01 09 MOD
03 LN 10 X<> 02
04 ENTER↑ 11 MOD
05 FRC 12 FRC
06 1/X 13 STO 01
07 X+2 14 END
```

This next technique is useful to anyone who programs the HP-41. It was contributed by Andrew Zawadzki, who lives in Birmingham, Michigan.

(41) Several times I found the need for a routine that would allow me to execute an instruction only every *second* time, while the program was running in a loop. Maybe the routine I came up with will be of interest to others. It is especially useful in viewing the ALPHA register. However, in order to *not* execute "INSTRUCTION" in the first run of the loop, flag 05 should be set before the loop starts. Of course, any other flag may be used.

```
Begin loop (Note that FS?05 at the
: beginning is not necessary.
FS?05 The two lines that follow
FC?C 05 will invert the status of flag
SF 05 05—Ed.)
FS?05
INSTRUCTION
:
End loop
```

Now, let's jump around the globe a little bit and see what other interesting things are being done on the HP-41. First, we land in Goteborg, Sweden, and we find that Thomas Fange has a contribution for us.

(41) This routine will "turn" an integer. For example, 124 will become 421, or 1981 will become 1891.

```
01+LBL "TURN" 10 ST+ Z
02 0 11 -
03 X<Y 12 X*0?
04+LBL 00 13 GTO 00
05 10 14 X<Y
06 ST* Z 15 10
07 / 16 *
08 ENTER↑ 17 END
09 FRC
```

(This routine sure would be handy during income tax time. Imagine being able to

"reverse" a tax of, say, \$9,862!! Of course it wouldn't be legal, but it might make one feel better—Ed.)

Next, we land in Jakarta, Indonesia. Here we find John O'Shannessy, who contributes a short routine that can save all of us some time.

(41) HP-41 owners should make a note to key in this short (shortest?) program to restore prompt execution of the two top rows of keys after running your "user" programs. Instead of ending programs with RTN or END, insert a GTO U instruction; any non-local ALPHA label may be used. And label U? It's simply: 01 LBL U, 02 END. Yes, GTO .. achieves the same result but is a nuisance, and it is usually executed *after* noting a slow response time, which can be quite substantial.

Okay, Mr. O'Shannessy, but you must "separate" it from other programs "above" it in memory. Be sure to GTO .. before you key it in—Ed.)

Meanwhile, back in Bensheim, Germany, we find that Christoph Wetzel is *always* on time. The routine that he has submitted reveals his secret of punctuality.

(41) After receiving your last issue of HP KEY NOTES for the first time, I was especially inspired about the "timer" routine from Graeme Leith (V4N3p.11b). But my dilemma is that I always forget important times. So I wrote the following routine that changes the HP-41 into a perfect alarm clock. It is necessary to use the function "PACK" after programming it.

```
01+LBL "A-CLOCK" 23 HMS+
02 CF 01 24 STO 01
03 "ALARM TIME?" 25 VIEW X
04 PROMPT 26 24
05 STO 02 27 X<Y?
06 "CURRENT TIME" 28 GTO 03
07 PROMPT 29 GTO 00
08 STO 01 30+LBL 04
09 FIX 4 31 .000091
10 RCL 02 32 GTO 05
11 X<Y? 33+LBL 01
12 SF 01 34 FS? 01
13+LBL 00 35 GTO 02
14 RCL 02 36 RCL 02
15 RCL 01 37 VIEW X
16 X<Y? 38 BEEP
17 GTO 01 39 GTO 01
18+LBL 02 40+LBL 03
19 FS? 01 41 ST- 01
20 GTO 04 42 CF 01
21 .000082 43 GTO 00
22+LBL 05 44 END
```

("Perfect" alarm clock? Be careful; timer routines are fun to use on HP calculators but the accuracy of these routines is highly dependent on temperature, battery condi-

(Continued)

tion, and the unique characteristics of various operating situations. You can customize this routine for your HP-41 by adjusting the constants in lines 21 and 31. But don't be surprised if this "alarm clock" sounds ½-hour late on a cold morning! Also, flag 21 must be cleared if you have a printer—Ed.)

Moving on to New South Wales, Australia, we find a contribution from David Morgan. His is one of the many, many variations of "restricted access" routines. Another such routine appeared in V4N3p5a under the flag 11 explanation.

(41) Being a new owner of an HP-41C and all the peripherals, I thought you might want to see this small access code routine to thwart "non-HP-41" users. It can be used at "turn-on," using SF 11, or it can be attached to the beginning of another program. The owner's own unique code is inserted at line 02, and it can be ALPHA, numeric, or a combination of both. The routine can be reduced to just 20 lines by deleting lines 07, 08, 15, 16, 17, 19, 20, 24, 25, and 26.

Thanks for a great product and an entertaining newsletter; I wish it came more often.

01*LBL "CODE"	16 AVIEW
02 "KEYNOTES"	17 PSE
03 ASTO Y	18 AOFF
04 " CODE?"	19 CLD
05 AVIEW	20 CLX
06 AON	21 RTN
07 TONE 9	22 GTO "CODE"
08 PSE	23*LBL 02
09 PSE	24 "--WRONG--"
10 ASTO X	25 AVIEW
11 X=Y?	26 BEEP
12 GTO 01	27 SF 11
13 GTO 02	28 OFF
14*LBL 01	29 GTO "CODE"
15 "**CORRECT**"	30 END

(It works, Mr. Morgan, but for people with printers attached, you should have a CF 21 for line 02. Thanks for the compliment; perhaps one day we can issue this newsletter more often—Ed.)

If you think that HP-41's don't get to faraway places, you haven't talked to Neil Hunter-Blair, who sent this input from Bangkok, Thailand.

(41) If you have a card reader for your HP-41, have you ever wanted VER in a program after a WDTA or WDTAX? Non-programmable, eh? Well, try this:

With your card reader plugged in, turn on the HP-41 and press **ASN**, **ALPHA**, **VER**, **ALPHA**, **LN**. Turn off the HP-41 and remove the card reader. Turn it back on and press **USER** and **PRGM**, then press **LN**. In the display, the program line will be NN XROM 30,05, but when the card reader is connected the display will show NN VER.

You can enter WALL and WPRV into a program by the same method. If you have a Wand, you can enter any of these functions into a program by first removing the card reader and then scanning the function on the Paper Keyboard.

(Yes, it does work. No, it won't harm the HP-41. It wasn't in the owner's handbook because, at the time the machine was designed, those weren't intended as programmable functions. Other nonprogrammable functions can be entered into a program in the same way, but not all of them will execute when a running program encounters them—Ed.)

In the last issue (V5N1p7c), we printed an alternative to AVIEW that works with or without the printer. Paul Cardinale of San Francisco responded with these two shorter routines that do essentially the same thing.

(41) The routine "AV" in the right column of page 7 in Volume 5 No. 1 can be replaced by the following routine.

01*LBL "AV"	07 CF 21
02 FS? 21	08 AVIEW
03 SF 15	09 FS?C 15
04 SF 21	10 SF 21
05 FS? 55	11 RTN
06 PRA	12 END

(Any user-controlled flag can be substituted for flag 15—Ed.)

(41) Referring to the same article referenced above, if you want flag 21 to control printing, you can use this shorter routine.

01*LBL "AV"	06 AVIEW
02 FS? 55	07 FS?C 15
03 PRA	08 SF 21
04 FS?C 21	09 .END.
05 SF 15	

This input is from Wyman W. Trotti, Jr. of Cayce, South Carolina. It is another nice routine for use in conjunction with the printer.

(41) There may be a better solution to this problem, but this one at least works. I am in the real estate business, and most of what I want to plot, using my HP-41 printer, cannot be generated by a function. The following routine stores data sequentially in registers beginning at R₁₃ and, when called by PRPLOT or PRPLOT, returns it. First, assign DATA2 to a key and use it to initialize the program and store data. As written, the program will store 50 values. Line 15 may be changed to accommodate more values. Although set for 50, you do not need to store 50 values.

Have PRPLOT call DATA to generate the plot. If the same data-set is to be plotted more than once, the program must be reset (RST) before each plot by executing DATA2 once. Data simply ignores input from PRPLOT and outputs the stored values sequentially.

01*LBL "DATA2"	13 GTO A
02 SF 00	14*LBL 01
03 XEQ 01	15 13.063
04 "RST"	16 STO 12
05 AVIEW	17 RTN
06*LBL A	18*LBL "DATA"
07 "N=?"	19 FS?C 00
08 PROMPT	20 XEQ 01
09 ARCL X	21 RCL IND 12
10 PRA	22 ISG 12.
11 STO IND 12	23 END
12 ISG 12	

Now, how about something for printer fans? This routine was contributed by William J. Quinlan, Jr. of Evanston, Illinois, and it is his first input for KEY NOTES.

(41) This routine creates any type of divider on printed tapes by simply inputting the decimal equivalent and the size of the line, which can be 0 to 23. A divider bar can be created in default by pressing R/S after the prompt.

01*LBL "DV"	13 ISG Y
02 "SIZE+CHAR"	14 GTO 01
03 PROMPT	15 PRBUF
04 X=0?	16 CLX
05 GTO 02	17 RTN
06 STO 01	18*LBL 02
07 X<Y	19 .023
08 .001	20 ENTER+
09 *	21 31
10 RCL 01	22 GTO 01
11*LBL 01	23 END
12 ACCHR	

Lately, we have received many letters about this next subject. And since the letters were all pretty much the same, we decided to print the first one we received. It came from Claude Roeltgen of Mondercange, which is in the Grand Duchy of Luxembourg.

(41) I am very glad to submit some tricks I found for my HP-41. Sometimes you have to express a complex condition; for example: if (x>y? or FS?00) then XEQ 05. Normally, you would have to do:

01 x>y?
02 GTO 01
03 FS?00
04 GTO 01
:
nn LBL 01
nn XEQ 05

But you can shorten this by doing:

01 x≤y? (inverse of first condition)
02 FS?00
03 XEQ 05

In the same manner, when you have two conditions separated by "and," you can shorten the solution of your problem. For example: if (x=0? and FS? 05) then XEQ 10. This would give:

```
01 x=0?
02 FC?05 (inverse of second condition)
03 GTO "CONT"
04 XEQ 10
05 LBL "CONT"
```

A further useful trick when you have to invert the status of a flag (from clear to set, or set to clear) is:

```
01 FC?Cnn
02 SFnn
```

The nn means "number or numbers," as any flag number can be used.

(Flag tests work the same way. For example:

```
FS?aa      FC?aa
GTOnn      becomes: FS?bb
FS?bb      GTOnn
GTOnn
```

As you can see, flags are extremely useful "tools" on the HP-41—Ed.)

Here's a contribution for those of you who use HP-67/97 programs in your HP-41. It was sent to us by Siebert Förster of Rosstal, Germany.

(41) Recently I tried to run, on my HP-41, a program that I have often used on my HP-97, but it did not work. So, I have discovered this translation problem.

In cases of HP-67/97 sequences like:

```
001      F0?
002      Σ+
```

the HP-41 translation is

```
01+LBL 67      03 ΣREG 14
02 FS? 00      04 Σ+
```

which is obviously wrong.

It is simple to overcome this translation problem by switching the conditional with the ΣREG 14 instruction.

Arnold Hinrichs, who lives in Hagen, West Germany, has been doing some very practical work on his HP-41. His contribution is a unique routine that is applicable to many situations.

(41) My contribution has to do with execution times. Since the HP-41 is not a large-scale computer system, execution of self-made programs (RAM) can sometimes last a long time. But, we can shorten the time that the user will have to wait for an output.

Thousands of students will use their HP-41 in schools, colleges, or universities to compute values for a function that they have to draw. They will write a program that will

generate some values according to the function, and then use either STOP or PROMPT to display the result. Each time [R/S] is pressed, it will take some time until the next value is displayed. Time is valuable in exams!

Can we make it better? We can! What about his subroutine instead of STOP or PROMPT?

```
01+LBL "DISP"      06 FC? 03
02 FS? 02          07 RVIEW
03 STOP            08 SF 02
04 FS? 03          09 RTN
05 VIEW X          10 END
```

It requires a cleared flag 2 at start, and flag 3 must be set or clear according to the desired output. When flag 3 is clear the ALPHA register is displayed, otherwise DISP will display X.

Now the description: The main program will compute the first value, which will be ready for output in either the X-register or the ALPHA register. If XEQ DISP is used instead of STOP or PROMPT, then either X or ALPHA is displayed and flag 2 is set. While our student is busy writing down the first result, the HP-41 is busy calculating the second result. The PRGM annunciator will stay on until XEQ DISP is encountered the second time. Since flag 2 is set now (don't clear it in your program!), execution will stop at line 03. When [R/S] is pressed now, the next value will be displayed immediately. While our poor student is writing down the second value, his main program will compute the third value and so on. But never press [R/S] when the PRGM annunciator is still on!

(Again, don't forget that flag 21 needs to be clear—Ed.)

Richard Manahan lives in Wichita Falls, Texas, with an HP-41C and an HP 82143A Printer. That he is getting along well with both of these friends is demonstrated in this next routine.

(41) While running a program that generated data that I wanted to print out on the HP 82143A Printer, I got hopelessly lost trying to get it lined up. In trying to find an easier way, I came up with the following routine.

```
01+LBL "B1"      07 ARCL 03
02 CLA           08 ARCL 25
03 ARCL 01       09 ARCL 06
04 ARCL 25       10 ACA
05 ARCL 00       11 ADV
06 ARCL 25       12 RTN
```

Essentially, the data was stored in registers 01, 00, 03, and 06. From the keyboard I stored a "blank" in register 25. In the main program, at the end of data generation, I used an XEQ "B1" label. Since the ALPHA register has 24 spaces, the same as the printer, I found this a lot easier to use than the skip-character, etc., exercise in ACX.

One caution: This routine is sensitive to the FIX mode that you are in, and it will truncate

data if it overflows. It is relatively easy to manually line-up your data in the ALPHA register and then tailor the routine around it.

We do think this next routine is a "neat" routine. It is a quick routine to find x^3 . Frank Wales of Glasgow, Scotland, is the contributor of this jewel.

I don't know about you, but I think this is neat! It works just like any other monadic function in that it puts x in LASTX and it leaves the stack untouched (apart from X).

```
01+LBL "CUBE"
02 X↑2
03 X<> L
04 ST* L
05 X<> L
06 RTN
```

For those of you who are byte-crazy (aren't we all?) and who do not mind sacrificing a few significant figures in order to save some bytes, we present this routine. It was sent to us by Leonard D. Cordwell of Romsey, England.

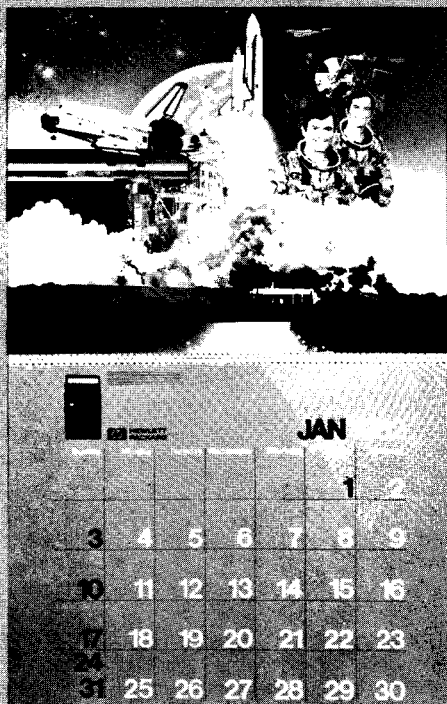
(41) A data register can store 10 digits, a decimal point, and a minus sign. If the data to be stored does not need all that accuracy, then more than one piece of information can be stored in one register. The SAVE routine I enclose is designed to store (in IND 00) two 5-digit numbers, each consisting of a 4-digit integer and one decimal place. One number (originally in the X-register) is multiplied by 10 to turn it into an integer, and the other (originally in the Y-register) is divided by 10^4 to turn it into a fraction, so that both numbers can be stored, one on each side of the decimal point. Also, since both numbers in this case are always positive, the minus sign is spare and is used to record the status of a flag. USE reverses the process to put the data back into its original form and into the registers it came from.

This routine uses 58 bytes as it stands (this can be reduced by using local labels), but it has saved 80 data registers in one of my HP-41 programs.

```
01+LBL "SAVE"      14+LBL "USE"
02 FIX 1           15 RCL IND 00
03 RND             16 X<0?
04 1 E1            17 SF 01
05 *               18 ABS
06 RCL Y           19 ENTER↑
07 1 E4            20 FRC
08 /               21 1 E4
09 +               22 *
10 FS? 01          23 RCL Y
11 CHS             24 INT
12 STO IND 00      25 1 E1
13 RTN             26 /
                  27 RTN
```


Tenth Anniversary Calendar Announced

Here is your chance to acquire what could become a real collector's item. Although it is hard to believe that 10 years have already passed since Hewlett-Packard introduced the remarkable HP-35 Scientific Pocket Calculator, it is true. And to celebrate this anniversary, we are producing a Hewlett-Packard Personal Computing Products Tenth Anniversary Calendar. It will be a limited edition. Opened, the calendar measures 18 by 30 inches (45.7 by 76.2 cm), and it has a spiral binding.



Hewlett-Packard has commissioned Michael Cacy, a leading U.S. artist, to create 12 original scenes that depict the exciting events and places in which HP Personal Computing Products have been used. These scenes will be illustrated in color and in mixed media. Among the events selected for the calendar are: on-board the space shuttle *Columbia*; across the Atlantic Ocean in a balloon; in the pits at a Grand Prix race; winning the America's Cup race, *twice*; at the bottom of the Pacific Ocean; and seven more exciting events.

The photograph shows a "mock-up" of the calendar before it went into production. The final calendar will have the name of the month in seven languages, and appropriate text describing the depicted event will accompany the HP product shown for each month.

Each calendar will be packed in a special flat mailing envelope to protect it during transit. Delivery will start on or about November 1, 1981, and you should allow 4 to 6 weeks for delivery. The purchase price is \$5* postpaid in the U.S., Alaska, and Hawaii; elsewhere, the price is \$8.50* postpaid. To order, send your name, address, and payment to:

HP CALENDAR

Attn: Darlene Johnson
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This beautiful calendar is something you will not want to miss, so don't wait too long to order your copy. It definitely would be a very nice Christmas present, so we will make every possible effort to get all orders in the mail as soon as possible. All overseas orders will be sent by air mail.

* 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. Payment must accompany your order.

A letter from C. Goldman (London, England) informed us that there was another small error in V5N1p10c in the "CL" routine. Line 22 is REG IND T and it should be REG IND Z.

I thank both of you for taking the time to bring these errors to our attention. Often, readers notice and just fix the small errors. But it is frustrating to try a routine, find it doesn't work, and not know why. So we like to correct even the small errors.

LETTERS TO KEY NOTES

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 addressed to that function. Also, questions about future products cannot be answered; Company policy permits me to discuss only those products that have been released. Federal regulations also prohibit discussing future products.

Letters to the editor should be addressed to:

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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 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.

By now you will have noticed that the time between V5N1 and V5N2 was considerably shorter than between past issues. Yet these two issues contained 16 pages. So you see, we are getting better in our effort to bring you lots of what you want and to get it to you on a reasonable schedule. And we have many more plans for making KEY NOTES better. However, if you don't subscribe (see page 15), you'll miss a lot of pleasant surprises in 1982 and beyond.

Editorial

If you haven't deciphered the coding of V4N3p10b or other such abbreviations throughout this issue, here is the solution: Volume 4 Number 3 page 10 center column. The letter "b" at the end indicates the center column; then "a" indicates the left column and "c" indicates the right column. It is so much easier to use this coding when referencing other issues, plus it makes it easier to index things in KEY NOTES. Especially in the future.

For Robert A. Green (Mississippi) and many others who wrote, "What modifications were made to the HP-41's on the space shuttle *Columbia*?", here is an answer. The small plastic "feet" on the bottom cover were removed because some plastics slowly "out-gas" and that cannot be tolerated in the shuttle. Also, the battery charger access door was glued shut as a safeguard against any possible electrical spark. And the standard thin-plastic keyboard overlays were not used because of out-gassing

possibilities. NASA used clear plastic overlays that were of a different material and which were slightly thicker. That's about it. Essentially, your HP-41's are identical to the calculators used by NASA onboard *Columbia*.

Norman C. Samish (Houston, Texas) asked a question that most Library members would also ask: "Can you order 'Special Programs' that cost \$12 and pay for them with two program coupons?" Yes, you can, Mr. Samish. You can use program coupons for *anything* available directly from the Library. That does NOT include *Solutions Books* or other HP products or accessories. If you have a coupon worth four programs and you want just a "Special," we will return two coupons with your purchase. In other words, you can use your program coupons like "6-dollar bills."

Mr. Samish also pointed-out an error in V5N1p14c. In the "TITLE" routine, line 04 is FC755; it should be FS755. That's been in print over a year, and no one ever noticed it!

KEY NOTES Corrections

Thanks to letters from William C. Tempelmeyer of Evanston, Illinois, Claus Primdahl Nielsen of Bagsvaerd, Denmark, and Hans Peter Brill of Aachen, West Germany, you can make the following corrections to the flag table appearing in V4N3p5:

The status at turn-on for flag 37 and flag 40 should be coded M.3 rather than M.1, indicating that their status is maintained by Continuous Memory, and that "Master Clear" sets rather than clears these flags (display is FIX 4).

The status at turn-on for flag 47, flag 50, and flag 51 should be C rather than C.4, indicating that these flags are always clear

at turn-on but *not* that they always test clear. Flag 50 will test set in a program as long as a message resulting from a VIEW or AVIEW command is being displayed. Flag 47 will test set in a program after a PAUSE if the shift key is pressed during the PAUSE. Flag 51 will test clear in a running program, but it will test set in a program that is being single-stepped.

We also received this letter from **John L. Gafford**, of Waco, Texas.

A couple of observations about the HP-41C

that may be of help to others:

First, regarding flags 22 and 23. Though implied in the instruction books and the article on flags in HP KEY NOTES V4N3, nowhere have I seen it explicitly stated that these flags, once set by a numerical (flag 22) or ALPHA (flag 23) entry, remain *set* until cleared by a specific clear command (CF, FS?C, FC?C) or until the calculator is turned off.

Second, when using AVIEW with the printer to print an ALPHA string, if the string is longer than 12 characters, program execu-

tion will be held up as the string scrolls through the ALPHA register. The PRA function in place of AVIEW will eliminate the delay, resulting in faster program execution.

I really enjoy KEY NOTES. Like a bottle of good wine, the longer it's around, the better it gets.

(I thank all of you for your sharp eyes. And special thanks are in order for that nice compliment. I know a red wine ages well; perhaps a "read" KEY NOTES also ages well?—Ed.)

KEY NOTES Subscription Plan

You were informed in the last issue that, because of skyrocketing inflation, we would soon be charging a subscription fee for HP KEY NOTES. This notice and a Subscription Order appear in this issue and will be in the next issue. The first issue in 1982, Volume 6 Number 1, will be mailed **ONLY TO THOSE WHO SUBSCRIBE BEFORE THAT TIME**. Here are more details.

FOR U.S. AND CANADA

In the United States and Canada the subscription fee will be \$5* for one year. For that fee you will receive four issues of KEY NOTES a year.

We will accept subscriptions any time after November 1, 1981. Just fill in the Subscription Order, then mail it (or a photocopy) and a check or money order for \$5* to the Users' Library in Corvallis (address on back cover).

All copies of HP KEY NOTES distributed in the U.S. and Canada will be sent by first-class mail. (By U.S., we mean any address with a U.S. Post Office ZIP code.)

If you are a member of the Corvallis Users' Library and live in the U.S. or Canada, you will receive HP KEY NOTES *free* for the first year (1982).

On January 1, 1982, all current members of the Corvallis Users' Library will be added to the HP KEY NOTES subscription mailing list for one year—free of charge. Such people do not have to send in the

Subscription Order. We will automatically put you on subscription for 1982. Also, everyone who joins the Users' Library in 1982 will receive a free one-year subscription to HP KEY NOTES.

FOR EUROPE (UPLÉ)

If you live in Europe and receive HP KEY NOTES through the Users' Program Library Europe (UPLÉ) in Geneva, Switzerland, you will presently continue to receive HP KEY NOTES, and you will receive it free in 1982. The issues you receive will be printed in the U.S. and bulk-shipped by air freight to the Amsterdam mailing house. **INDIVIDUAL COPIES CANNOT BE OBTAINED FROM CORVALLIS** unless you are a paid-up member of the Corvallis Users' Library. If and when this plan changes, you will be notified in advance.

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If you live in Mexico, South America, Africa, Australia, New Zealand, or Asia, or in any country not covered above, please fill in the Subscription Order on this page and mail it to the nearest Hewlett-Packard office. This will assure that you will continue to receive HP KEY NOTES in 1982. If you cannot determine where to send the form, send it to Corvallis, and we will see that it gets to the right location. Depending on where you live, you might be asked to pay a mailing fee in order to continue receiving HP KEY NOTES.

Of course, if you live anywhere outside the U.S. and are a member of the Corvallis Users' Library, you do not have to send in the Subscription Order. You will receive HP KEY NOTES in 1982 as part of your Library subscription.

FOR THE FUTURE

Effective January 1, 1982, we will include a copy of the current KEY NOTES and an invitation to subscribe to it inside each HP-41, HP-67, and HP-97 carton.

AND FINALLY...

We want you to know that, as a result of this subscription plan and future plans, KEY NOTES will only get better. You will get it on a regular schedule. There are still a few "bugs" to iron out of some overseas shipments, but we *are* making progress. Right now, Europe receives KEY NOTES five times faster than just a year ago. And perhaps we can improve on *that* record.

Without the economic problems that have haunted the newsletter of late, and by using better classes of mail and freight delivery, you will find that KEY NOTES will be a regular companion—there when you count on it. And with many exciting improvements in the next year, you won't want to miss getting KEY NOTES.

We'll bring you more details in the next issue.

* 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. Payment must accompany your order.

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Getting Down to Earth With an HP-41 ...

Believe it or not, there are *many* people who *like* to jump out of airplanes and fall a great distance **before** deploying a parachute! While this premeditated act might not be everybody's cup of tea—so to speak—"skydiving" is an active and widespread sport. And you can bet that anyone who practices skydiving wants to enlist every facet of modern science to make certain (!) their fall is going to be an enjoyable experience. But what does all of this have to do with calculators?

Well, it so happens that skydivers' jumpsuits are almost as important as their parachutes. The "wings" on their suits are actually extra material between the underside of the sleeve and the body, plus extra material in the lower legs. (Take a good look at the photograph.) A suit not properly designed will not allow the wings to be self-inflating, and unwanted flapping will occur. Besides all this, suit design is important in determining the fall rate.

So along comes Garry Carter of Pope Valley, California, holder of three world championships and five world records in skydiving, and with him his friend Paul Heckel, a Systems Consultant in Los Altos, California. Do you begin to get the picture? Garry had a small business that made skydivers' jumpsuits. Paul owned an HP-41C. But to Garry, the HP-41C was only something he once saw in a magazine ad. And since he didn't have that kind of technical background, he certainly couldn't program the HP-41C.

Well, as you can imagine, Garry and Paul and the HP-41C got together, mainly because Garry couldn't afford a desktop computer even though he realized that the varied requirements for custom-made jumpsuits could be handled readily by a small computer. However, he also realized that, if he could program the HP-41C, he *could* actually have a small *handheld* computer to run his business.

In truth, it has worked out wonderfully well. Garry *did* learn to program and, using Paul's HP-41C for a start, developed an HP-41 program to calculate the critical



Photograph courtesy of 4th Dimension. This team, informally known as 4D, consists of Paul Stromberg, Jerry Swovelin, John Downing, Brian Johnson, and Bob Buehrer. They placed third at the recent U.S. Nationals meet and set a new world record with Garry Carter's flight suits, which they are wearing in this photograph. There are five names above and only four skydivers in the photo? Well, that's because Bob Buehrer is taking the photo!

dimensions of a jumpsuit so as to ensure that all jumpers in a team will fall at the same rate even though they differ in height and weight. This is very important in forming geometric formations that are made in the air during free fall.

Of course, all of this happened some time ago. Today, Garry has his own HP-41C, card reader, and printer, and he has a thriving business. He even purchased an HP-41CV as a "portable computer" that can be taken out in the field to solve problems on the spot—or to make extra sales!

Garry recently came back from the U.S. Nationals (skydivers meet) and informed us that the U.S. Army "Golden Knights" skydiving team won first place in the competition. And you guessed it: they were wearing jumpsuits designed and manufactured by Garry Carter.

With the HP-41's, Garry now can easily custom-tailor a jumpsuit for anyone—even by mail-order. He can even design it to

allow an "extra-slow" (!) fall rate of only (!) 92 miles per hour (148 km/h) or an "extra-fast" fall rate of up to 106 mph (170 km/h). All you have to do is furnish the parameters of height, weight, and gear weight and such measurements as waist, arm length, inseam length, and so forth. You can even specify colors and choose from various materials.

Today, Garry has a successful and larger business, and he *does* now own a computer system to run the business. But he still uses the HP-41 for suit measurements and still finds it an invaluable "field" computer.

The next time you watch some skydivers in flight, whether in person or on television, we'll bet that you think of Garry Carter and the HP-41's that made a good business profitable for him. And since you are reading this, *you* probably own an HP-41 and now know that just about *anything* can be done with that remarkable little machine. And if you still argue that it isn't a computer, maybe you should talk to Garry Carter.

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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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