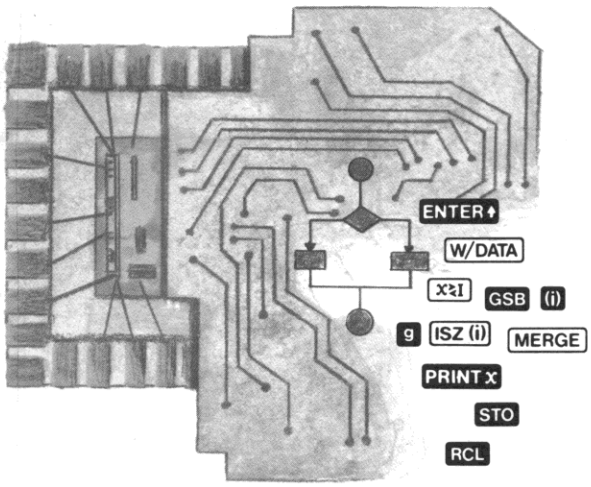


HEWLETT hp PACKARD

HP Key Notes

February 1978 Vol. 2 No. 1

Now's The Time

If you have been thinking of "moving up" from the HP-65 to the HP-67, or from the HP-67 to the HP-97, you couldn't pick a better time. Between February 1 and March 31, 1978, we are offering a powerful incentive to help anyone make the decision to buy certain HP programmable calculators. So if you have been sort of "sitting on the fence" about one of the machines mentioned below, take a trip to your HP dealer and get all the details.

The offer is: Purchase an HP-67 or HP-97 during the offer period and you will get one Application Pac and five *Users Library Solutions* books of your choice plus 40 blank magnetic cards. A $105* value *absolutely free!!* Or, purchase an HP-19C or HP-29C during the offer period and you will get your choice of five new *HP-19C/HP-29C Solutions* books. A $37.50* value *absolutely free!!*

And we have made it easy to get the free software. Packed with each new calculator mentioned above, there will be a certificate (or your dealer will give you a certificate). All that's necessary is to fill in your name and address, sign the certificate, and make your choices from the list on the back of the certificate. Then send the certificate, your calculator registration card, and a copy of your sales receipt to us, and we will send your free software directly to you.

Now you'll find the decision easier to make if you were thinking of buying an HP-19C or HP-29C—or even an HP-67 or HP-97—for your son or daughter. The only hard decision to make will be: *which free software should we order?*

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

"25 Words Or Less"

We have often said that this newsletter is for *you*–and we mean that. So when we get letters like the one below, we share them. It presents a good idea, and if *you* like the idea and respond, we will do our part. Read on. It's worth your time.

Dear Editor:

I would like to suggest an addition to HP KEY NOTES that would complement your excellent periodical: "25 Words Or Less"; a column devoted to routines of 25 program steps or less and documented in 25 words or less. This category of routine would include both applications and programming tricks and could prove invaluable in avoiding reinvention of the small round pebble (the precursor of the wheel). Routines in this category are not readily available to Users' Library customers because they are frequently buried, without comment statements, in big programs that never seem to be in your application category of interest. The rigor of the formal Users' Library submittal documentation and the per program purchase cost, discourage the use of the Library for this type of information exchange.

Attached is a sample, laid out in a KEY NOTES compatible format.

Order and Store 23 Values

```
LBL A   (Go)          STO 0
STO 0                   R↓
  2                   STO i
  3                   DSZ I
STO I   (Start        GTO 1
LBL 1    with all     RCL E
RCL i    CL REG.)       1
RCL 0   (Key Val.)      +
 x>y?                 STO E
 x⇄y                   RTN   (n)
```

Put a Small Number in All Zero Registers

```
LBL A                 CHS
  0                   RCL i
STO I                 x=0?
LBL 1                 x⇄y   (Ends
 EEX                  STO i  with
  6                   ISZ I  Error)
  7                   GTO 1
```

Simple Flag Test

```
LBL A                   2
  0     (Stack          F2?   (Set F)
 F0?     & regs.      PRT x  (No. 's
PRT x   unchanged       R↓     flash.)
  R↓     except          3
  1     T is lost.)     F3?   (If set, F2, F3
 F1?                   PRT x   must be reset.)
PRT x                   R↓
  R↓                   RTN
```

Sincerely,
James S. Hayden, Edwards, CA.

(Thank you, Mr. Hayden, for sharing this idea with all of our readers. As I see the situation, this is a good idea. However, two things must be considered. First, not every person is a programmer. Second, some routines are very tricky and are worthless unless a proper explanation is given. Therefore, while it is good to keep to "25 words or less," I won't insist on it if the routine is a real *contribution and can help others over the rocky spots. Ed.)*

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

Library Corner

We thought the Christmas holiday season would slow down the flow of programs to the Library while you spent some time on Christmas shopping and just good old holiday relaxing. However, no such thing happened, and so the Library continues to grow and grow.

We hope you all had a pleasant Christmas and that you will have a happy and prosperous New Year.

HP-67/97 LIBRARY NEWS

Starting on March 1, 1978, we will offer two ways to buy programs from the Corvallis Library. You still will be able to buy programs for $3* each, as you have in the past, but on March 1, for a new price of $5* per program, you also will receive a pre-recorded magnetic card, or cards, as the case may be. (The card or cards will not be preprinted.) Thus, you will not have to key in all the keystrokes in order to use the program.

On the same date (March 1), the annual subscription price for the HP-67/97 Library will go up to $15.* And, as before, with your subscription you still will get three free programs of your choice, *but they will include pre-recorded magnetic cards.*

The subscription price does not change for our Canadian and "International" subscribers who are part of the Corvallis Library.

These price changes do not affect the European Library.

As a final note, we will mail another 67/97 *Library Catalog Addendum* in April. It will contain 882 programs. And, as of January 30, there were 1,955 programs in the HP-67/97 Library in Corvallis.

HP-65 LIBRARY NEWS

The HP-65 Library will stay "as-is" until 1981. That is, a catalog still will cost $8* and all programs will be $3* each, **without a magnetic card.** Supplies of the Catalog and addenda are limited, and there are no plans to reprint once the supplies are exhausted.

The final *HP-65 Catalog Addendum* will be mailed in February. It will contain a total of 597 programs, ending with program #05554A, the distinction for which belongs to **Jon C. Rysdon** of Ann Arbor, Michigan.

ORDERING PROGRAMS

Any program you see in HP KEY NOTES can be ordered either from the Users' Library in Corvallis, Oregon, or from the Users' Library in Geneva, Switzerland. (Both addresses are on the back cover.) For most of the world, use the program number listed next to the program's title, then order it from Corvallis. The only exception is if you live in the European areas; in that case, *use the number listed in italic type below the program abstract,* then order it from Geneva. Payment for programs must conform with the instructions from *your* area Library. **Always use order forms if possible,** and be sure to include any state or local taxes.

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

SUBMITTING PROGRAMS

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

NEW HP-67/97 PROGRAMS

We have for you this month a real *smorgasbord* of programs from those submitted over the past months since *Catalog Addendum 1* was issued. There is something for everyone, and some of these programs are virtually works of art, or state of the art, as the case may be.

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

67/97 Collisions of Vehicles at Road Intersections (#01470D)*

This program calculates the probability of collision between two vehicles at the intersection of two roads. Required inputs are lengths, widths, and velocities of main-road vehicles and of a side-road vehicle, and the length of a repeating interval on the main road. Given that a collision occurs, the program also calculates the probability of each vehicle's being hit in the side. (Are large cars or small cars hit more often?) (206 steps)

(Well-documented and carefully thought out. Very topical in this day of shrinking cars and gasoline supplies. Ed.)

Author: **Hugo E. Mayer, Jr.**
Warrensburg, Missouri

**In European areas, order by number 00247D.*

67/97 Height of Tide (#01473D)*

For an input year, the program encodes station tidal constants for that year. Using up to 20 of these encoded constants, the height of tide for any date and time during the year is computed. (2055 steps)

(A 32-page, much-desired program, long overdue. But here it is, at last. However, the program requires a list of the standard harmonic constants (Coast and Geodetic Survey C&GS Form 444) for the station of interest. The Program Description form lists the source where you can obtain this list. In fact, even the C&GS people were impressed with this program and offered some minor corrections. Congratulations to the author! Ed.)

Author: **James W. Burrows**
Seattle, Washington

**In European areas, order by number 00248D.*

67/97 Rational Tic-Tac-Toe (#01475D)*

Your HP-67/97 randomly selects a center, side, or corner opening for this old, well-known game. Your calculator plays an aggressive game, taking every possible opportunity to force a win. A perfect "user" game is required for a draw. If the calculator has alternate winning responses to an initial user move, strategy is chosen randomly. The HP-67/97 moves first. For user moves, the keyboard is the playing board, with each digit representing one board cell. The display shows the current move plus all nine board cells simultaneously. A flashing display signals an HP-67/97 win. (224 steps)

Author: **Delmer D. Hinrichs**
Washougal, Washington

**In European areas, order by number 00249D.*

67/97 Pinochle (#01511D)*

You play the calculator in a game of two-handed pinochle. Each player is dealt 12 cards and melds his/her hand. (Melding is getting points for certain card combinations in your hand.) After this is done, play begins. Either player leads a card and the other must follow suit or trump. Good luck against the calculator; it's an excellent player and difficult to beat! (702 steps)

(A 16-page rather complex program, but a real challenge for the casual enthusiast. If you like pinochle, you'll love playing against your HP-67/97. And ... oh, yes; the author is only 17 years old! Ed.)

Author: **Bruce G. Hansen**
Lansing, Michigan

**In European areas, order by number 00250D.*

67/97 Microelectronic Burn-in and Life Test, Purple Plague (#01522D)*

Computes (1) Microelectronic burn-in time (class A, B, and C), (2) life-test duration (40% and 5% failure levels), and (3) wirebond purple plague (gold-aluminum intermetallic compound formation) warning time in hours, or in days and hours, with data input of the desired temperature in degrees Celcius. The program also calculates the ratio of burn-in or life-test times at any two temperatures. Values for (1) and (2) are based on Military Standard 883B. Values for (3) are based on existing literature. (114 steps)

Author: **George G. Harman**
Laytonsville, Maryland

**In European areas, order by number 00251D.*

67/97 LNAP: Ladder Network Analysis Program (#01585D)*

The program will provide the magnitude (in dB) and phase response of arbitrary ladder networks containing up to 8 branches and 16 R-L-C components. Each branch may contain a resistor, a capacitor, an inductor, a series R-C network, a series R-L network, a parallel R-C network, or a parallel R-L network. All input data is stored, and linear or logarithmic sweeps are done. (207 steps)

(Completely and superbly described, flow-charted, and documented! You get 21 pages of superior programming from an author who obviously knows the subject. Well done! Ed.)

Author: **Bruce K. Murdock**
Goleta, California

**In European areas, order by number 00252D.*

67/97 Cave Survey (#01594D)*

This program locates the x, y, and z coordinates and the horizontal distance for a given compass bearing, tape distance, and slope. All coordinates are given relative to the coordinates of the first reading. (146 steps)

(Here is a well-documented, interesting, and amusing program. And the humor is instructive! You spelunkers or speleologists will be intrigued with this one. Good show, W.L.K.! Ed.)

Author: **William L. Koehler**
Toledo, Ohio

**In European areas, order by number 00253D.*

67/97 Hierarchial Structure of River Systems (#01596D)*

This program deals with the geomorphology of rivers. Given three of the four drainage-basin parameters, the program calculates the fourth. The parameters are: the bifurcation ratio, the stream-length ratio, the basin-area ratio, and the basin-shape parameter. Also, given the area of the drainage basin and the mean annual runoff, the program calculates the width, depth, and velocity of the river leaving the basin at mean annual flow. (102 steps)

(Quite topical for Oregon these days! I can guarantee that the rains are not in Spain this year; they are here in the Northwest! Very unique and topical program. Ed.)

Author: **Hugo E. Mayer, Jr.**
Warrensburg, Missouri

**In European areas, order by number 00254D.*

67/97 Heliodon (#01636D)*

Given any date and latitude, this program calculates solar azimuth, measured from south, and solar altitude; and, if desired, the shadow length cast by a given object over an infinite horizontal plane and the height and location of the same shadow upon intersecting any defined vertical plane. The above is output either hourly from sunrise to sunset (whose times are also calculated), or at any single time. (222 steps)

(Excellent and very topical! But read the next one by the same author before you decide to buy. Ed.)

Author: **Bruce D. Gough**
Ottawa, Ontario, Canada

**In European areas, order by number 00255D.*

67/97 Daily Insolation (#01531D)*

Given the day's total horizontal radiation at any location and on any day of the year, this program calculates the total daily beam, sky diffuse, and ground-reflected diffuse solar radiation incident upon a unit surface of any slope within 45 degrees of due south or north; and upon a vertical surface of any orientation. The program will assess insolation for any regular series of slopes and/or orientations, or for any specific slope-orientation. (409 steps)

(Solar energy calculations are in great demand these days. This is a real contribution. The author has done a superb job. The program uses two cards and automatically merges the second card during execution. Ed.)

Author: **Bruce D. Gough**
Ottawa, Ontario, Canada

**In European areas, order by number 00256D.*

HP-65 Program Leads The Way!

All electronic devices designed for the U.S. Government, particularly for military use, are governed by very strict specifications that extend right down to the smallest component on a printed-circuit board. These components must be not only first-class material but also reliable to a degree that can be measured. Therefore, since we know that a lot of you are involved with MILSPECS, a lot of you will like the following program. You also will find a similar program, by the same author, under "New HP-67/97 Programs".

Microelectronic Burn-In and Life-Test (#05193B)*

This program computes microelectronic burn-in time (class A, B, and C) and life-test duration (40% and 5% failure levels) in hours or days, with data input of desired temperature in degrees Celcius. It also calculates the ratio of burn-in or life-test times at any two temperatures. All values are based on Mil/Std 883B. (100 steps)

Mr. Harman was partially responsible for the final equations used in Mil/Std 883B, which was published last Autumn. His HP-97 version, written later, has additional information. Ed.)

Author: **George G. Harman**
Laytonsville, Maryland

**In European areas, order by number 51645A.*

RPN Logic Is ... Well, Logical!

There have been many words written about the various pro's and con's of RPN and algebraic logic systems—as they apply to personal calculators. But when you say, "personal programmable calculators," you narrow things down to some pretty finite facts. *We* know that the RPN system is superior, and we also know that *you* do. After all, you wouldn't be reading this if you hadn't bought one of our calculators.

But, have you ever wondered what a youngster in school thinks about RPN? Well, here is a letter from a young man in Belgium. Read what *he* thinks of our system.

"I recently learned that some teachers and professors think that the RPN system, predominately used in HP calculators, does not suit, or is too difficult for, 15-year-old students—or even older students.

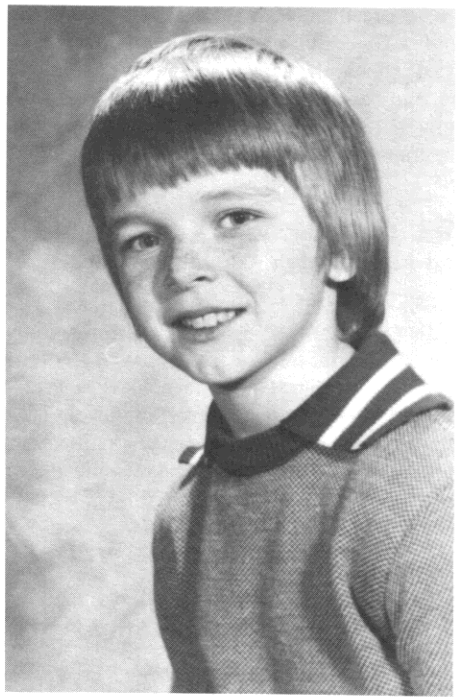
I am convinced this is not correct. I am only 13 years old, and I have been working with the RPN system for more than 2 years, first with another brand, and afterwards with the HP-25A, HP-25C, and now with my HP-67. I am also a member of the User's Club Europe.

Would it not be useful, considering my young age, to publish my opinion so that young students would not be scared or discouraged any longer to work with this clever RPN logic system?

I mostly program problems concerning prime numbers and Fibonacci numbers, for which, the RPN system is well-suited. Some of my programs even obtained approval to appear in the User's Club Catalog.

I think that all of this proves that anyone with some mathematical talent can write programs—even someone at my age. This is possible because of the RPN system. And, after all, I am not Einstein, am I?"

Yours sincerely,
Ronnie van Thielen



HP-67 Saves A Life!

Yep! You read that right, and we're not kidding! But why belabor the point? Here's the actual letter:

Gentlemen:

I am completing my medical residency and entering a cardiology fellowship. I plan to enter academic medicine, specializing in the application of computers to critical care.

I have written (and am continuing to write) a compatible series of critical care programs for use on my HP-67, which always hangs on my belt. These programs are designed to facilitate making patient management decisions quickly on the basis of such data as Swan-Ganz catheter readings, blood gases (venous and arterial), electrolytes and other chemistries, and digoxin levels, etc. They are aimed at providing rational bases for adjustment of ventilators and titration of drugs with narrow therapeutic indices. I would like to share these programs with other HP Users, so would you please send me a fairly large supply of program submittal forms.

By the way, my HP-67 was directly responsible, a week ago, for successful resuscitation of a patient in our medical ICU *(intensive care unit)* who suffered an unexplained cardiac arrest. The calculator allowed me to quickly go through the past few days' flow sheets on the patient, while CPR *(cardiopulmonary resuscitation)* was being performed, and to determine that the patient was probably digitalis toxic and had arrested due to a respiratory alkalosis induced by a breathing treatment. He was given (on the basis of this hypothesis yielded by my HP-67) IV *(intravenous)* Dilantin, and the use of IV $NaHCO_3$ *(sodium bicarbonate)* was eschewed. He responded almost immediately by being successfully cardioverted (after 10 previous vain attempts at 400 watt-seconds) and is still alive and recovering uneventfully.

Sincerely yours,
Ross M. Tonkens, M.D.

Of course, all of this happened some months ago. Since then, Dr. Tonkens has submitted quite a few critical care programs. We have listed, below, the abstract of his first one, plus the numbers and titles of some recent submittals. (Space does not permit printing all these abstracts.)

67/97 Aminophylline IV Loading and Maintenance Dosage (#01567D)*

This critical care program calculates IV loading and maintenance doses of Aminophylline based on one of three user-selected metabolic clearance rates to achieve a user-selected target serum Theophylline level. The calculator displays dosage range (in mg/hr), both upper and lower limits, and recommended starting dose for patient's weight. (125 steps)
Author: **Ross M. Tonkens, M.D.**
Los Angeles, California

**In European areas, order by number 00257D.*

And here are more critical care programs that will appear in the next Library *Catalog Addendum*. To order programs in European areas, use the number in blue ink.

67/97 Estimated Serum Osmolality and Water Excess or Deficit #01779D (00258D).

67/97 Critical Care Hemodynamic Profile #01780D (00259D).

67/97 Anatomic and Physiologic Shunt Fractions, O_2 Contents #01781D (00260D).

67/97 V_D/V_T, Minute Production of CO_2, and Predicted PCO_2 #01782D (00261D).

67/97 Arterial-Alveolar O_2 Ratio and Gradient, Predicted PO_2, F_IO_2 #01783D (00262D).

67/97 Amikacin Dosages, Peak, Trough, and Average Serum Levels #01784D (00263D).

67/97 Gentamicin Dosages, Peak, Trough, and Average Serum Levels #01785D (00264D).

67/97 Nitroprusside Dosage #01786D (00265D).

67/97 Digoxin Loading and Maintenance Doses and Serum Levels #01787D (00266D).

67/97 Dopamine Dosage #01788D (00267D).

(V_D = "physiologic" dead space and V_T = tidal volume. Congratulations, Dr. Tonkens, for putting your HP-67 to such a worthwhile use. We can think of no other application more important than that of saving someone's life. Ed.)

Fractional Power Trick

We received the following letter from a 16-year-old young man who lives in California. Notice that although both routines require pressing eight keys on the keyboard, the writer's method used less space in memory.

Dear Sirs:

I have discovered an interesting "trick" that saves steps under limited conditions. It deals with raising any number to a fractional power when it has a numerator of "2" and an odd denominator (e.g., $4^2/_5$, $8^2/_3$, etc.). Compare both methods, using $8^2/_3$.

USUAL METHOD	MY METHOD
8	8
ENTER	g x^2
2	3
ENTER	h $^1/_x$
3	h y^x = 4.00
÷	
h y^x = 4.00	

My method will save one or two program steps, depending on how it is used.
Sincerely,
Bill Hurdle

Beyond Your Owner's Handbook

If you are curious about what others do with their programmable calculators and if you want to "meet" some of these enthusiasts through "pen pal" or "share a program" functions, be sure to read the following letter.

Dear Editor:

Although our Club has appeared before in your newsletter, I thought you might enjoy hearing about some of the applications of HP calculators by this very dedicated group of HP calculator enthusiasts who are always finding clever ways to make their HP calculators do more and thus provide increased capability and enjoyment. We call these unusual uses of the calculator "advanced applications," because they are more than just clever programs. I realize that some of these applications are rather unconventional, but they do show what dedicated Users can accomplish when given the high quality and well-thought-out machines that HP manufactures. A few examples are listed below.

1. **HP-65 Lampman Split Logic.** This is a little known characteristic of the HP-65 where the instructions for keyboard rows two and three can be split by any number of stack operations or logic compares. Using this approach, it is efficient to program five-way branching, storage in registers dependent on stack order, etc.
2. **HP-65/67/97 Correction Card.** This easily modified magnetic card allows quick, reliable, and convenient rewriting on a clipped-corner magnetic card.
3. **Rausch Keyboard Overlay.** This overlay and coding method facilitates easy alphabet inputs and outputs for games and message encryption. This Rausch Overlay concept can be applied to all HP programmables.
4. **HP-65/67 Timers.** These are incrementing and decrementing counters that use "non-normalized numbers" (NNN's) to implement precise control of timing of displays. The "Moon Rocket Lander," for example, can have the keyboard "locked out" during the countdown so that anxious key-punchers can't stop the program—as happens when using the conventional pause.
5. **HP-67 Display Words and Phrases.** By using specially generated NNN's and storing them in registers, the numbers 0 through 9, the letters r, C, o, d, and E, and "blank" may be arranged in the display in any desired order to make a limited—but very effective—vocabulary of several thousand words/phrases. For example, a biorhythm program tells you, in English words in the display, how your day is going to be. The "Arithmetic Teacher" program (similar to Standard Pac SD-13A) indicates word responses to each problem and displays such things as: "score is" and "goodbye" when the session is finished.
6. **HP-97 Special Graphics.** This makes it possible to print the digits 0 through 9 and ., −, ×, *, and "blank" across a line of 11 or 12 spaces, and *in any order.* These NNN's are called from registers and printed as patterns to make letters, words, large banners, plots, tic-tac-toe grids, etc.

Space doesn't allow many details. If your readers are interested in obtaining more information on these and other programs, techniques, and advanced applications, they may send a 9 - by 12-inch self-addressed envelope with 24¢ of firstclass postage to:

PPC Club
2541 W. Camden Place
Santa Ana, CA. 92704

Effective January 1, the HP-65 Users Club will change its name so Users won't think that the Club's activities and newsletter are limited to only the HP-65. The new name will be **PPC.** These letters have no specific meaning but could stand for "Personal Programmers Club."

The present format of KEY NOTES is great. Your publication provides an important service to HP calculator Users to keep them informed on what is happening in the world of HP "personal computing." Good luck and best wishes for 1978.
Happy Programming,
Richard J. Nelson,
Editor, **PPC JOURNAL**

(Many of the "advanced applications" described above make use of what are sometimes called "hidden characteristics;" that is, characteristics that are not documented in the owner's handbooks, sales literature, or otherwise made available through HP sources. There are three main reasons why we might choose not to support these "hidden characteristics." (1) We cannot guarantee that these characteristics will be available in every calculator of a particular model; (2) improper use or implementation of some characteristics could cause damage to the calculator; and (3) it might require physical modification of the calculator to access some of these "hidden characteristics," and the modification will void our warranty. Ed.)

Blank Cards By The 1000

On December 1, 1977, we introduced a new accessory: A box of 1000 blank magnetic cards. That's right! **One thousand blank cards!** No frills, no plastic bags, no card holders; just a long, flat box of cards.

This package is intended to satisfy the needs of large industrial customers who develop their own software and distribute it internally. These customers—and some dealers—often have requested that we should offer some sort of quantity packaging/pricing of blank cards. For example, we have had requests for quotation on quantities up to 80,000!

Now the "1000" package is a reality! And the price is only $195* for a box of 1000. That's merely 19½ cents a card! The part number is 00097-13206, and it is available at your local HP dealer. If not in stock, you can order directly from the factory, **but only if you live in the Continental U.S.A., Alaska, and Hawaii.** And you must follow the five considerations set forth under **More Software For The HP-19C/29C,** on page 6.

Elsewhere in the world, contact your nearest HP Sales Office if you cannot locate this new accessory.

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

A Sticky Problem?

In the June 1977 issue of KEY NOTES we published an article about using two pieces of transparent tape to attach magnetic cards to almost any surface. The originator of the idea recently wrote to us to comment further on the idea.

Dear Sir:

Thank you for printing in Vol. 1 No. 2 my suggestion on how to make card storage tape. Since then I have discovered that the double thickness of adhesive between the tapes can ooze out along the inside edge and at the ends where the lengths are cut.

Inspection of several hundred cards mounted in Application Pac books for about a year revealed that several cards did have sticky adhesive on them. This adhesive can be removed from the magnetic card by pressing on a piece of tape and pulling it off.

The added thickness of the pac books causes pressure on the tape and occasional oozing of adhesive with time. However, no problem has been experienced when cards are merely attached to a surface for convenient use.
Sincerely,
Richard A. Milroy, Annapolis, MD.

Mr. Milroy has pretty well stated the case; however, there is one thing to watch for, as brought to our attention in a letter from **Robert Olsen** of Placentia, California. While the adhesive that might ooze onto a card will not harm the card, it will have a tendency to "gum up" the card reader. So if you have cards stored in this manner over a long period of time, make sure they are clean before running them through your calculator.

In spite of this slight nuisance, we still think Mr. Milroy's card storage idea is a very good one.

Keep Labels In Order

Sometimes a simple solution to a problem escapes us because we are engrossed with the complexity of the problem and are looking for a complex solution. Here is a neat idea that is a simple solution for keeping your labels in some semblance of order.

Dear Sirs:

Here is a User's tip: It is often useful to use labels *starting* with f E through f D etc., then 9, 8, 7. This saves the lower-numbered labels for indirect control purposes. Where a program is long, this is sometimes the only method that will allow the program to be shortened enough to fit into 224 steps. Similarly, labels might be used starting with E, D, C, etc., so that a "stuffer" loop will allow input into 1, 2, 3, 4 in order.

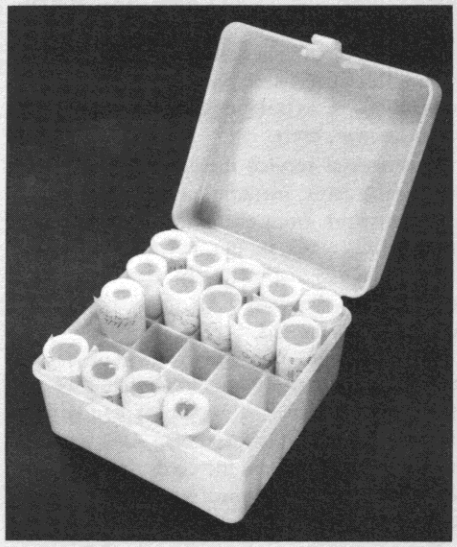
By use of these two methods, one of my programs that at first writing took 315 steps was cut down to 222, although I must admit there were other refinements.
Yours truly,
R.G. Newbury, Toronto, Canada

HP-97 Tape Storage Solved!

Until we received the following letter, we had never given a tremendous amount of thought to the problem of storing long tapes from the HP-97. But the effort has been spared us, because the writer has a perfectly elegant and most satisfactory solution.

Dear Editor:

Soon after receiving my HP-97 I discovered the need for a way to file printouts of data. Many of them were very long, so filing them flat was awkward. I discovered that plastic, 12-gauge shotgun shell boxes are ideal for this



purpose. A typical box measures 4½ by 4½ inches by 3 inches high and is divided into 25 sections, each $^{13}/_{16}$ inch square. Up to 200 inches of printout easily can be stored in each section. These boxes are readily available from stores specializing in hunting supplies.
Sincerely,
David L. Smith, Burlington, MA.

New Type Of Almanac

Last year, just after we put KEY NOTES "to bed," we got a letter from **Louis A. Valier** of Honolulu, Hawaii, about a new almanac that should interest quite a few readers. It will interest surveyors as well as mariners, and is called, *The Star Almanac For Land Surveyors For The Year 1977*. It was prepared in England by H.M. Nautical Almanac Office.

Although in its twenty-seventh issue, the exciting thing about this particular one is that it includes a new section. In order to increase the accuracy of the coordinates of the Sun to 1" of arc, and as an alternative to the main tabulations of Greenwich sidereal time, monthly sets of polynomial coefficients are given for use with small programmable calculators.

This almanac is available in North America from the following offices of Pendragon House: 2525 Dunwin Drive, Mississauga,

(Continued)

Ontario, Canada L5L IT2; or P.O. Box 5, Rowayton, CT 06853; or P.O. Box 132, Mount Prospect, IL. 60056; or 2592 E. Bayshore Road, Palo Alto, CA. 94303.

Customized Mag-Card Pacs Now Available

Because we have had repeated requests to produce customized magnetic program/data cards for first the HP-65 and now the HP-67/97, we are making this service available.

Generally, this service would best benefit individuals and those companies who want to supply both calculators *and* specialized, product-oriented software to such users as sales representatives, field engineers, etc. in order to more effectively sell *their* products (e.g., control valves, lighting equipment, insulation, life insurance, etc.).

This special service includes all aspects of making the cards, including: (1) preparation of master artwork from customer input data and printing the cards in our normal multicolor format and (2) magnetically encoding your programs on the cards. *No program-writing services are included.*

While the minimum order we will process is 100 cards, the most economical quantities are 500 copies or more, although we can supply virtually any quantity of cards. Also, special logos can be printed on the cards to meet your needs. It is not economically feasible to print small quantities.

You can get more information about this new service by contacting the local HP Sales Office. Ask for the Consumer Calculator Salesperson and she or he will help you with your particular application.

Blinking Decimal Points?

That title might be misleading—because this is a *good* idea! At least it works well for the following User, and we'll bet that a lot of our readers will like this useful trick.

Dear Editor:

I thought that other HP KEY NOTES readers might be interested in my solution of a small, but fairly common, problem:

When running long programs on my HP-67 where more than one answer will be output in succession, constant watching of the flashing display while it calculates is usually necessary to avoid missing the first answer. To minimize the need for such constant attention, I use a three-program-step method for signalling the start of the display routine and also to separate groups of data within a display sequence:

KEY-ENTRY	KEYCODE
.	83
f -x-	31 84
h R↓	35 53

This blanks out the entire display for 5 seconds, except for a blinking decimal point, and works in all display modes. Its use not only brings emphasis to specific answers but also helps you keep track of where you are in the data output stream.

The first two steps lift the stack and place a zero in the X-register; the h R↓ step restores the stack to its original position, except for the T-register, which will then contain zero.

As a draftsman in a steel fabrication business I find that the HP-67 is the most important tool I own. It performs in seconds operations that used to take me minutes, and its accuracy is absolutely incredible.

Keep up the good work...

Richard E. Rose, Sacramento, CA.

Key Notes Schedule

Because many people have asked us for the schedule for KEY NOTES for this year, here it is: February 3, May 1, August 1, and November 1. These are the dates on which it is scheduled to be mailed. Depending on where you live, it will take anywhere from a few days to a few weeks to get to you.

Also, if you live in the European area, there will be a slightly longer delay because we send only negatives to Europe, and the newsletter is then printed and distributed by the Library in Geneva.

More Software For The HP-19C/29C

In the last issue we told you about our two new keystroke programmables with *Continuous Memory,* the HP-19C and the HP-29C. We also told you about the new *Users' Library Solutions* books for the HP-67 and HP-97. Well, since the "Solutions" books have been so overwhelmingly popular with HP-67/97 owners, we have had many, many requests for the same type of book for the HP-19C/29C.

Therefore, check with your HP dealer after February 1st for the 10 new *HP-19C/29C Solutions* books listed below. Your HP dealer may have ample quantities of the new "Solutions" books by then. However, if you can't find them or if a dealer is out of a particular book, you can order directly from the factory. There are, however, several considerations:

1. Factory-direct orders are good only in the United States (including Hawaii and Alaska).
2. You must allow up to 3 weeks for normal delivery.
3. Your order must include a negotiable check (or money order), in U.S. dollars, drawn on a U.S. bank, and must include any State or local taxes.
4. You must order by book name and part number.
5. You must mail your order to:

Hewlett-Packard Company
Order Processing Department
1000 N.E. Circle Boulevard
Corvallis, Oregon 97330

There is at least one nice surprise. Each new *HP-19C/HP-29C Solutions* book is priced at only $7.50*. And since each book contains at least 10 programs, it is a genuine bargain in this era of inflation.

00029-14001 Mathematics Solutions
00029-14002 Statistics Solutions
00029-14003 Finance Solutions
00029-14004 Electrical Engineering Solutions
00029-14005 Surveying Solutions
00029-14006 Games
00029-14007 Navigation Solutions
00029-14008 Civil Engineering Solutions
00029-14009 Mechanical Engineering Solutions
00029-14010 Student Engineering Solutions

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

Not *Another* NOP?

Surprisingly, we have had a lot of mail about the lack of a NOP (no operation) key on the HP-67/97, and about substitutes for such a key. In Vol. 1, No. 1, we recommended using a label that is never called. In Vol. 1, No. 2, a reader wrote to us to recommend the use of "h SPACE." Now, here is another letter, with another recommendation. But, by now, you can see that whatever fits *your* situation is the "NOP" to use.

Dear Editor:

When converting HP-65 programs to the HP-67/97, a better replacement for the HP-65 NOP is to use the MERGE key on the HP-67/97. This is much easier to use than to (1) use an unused label or (2) set or clear an unused flag.

The MERGE key, when executed in a program, will operate as a NOP except for one infrequently used case. That is, when a PAUSE statement follows the MERGE keycode, and the pause is used to input cards into the program. In this case, when the MERGE and PAUSE statements are executed, the cards are merged into the existing program, or data registers, instead of replacing them, which may lead to some highly undesirable results. Other than for this infrequently used case, the MERGE key works perfectly as a replacement for the HP-65 NOP, and leaves all the flags and labels to be used for programming and for optimizing new programs.

Sincerely,

Lt. Richard P. Henderson, Dayton, Ohio

Now...here is *another* letter, and we hope the last on this subject...

Gentlemen:

The June 1977 issue has a comment on NOP's on page 10. While the "h SPACE" can serve as a NOP on the HP-67, it is *not* a NOP on the HP-97. Programs written this way for use on an HP-67 could advance a lot of blank paper if the "h SPACE" happened to be in a loop that is executed many times. Therefore I would like to suggest the following alternates that are suitable for either the HP-67 or the HP-97.

1. If your program doesn't use any trigonometry functions, then "h DEG" serves as a harmless NOP.
2. If you are using trigonometry functions (in radians, say), use the mode that agrees with the mode you already are using: "h RAD."
3. Just repeat the display format that you have chosen. For example, if that should be "g SCI, DSP 6" then either "g SCI" or "DSP 6" could serve as NOP's.
4. Clear a flag that isn't used by the program.

All of these are instructions that can be executed without changing anything to supplement your recommendation of using an instruction that is never executed (e.g. "LBL 9").
Sincerely yours,
John E. Miller, Lakewood, CO.

IRS Changes "Taxes"

The tax season is upon us again and with it the usual hair-pulling, pencil-sharpening, and countless erasures. But don't despair, this year help is available from your trusty HP-67 or HP-97 in the form of the *Users' Library Solutions* book, *Taxes,* which has recently been revised for the 1977 tax season and is available on your dealer's shelves. It includes programs to aid you in income averaging, medical and dental deductions, maximum tax on earned income, and many more. Whether you are a tax practitioner or just a struggling individual filer, you owe it to yourself to drop by your local dealer and look at the 1977 tax book.

Some of you already might have bought the first *Taxes* book, which was brought out in mid-1976 before the current changes in the tables, forms, and laws were made by the IRS. There is no need to throw it in the waste basket. With the minor changes listed below, many of the programs still can be useful in the current tax season. (If you're not sure which book you have, look near the bottom, center, of the back cover. If it does not say 1977, it is the old book.)

Changes to the "old" book are as follows:

INCOME TAX PLANNING-I

On page 11, under "Program Description," delete the OTI description and add:

OTI = Ordinary Taxable Income (Form 1040, Line 34) minus Exemptions × 750 minus one of the following three:

3200 Joint
1600 Separate
2200 Single

and minus 0.5 × CG.

Even with the changes, there will be minor differences in the computation of the regular tax (as computed by table A-D) and the income averaging tax, but the differences are well within the tolerance required for tax planning.

FEDERAL INCOME TAX...

On pages 28 and 34, re-define Taxable Income for step 2 as follows:

Taxable Income = Schedule TC, Line 3, minus one of the following three:

3200 Married
1600 Separate
2200 Single

MAXIMUM TAX...

First, load the program (page 43), then switch to PRGM mode and key in the following changes.

GTO .029	GTO .009
DEL	DEL
2	2
BST	BST
BST	BST
DEL	DEL
DEL	DEL
4	5
0	5
2	2

Now, record the program on a new card. And, of course, all form line numbers have to be changed to conform with the new IRS forms.

INCOME AVERAGING TAX

On page 48, steps 4 and 5 are redefined as follows:

Taxable Income = Schedule TC, Line 3.
Base Period Income$_n$ = Entries for Schedule G, Line 1, plus one of the following three:

3200 Married
1600 Separate
2200 Single

And, again, all form line numbers have to be changed to conform with the new IRS forms.

TAX PLANNING II

Because of the large number of changes made by the IRS, this program has been deleted from the new *Taxes* book. The concept of the program still is good, but the new law has rendered the program practically useless.

Even though these revisions will update your old book, you may still want to stop by your HP dealer and look at the new book. Some of the added programs may be of interest.

Application Pac Corrections

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

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

Please note that, because of a delay beyond our control, the following new "revised" cards will not be available until after March 6, 1978. None will be mailed until *after* that date.

HP-67/97 NAVIGATION PAC

Program NAV-01, "Estimated Time of Arrival," should have an H.MS→ (HP-97, or H← if HP-67) command inserted at step 065 (immediately following LBL 6). Mark the correction in your book. To receive a revised card, **you must send your old card to:** *HP Service Department, P.O. Box 999, Corvallis, Oregon 97330.*

"Star Line of Position" program card NAV-08A7, "Star Data 6," has the incorrect sign for the Sidereal Hour Angle of the star *Shaula.* On page L08-13, delete the CHS at step 042. *(Shaula, the sting of the scorpion, was an unlucky star with astrologers, and not too good for us, either! Ed.)* To receive a revised card, **you must mail your old card to:** *HP Service Department, P.O. Box 999, Corvallis, Oregon 97330.*

HP-67/97 ME PAC

Program ME1-22A, "Conduit Flow," has two errors. To correct your book (pages L22-01 and L22-02), insert "STO 5" after step 126 and insert "LSTX" and "÷" after step 034. To receive a revised card, **you must mail your old card to:** *HP Service Department, P.O. Box 999, Corvallis, Oregon 97330.*

Program ME1-03A, "Stress On An Element," needs an addition on page 03-06. At the left center of the page under "Keystrokes:" add the following directly under f B: 30 EEX 6 ENTER↑ .3 f D These keystrokes are implied, but they were not printed in the book. **No new card is needed for this change.** Just mark the additional keystrokes in your book so you won't forget them.

67/97 CE PAC

Program CE1-17A, "Reinforced Concrete Beams," has a small, but disconcerting keystroke error in it. On page L17-02, the "x" at step 148 should be a "÷". Because of this, the program would not work for $f_c > 4000$. To receive a revised card, **you must mail your old card to:** *HP Service Department, P.O. Box 999, Corvallis, Oregon 97330.*

"Rounding" Revisited

As you read in the last issue, **Gary Tenzer's** "Rounding the HP-67/97 Display" article in the June 1977 issue raised quite a storm of letters, and the ideas printed in the last issue created another deluge. It is now obvious that there are many, many ways to "round" the display and, because people "customize" their routines to fit their specific program needs, it

(Continued)

would take a whole issue of KEY NOTES to present all of them.

So, before we beg off of this subject, there are two things left to do. One is to thank all of you who wrote about "rounding" and the other is to print a correction for a routine in the last issue, to wit:

Dear Editor:

Many readers will write in to tell you that my floating point subroutine will not work as printed in the October 1977 KEY NOTES. An alteration must be made for large negative numbers, and steps 015 and 025 are misprinted. The modified subroutine is enclosed. I apologize to any frustrated readers who attempted to use the subroutine.

Sincerely,

Duane Chapman, Rancho Palos Verdes, CA.

And here are the *correct* keystrokes:

001	*LBL1	014	SCI
002	FIX	015	CLX
003	ABS	016	STOI
004	EEX	017	+
005	1	018	*LBL2
006	0	019	DSPi
007	X≤Y?	020	ENT↑
008	SCI	021	RND
009	LSTX	022	X=Y?
010	DSP9	023	RTN
011	ENT↑	024	ISZI
012	RND	025	X≠Y
013	X≠Y?	026	GTO2

SD-05A Revisited

Mr. Harold S. Stone of Berkeley, California, wrote to us recently to point out a shortcoming in our October 1977 KEY NOTES article, "HP-67/97 Standard Pac Error?" on page 9. While our suggestion for avoiding a potential error in the use of SD-05A "Annuities and Compound Accounts" in the Standard Pac was helpful, it did not go far enough.

As Mr. Stone accurately points out in his letter, while our suggestion relieves a potential ambiguity, it also leaves the User with an Error message on some attempts to solve for the interest rate.

Fortunately, Mr. Stone's letter goes on to offer a partial remedy. It involves "... replacing the initial guess formula (for the iterative solution of I) with a very simple initial guess of 1%." Although admittedly not the perfect solution, it is for most realistic problems a substantial improvement.

For those of you who use SD-05A frequently, we recommend ordering Mr. Stone's recently accepted Library program #01583D, Annuities and Compound Amounts.

Stick With Tape!

Gentlemen:

Have you ever tried *Scotch*® Double Stick Tape (marked CAT. 136) for mounting program tapes to your Program Listing sheets? It works terrifically, and you don't have to worry about the printing fading if glue comes in contact with it because this tape is applied to the back of the machine tape.

Sincerely yours,

Otto Barth, Schaumburg, Illinois

"Smoothing" The Rough Edges

For those who bought the *Users' Library Solutions* book, *Marketing/Sales,* here are several suggestions for improving the program, "Forecasting Using Exponential Smoothing."

Load the program, and switch to write-program mode. Now press GTO . 012 DEL DEL DEL GTO . 014 DEL SST 9.

In the users instruction Mode 1, replace steps 10 through 15 with the following instructions:

10. Using the α associated with the smallest forecasting error, repeat steps 3-8 one last time.
11. Save the smoothing factor (α), the smoothed average (S_{t-1}), and the smoothed trend (T_{t-1}) for future use by creating a data card. (Press the write data key and run a blank card through the card reader. Clip and mark card.)

In Mode 2, replace steps 2 through 14 with:

2. Enter data card.
3. Key in the current data (X_n) ---------- B. NOTE: Repeat 3 for multiple values.
4. Calculate forecast for next period (D_{t+1}) ---------- C.
5. Store forecasting constants for use for next period. (Press the write data key and run a blank card through the card reader. Clip and mark card.)

As a final note: When using the seasonal value, be certain that the first seasonal value stored in register 0 (Mode 1, Instruction 2-b) corresponds in time to the second historic value (X_2) (Mode 1, Instruction 3). This is a correction of the misprinted note that appears in some program versions.

These changes should make the program considerably easier to use. They will also alleviate a source of potential error in selecting the best smoothing factor (Mode 1) when seasonal factors are used.

®Scotch is a registered trademark of the 3M Company.

Don't Cover Your Keyboard!

Two years ago we published an article in KEY NOTES in which we told you that plastic sandwich wrap could be stretched over your calculator's keyboard to protect it from dusty or dirty environments.

Because there now are some types of plastic film that can chemically react with the ink used on our later keyboards, we do not recommend that you use this idea. If you absolutely must use your calculator in a highly dusty area, you can temporarily put it in a plastic bag of the type with a self-closing seam. Then remove it from the bag as soon as you leave the harsh environment.

HP KEY NOTES

February 1978 Vol. 2 No. 1

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

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Editor, HP KEY NOTES
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Corvallis, Oregon 97330 USA

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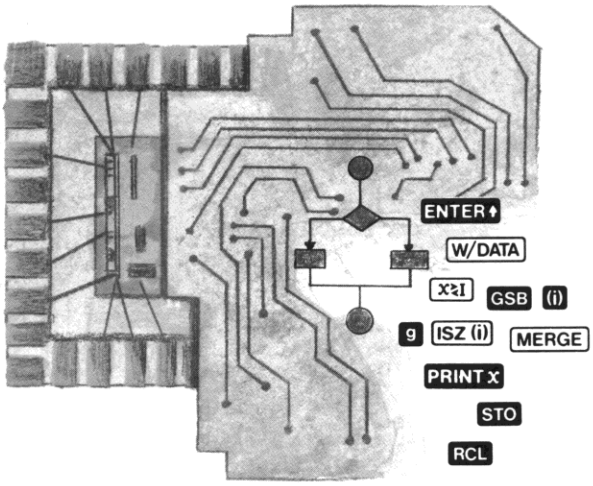


Featuring, this issue:

HEWLETT hp PACKARD

HP Key Notes

May 1978 Vol. 2 No. 2

New Design ... New Prices ... Series E is Here!

On April 17 Hewlett-Packard announced the new Series E calculators, an extensive low-end product line that presently includes five new machines.

Among the new features of Series E are:

- **New level of accuracy:** gives you confidence that your answers are correct.
- **New larger, "tilted" display:** makes it easy to read over a wider viewing angle.
- **New display format:** uses *commas* to aid legibility and number recognition.
- **New Error codes:** tell you *what kind* of mistake you made.
- **New self-test capability:** allows *you* to check the calculator for possible malfunction.

And there is much more, including a new modular handbook system. But you'll have to actually *see* these new calculators before you'll believe what they can do. It would take an entire issue of KEY NOTES to begin to cover the many advances in Series E. Here is a short summary to whet your appetite!

HP-31E SCIENTIFIC $60* A basic preprogrammed calculator with 4 storage registers.

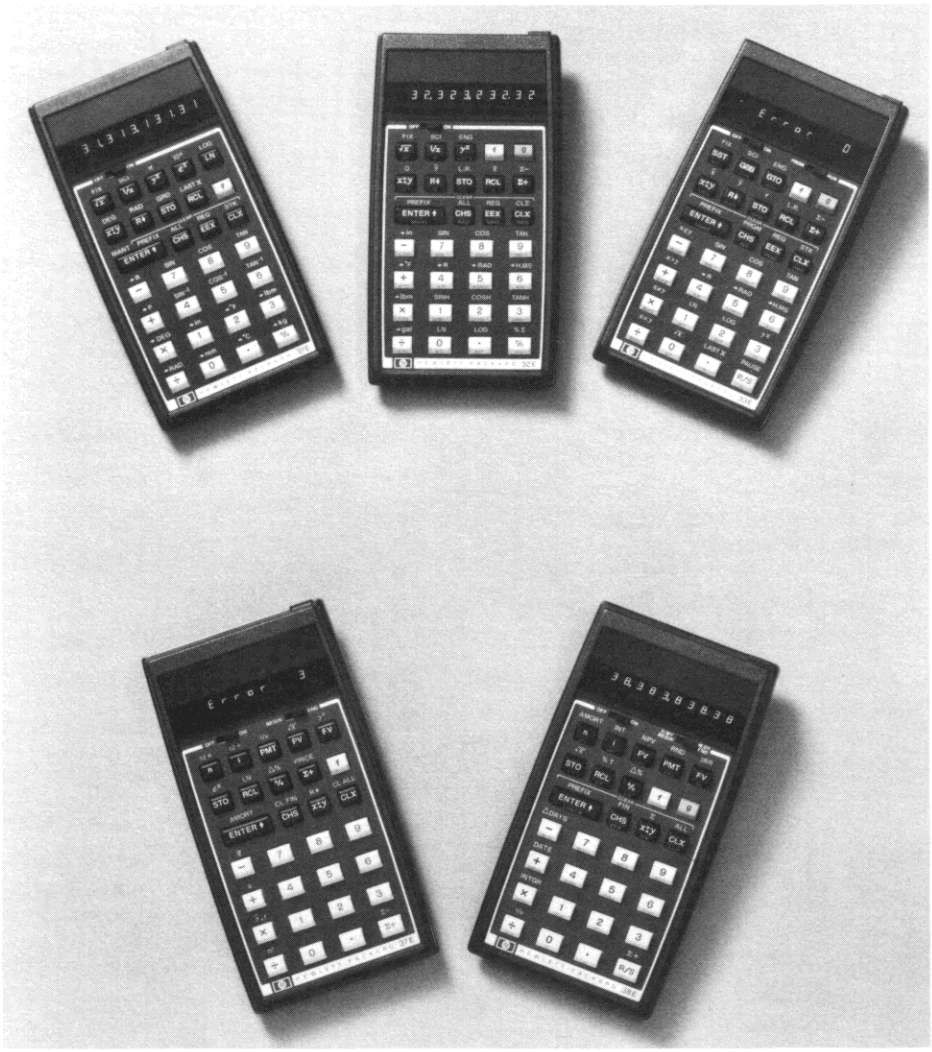
HP-32E ADVANCED SCIENTIFIC WITH STATISTICS $80* An advanced, preprogrammed calculator with a powerful set of statistics functions and 15 storage registers.

HP-33E PROGRAMMABLE SCIENTIFIC $100* A programmable calculator with 49 fully merged program lines and 8 storage registers.

HP-37E BUSINESS MANAGEMENT $75* A basic calculator for business and finance, with financial, retail/percent, and statistical functions and 7 storage registers.

HP-38E ADVANCED FINANCIAL WITH PROGRAMMABILITY $120* Our first programmable financial calculator, with up to 99 fully merged lines of easy programming, plus IRR for 20 groups of cash flows with up to 99 cash flows in each group, a 2,000-year calendar, and up to 20 storage registers.

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



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

Library Corner

As of April 13, there were 2,311 programs in the HP-67/97 Users' Library in Corvallis. It seems they come in bunches, and we are at present facing another large bunch to review, log into the system, and add to the list.

HP-67/97 LIBRARY NEWS

In the last issue we told you that *Library Catalog Addendum 2* would be mailed in April. Let's make that "about May 15." It isn't a pleasure to move the date back, but paper shortages, printing problems, and interstate problems beyond our control have delayed the mailing by one month. On a positive note, the addendum will contain programs from #00918D through #01800D, and we know that you will spend many hours reading abstracts about some really fantastic programs. As you gain ever more experience and expertise, the quality and variety of programming moves from merely "excellent" to "sensational." Keep up the great work!

Another item that will be of interest to you is that subscription renewal letters for HP-67/97 Library members will be mailed starting about the end of May.

Don't forget that there are now *two* ways to buy a Library program from Corvallis: (1) the regular $3* fee for only the program and (2) a $5* fee for the program *and* a prerecorded card.

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

HP-65 LIBRARY NEWS

As you know, the HP-65 Users' Library is closed for submittals and remains at 5,554 programs. However, through an unfortunate oversight, two programs that should have been included were mislaid. This matter is being corrected by publishing the abstracts below. Thus, there are *actually* 5,556 programs from which to choose.

Also, another milestone to remember: The original HP-65 Library Catalog supply has been exhausted and will not be reprinted. However, we still have supplies of Catalog Addenda 1, 2, and 3.

65 Normal/Lognormal, Parameters (#05555A)*

Computes and stores the mean, variance, standard deviation, and standard error for the normal (M,S^2, S,SM) and lognormal (MU,SIG^2, SIG, SIGMU) distributions (given the data XI, I=1 to n). It also computes and stores the median (EXP(MU)), coefficient of deviation (EXP(SIG)), and coefficient of deviation of the mean (EXP(SIGMU)). Negative values and zero are discarded for the lognormal computations. Registers are protected from accidental destruction. (199 steps)

Author: **Frederick A. Olson**
Camillus, New York

**In European areas, order by number 51646A.*

65 Capacity of Curb Opening Inlets (#05556A)*

This program will compute the depth of flow and spread of a known quantity of water flowing in a street, also the capacity of curb opening inlets on a continuous grade, giving the inlet length required to intercept the entire gutter flow. It also will design or analyze known inlet length. The program is used by the Montgomery County Department of Transportation and the Washington Suburban Sanitary Commission (both located in Maryland. (100 steps)

Author: **Philip A. Hendrick**
Wheaton, Maryland

**In European areas, order by number 51647A.*

ORDERING PROGRAMS

Any program you see in HP KEY NOTES can be ordered either from the Users' Library in Corvallis, Oregon, or from the Users' Library in Geneva, Switzerland. (Both addresses are on the back cover.) For most of the world, use the program number listed next to the program's title, then order it from Corvallis. The only exception is if you live in the European areas; in that case use the number listed in italic type below the program abstract, then order it from Geneva. Payment for programs must conform with the instructions from *your* area Library. **Always use order forms if possible,** and be sure to include any state or local taxes.

NEW HP-67/97 PROGRAMS

Here are a few new programs you won't find in the new Addendum 2. Before you order *any* of these programs, be sure you read the paragraph on **Ordering Programs.**

67/97 Lifetime Program (#02025D)*

This program estimates your lifetime in years. Given the answers to various questions in the areas of heredity, health, diet, exercise, education, occupation, and life-style, the calculator determines your expected lifetime. Starting with individuals 20 years old or over, the program first finds the base expected age from your sex and present age, and then a value is added to or subtracted from your base age, depending on the responses to questions. (223 steps)

Author: **Bruce G. Hansen**
Lansing, Michigan

(Fascinating! Juan Ponce de Leon should have had an HP-67/97; it would have discouraged his search. However, for me, the program turned out to be a veritable "fountain of youth!" Try it, you'll like it. And if you hate the answer, well ...you can always cheat a little! Ed.)

**In European areas, order by number 00293D.*

67/97 Three Gravitating Bodies in a Plane (#02161D)*

Given the masses, initial positions, and initial velocities for three bodies (e.g., stars) moving in a plane, this program will integrate their positions forward in time, using a straightforward algorithm. The program also computes the energy of a given configuration and it will adjust particle velocities so that the center of mass appears stationary. There are two cards; one sets up the configuration and the other integrates it. (430 steps)

Author: **Harold T. Coderre**
Princeton, New Jersey

(Very good, Mr. Coderre! The chart and graph help an already fine program. And your second one, below, also is a contribution. Ed.)

**In European areas, order by number 00294D.*

67/97 Fundamental Physical Constants (#02162D)*

This program outputs the values of nine fundamental physical constants in either C.G.S. or M.K.S. units. The user can call up the values of the speed of light, the charge on an electron, Planck's constant, Avagadro's number, the mass of an electon, the mass of a proton, Boltzmann's constant, the universal gravitational constant, or the energy of 1 electron volt. Only one storage register is used and the stack is undisturbed. (205 steps)

Author: **Harold T. Coderre**
Princeton, New Jersey

**In European areas, order by number 00295D.*

"25 Words or Less"

In the last issue, **James S. Hayden** (Edwards, California) suggested that we should add *this* column to HP KEY NOTES. Evidently our readers agree, because we received a lot of encouragement and many inputs for the column. It might not be possible to print all of them, but we'll try our best.

And, remember, don't limit yourself to 25 words if it takes more than that to explain your contribution.

Here are three routines from the first contributor, **Hugh Kenner,** of Baltimore, Maryland.

Y^x FOR LARGE NUMBERS: x ≒ y, LOG, x, FRAC, LSTX, INT, x ≒ y, 10^x, RTN. The result is in the X- and Y-registers in the form x EEX y.

TRIANGLE SOLUTION, ANGLE GIVEN 3 SIDES: Enter sides in stack to start: a ENT↑, b ENT↑, c. Then program: ENT↑, x^2, R↑, x^2, −, R↑, x^2, +, x ≒ y, ÷, x ≒ y, ÷, 2, ÷, arc COS, RTN. The display shows the angle opposite side a.

TRIANGLE SOLUTION, GIVEN 3 SIDES AND INCLUDED ANGLE: Start with side, angle, side in stack: a ENT↑, b ENT↑, c. Then program: x ≒ y, ENT↑, R↑, →R, R↑, −, CHS, →P, R/S (side B in display), CLX, π, R→ D, x ≒ y, R/S (angle A in display), R↑, +, −, RTN (angle B in display).

Now, two examples from **Shellman H. Brown,** Hyde Park, New York.

FLAG FLIP-FLOP: This routine avoids the GTO and LBL of the example shown in "Vector Operations" in the Standard Pac. Program: LBL E (any label), 1 (assume on), F?1 (test flag), CLX (indicate off), SF1 (assume on), x = 0 (test indicator), CF1 (turn off), RTN.

FLAG TEST: Mr. Hayden's simple flag test (Vol. 2 No. 1, page 1) ducks the difficult part: resetting of flags 2 and 3. Best I can manage is 25 steps; maybe someone else can improve it. This program is to be read in after g MERGE. Program: LBLe (load LSTx), ABS, CLx, F?0, GSB4 (display 0 if on), 1, F?1, GSB4 (display 1 if on), 2, F?2, GSB2 (display 2 if on), 3, F?3, GSB3 (display 3 if on), LSTx (restore x), RTN, LBL2, SF2, GTO4, LBL 3, SF3, LBL4, PAUSE, R↓, RTN.

And, for brevity, how about *this* one from **Frank P. Rust,** Salt Lake City, Utah.

PRINT-PAUSE ROUTINE: The following is shorter and saves one label over the print-pause toggles used in the Standard Pac programs. For a 0 or 1 input: LBLE, SF1 (sets flag 1), x = 0? (if input was 0, then clears flag; otherwise, leaves flag set), CF1, RTN.

(However, the above routine requires User inputs; the Standard Pac routine does not. Ed.)

Here is one that was once supplied by our Customer Support to **Richard Scott** (Fairbanks, Alaska) and now is coming back to KEY NOTES readers.

COMPARING THREE VALUES TO FIND THE SMALLEST: Assume A, B, and C in registers 1, 2, and 3. Program: RCL2, RCL1, x ≤ y, GTO1, X ≒ Y, LBL1, RCL3, x ≤ y, RTN, x ≠ y, RTN.

From **Valerie Van** (Sacramento, California) comes this neat routine.

THE LAZY BONES ADDING MACHINE: I gave it that title because it shows one possible use of Data Entry Flag F3 (which is set to "true" when a number is keyed in), coupled with the pause for data entry. The routine works best for the HP-97, because the sound of the printer prompts you to key in your next number. If you fail to do so, you are given extra time in the form of two more PAUSE's. If you *still* don't respond with a number, the routine gives you the current total and stops. The summation is resumed by keying a new number followed by [A]. Register 1 must contain zero initially. For the HP-67, omit the PRINT and SPACE instructions. Labels 1 and 2 aren't really necessary in this format of the routine, but were included to more clearly show the routine's division into subroutines. Program: LBLA, ST+1, PRINTx, CF3, PAUSE, F3?, GTOA, GSB1, RTN, LBL1, PAUSE, PAUSE, F3?, GTOA, GSB2, RTN, LBL2, RCL1, SPACE, PRINTx, RTN.

Around the world from Tel Aviv, Israel, comes this contribution by **Micha J. Schocken.**

INPUTTING/RETRIEVING VARIABLES/RESULTS: Please consider the following sets of subroutines that I have found useful for inputting/retrieving variables/results totalling up to 25 inputs and results, where assigning user-definable keys to various subroutines proved to be impractical. Program: LBLA, STI, R↓, STO(i), RTN, LBLD, STI, LBLe,* RCL(i), R/S, ISZ,* GTOe,* LBLE,* CLx,* STI,* GTOe.* To use this, key in the value to be stored, press [ENTER↑], key in the register to be used (say, 12) and press [A]. Continue until all inputs are keyed in. Then, to recall a register (say, 12) key in the number and press [D]. To see the next register, press R/S. To retrieve *all* registers in sequence, press [E] and then R/S for as many inputs as you made.

If program memory is overloaded, this 16-step set of subroutines can be reduced by omitting the steps marked * at the loss of only the retrieval-in-sequence feature.

This input is more like the "25 Words" part of the column title. Submitted by **Jon Brewster** (Corvallis, Oregon).

SAVE ONE STEP: Sometimes saving one step can save a program. If you are a surveyor, astronomer, navigator, or geometry buff, and you need to generate 180°, try: π, R → D.

The following routine will neatly store 24 values in the order in which they are keyed in. Donated to KEY NOTES by **Richard H. Baker** of Queen Creek, Arizona.

STORE-IN-ORDER: Program: LBLA, STOE, RCLE, STO(i), ISZI, RCLI, 2, 4, x=y?, GTO1, RCLE, RTN, LBL1, 0, STOI, STOE, RTN. To use, key in, say 24 [A], 16 [A], 83 [A], 38 [A], ..., etc. up to 24 values. The values will be stored in the registers in the order they are keyed in. Additional values cause the program to start over with R_0.

How about this entry by **T. R. Bainbridge** of Kingsport, Tennessee?

AUTOMATIC INITIALIZATION OF CONSTANTS: Program: LBLA (start), F0? (CF0 before recording), GTO1, SF0, ...(generate and store one or more constants), LBL1, ...(use constants in remainder of program), RTN. The routine generates and stores constants only the first time the program is run, when F0 is not set.

And **John B. Hart** (Cincinnati, Ohio) didn't make it in "less than 25 words," but he did add a good idea.

NOTHING BUT R/S: A card filled with R/S instructions is very useful when all steps below a given line in a program are to be deleted. Go to the last line to be saved in a program, key MERGE, and load the R/S-filled card. An R/S-filled card is created by running a card through the HP-67/97 just after it is turned on and switched to PRGM mode.

Now we switch to Pittsburgh, Pennsylvania, and this input from **Edwin J. Borrebach.**

SHORT-AND-FLEXIBLE: For inputting a number of constants into memory, such as the beginning of a program, the following subroutine is short and fully adjustable in length. Program: LBLA (initialize), 14 (or any number between 1 and 24), STI, LBL1, RCI, R/S (data input point. Press R/S to enter data), STO(i), LBLB* (data is okay), DSZ, GTO1 (program continuation is automatic after input of last piece of data).

*Having entered a set of data, if only part of the data is to be revised for another run, this permits a skip-over of those data input values that are not to be revised.

What's in an HP-67 Register?

We get a lot of register-checking routines for the HP-67, so we publish one now and then. But rarely are these routines foolproof, and so they elicit lots of mail—which takes many, many hours to answer. The problem is that it takes a terribly long time to fully check *all* the ramifications of a routine or a subroutine. You never can be sure what might precede it, causing all sorts of problems. Also, maybe we will forget to input oddball numbers, and then find to our dismay that a routine won't work with decimal numbers that start with .0000 etc.

Well, *this* routine looks bulletproof, and it has worked flawlessly ...so far! It is the contribution of **Paul Schüle** of Zurich, Switzerland. It displays the contents of all registers from 0 to 24 if they *do not* contain zero. There is no bothersome I-register display at the end. When you press [E], the number of each register is shown for 1 second, then the register contents are displayed for about 5 seconds. If a register contains a zero, the routine bypasses it. For repeated operation, all you need to do is press [E]. It works, and very well.

If you record the routine on a magnetic card, it can be appended by means of g MERGE to any program consisting of not more than 198 steps. Try it; it works wonderfully well. Key in the routine, switch to RUN and load anything but zero in all the registers, and then press [E].

Congratulations, Mr. Schüle. It appears that you have corrected all the faults of previous routines.

```
001   *LBLE        014    X=Y?
002       0        015    GTO7
003    STOI        016    DSP0
004   *LBL9        017     PSE
005    RCLi        018    RCLi
006    X≠0?        019    DSP2
007    GTO8        020    PRTX
008    ISZI        021    ISZI
009    GTO9        022    GTO9
010   *LBL8        023   *LBL7
011       2        024       0
012       5        025    STOI
013    RCLI        026     RTN
```

A New Almanac For Calculator Users

Thanks to **P. Kenneth Seidelmann,** a director of the Nautical Almanac Office (U.S. Naval Observatory), here is news about the *Almanac For Computers*. It was designed for use with small electronic computers and pocket-sized calculators. Instead of the familiar tabulations at short, fixed intervals, this almanac presents astronomical data in the form of efficient polynomial series, valid for prescribed

(Continued)

time spans. The navigational section contains short representations of the Greenwich Hour Angles (GHA) and declinations of the Sun, Moon, and navigational planets and the GHA of Aries. These functions are represented to navigational precision (±0′.1) as power series of fifth degree, which can easily be evaluated with programmable pocket calculators.

An applications section contains many formulas and algorithms of general utility in navigation and astronomy.

In the astronomical section, Chebyshev series represent such data as the apparent right ascensions and declinations of the Sun, Moon, and planets, nutation in longitude and latitude, sidereal time, and the equation of the equinoxes. Since a small computer is required to evaluate the series efficiently, these data are available in machine readable form. An algorithm for evaluating Chebyshev series is provided in the almanac.

Finally, a list of 176 stars is included. In addition to mean places at the beginning of the year, this list provides data for simply calculating apparent places during the year to a precision of ±0′.1.

The 1978 edition of the *Almanac for Computers* can be obtained by sending a check for $3.00 payable to the U.S. Naval Observatory; 34th and Massachusetts Ave., NW; Washington, DC 20390.

Tip for E.E. Pac Owners

If you have our *E.E. Pac 1,* you'll enjoy—and make use of—this neat improvement to one of the programs.

Dear Sirs:
HP-67 Users who have utilized EE1-18A, "Bilateral Design: Gain and Stability Circles, Load and Source Mapping," may be interested in the following helpful tip.

Besides computing constant gain output circles, the program can readily compute input or constant transducer gain circles. Simply interchanging only the S11 and S22 data entry on card EE-17A, while not altering the data for S21 and S12, allows this computation. No alteration of the program is necessary. This modification of data-input entry extends the usefulness of the program to optimization of transducer gain and noise figure.

To use this tip, load card EE1-17A, then enter S11 data; angle, magnitude, 22. Next, enter S22 data; angle, magnitude, 11. S12 and S21 are left unchanged. Now, load card EE1-18A and compute *input* gain circles.

Sincerely,

Alan Victor, Cooper City, Florida

You're Never Too Young...

Do you remember your 8th birthday? If programmable calculators had existed when you were that age, do you think you could have programmed one? Or do you think that 8 years old is too young to start programming? And if you have guessed by now that we are leading up to something, you're right. We are.

Here is a most remarkable account about an 8-year-old youngster in Israel who can program a 223-step game even though he hasn't yet learned to spell all of the words of calculator jargon we so freely toss around. And the program works; we checked it carefully. Also, he did it by himself, which is all the more startling.

Following is an excerpt from a letter his father wrote to our Product Marketing Manager, then the abstract for the program.

Dear Sir:
Our eldest son, Zvi, has become hooked on programming. It's funny, but he took to it like a fish to water and spends almost all of his free time working out programs for all sorts of things and, for his age (8), really seems to do very well. He's been dying to write a program good enough for the Library, and it is hard for me to explain that it would not be taken. I do want to encourage him, so I promised to send this program (all completely his own work) to HP. It would be super if you could take the trouble to just drop him a note from HP

Sincerely yours,

David Schreiber, Jerusalem

67/97 Noughts-and-Crosses (01884D)*

The game of noughts-and-crosses *(also called tic-tac-toe, Ed.)* is played by two players; one writes noughts (zeros), the other writes crosses (x's) in any of the nine squares in the familiar pattern: #. Players 1 and 2 take turns and "write" a nought or a cross by using the [1] through [9] keys on the keyboard. The HP-67/97 will record the move internally but will not show the move in the display. Thus, the other player cannot see which square was chosen. And if a player tries to play twice in a row, the calculator will catch the double move and flash a 0.000 display. If a player tries to put a cross or nought in a square that already contains one, the number (of that square) flashes in the display. When one player gets three noughts (or crosses) in a row, the calculator indicates which player won and which squares were used.

(Congratulations, Zvi, for a sensational job and for proving what all of our Users already know: HP calculators are easy to program. Ed.)

Author: **Zvi Schreiber**
Jerusalem, Israel

**In European areas, order by number 00296D.*

What Is A "Quality" Program?

Why are *some* programs highlighted in KEY NOTES? Why do *some* programs you buy seem (ahem) "less perfect" than others? Well, after seeing over 7,000 programs in the last 4 years, we can make a few observations.

Most really "good" or "excellent" programs get that attribute because the author has taken the time to *carefully* document the problem, the solution, and *how* it was derived. Examples, for example, make all the difference in the world. Also, just because there are only five sheets in a program submittal package does not automatically limit you to only five sheets. Don't attempt to cram a complex matrix algebra program on one sheet—or five sheets—when six or eight are necessary. And keep in mind that some people have HP-97's (or HP-67's) and program accordingly.

Try to realize that someone else will have to interpret your program, perhaps someone who doesn't know the subject matter as well as you do. So, when you find an obscure solution to a tricky problem, reference it! Take the time to show how you got from step A to step B. Don't be afraid of *too much* detail; it can be invaluable to the neophyte and is easily "skimmed over" by the professional.

When necessary, list the definition of symbols used. Show the derivation of equations and algorithms. Flow charts and diagrams are invaluable to *your* compilation of the program; don't short-change the final submittal by leaving them out. Also, a concise and usable sample problem(s) usually will get most people acquainted with the subject so they will be able to *apply* the program. And, last but not least, make the program listing totally useful by carefully listing all register contents and completely describing all labels.

Remember, when *everyone* submits well-documented, high-quality programs, all of *you* are the beneficiaries, not the Library.

Now that we've gotten *that* off our chests, we'll treat you to a real treat. We'll tell you about a whole bunch of "excellent" programs—all by one author. All are neat. All are precise. All are eminently usable. All are totally and fully documented. So we know it can be done. They are the work of **Bruce K. Murdock** of Santa Barbara, California. His LNAP program (01585D) (00252D in Europe) in the last issue was extremely popular. Too bad we don't have enough space to print all of the abstracts. His first nine programs, on filter design (Butterworth, Chebyshev, etc.), appear in your Library Catalog Addendum #1 (Corvallis Library, only), and most are in the *Users Library Solutions* book "Butterworth and Chebyshev Filters."

Here is a list of Mr. Murdock's latest programs, ending with one of the best business programs we've seen in a long time. To order programs in European areas, use the number in blue ink.

NETWORK ANALYSIS

67/97 LNAP; Ladder Network Analysis Program* (21 pages) #01585D (00252D)
67/97 LC-LNAP; LC Ladder Network Analysis Program (18 pages) #02259D (00297D)
67/97 LC-LNAP, Z_{in}; LC Ladder Network Input Impedance (14 pages) #02260D (00298D)
67/97 Lossy Transmission Line Input Impedance (11 pages) #02258D (00299D)
67/97 Voltage Along a Lossy, Loaded Transmission Line (8 pages) #02257D (00300D)
67/97 Second Order Active Network Pole and Zero Polynomial Coefficients (26 pages) #01859D (00301D)

CIRCUIT DESIGN

67/97 Bilateral Transistor Amplifier Design Using S Parameters (10 pages) #02256D (00302D)
67/97 VHF Oscillator Design Using Scattering Parameters (20 pages) #02255D (00303D)
67/97 Transistor Configuration Conversion (9 pages) #02254D (00304D)

MAGNETIC COMPONENT DESIGN

67/97 Inductor Design (Iron Core)—Magnetics* (15 pages) #01516D (00305D)
67/97 Inductor Design—Wire Size Calculation* (8 pages) #01515D (00306D)
67/97 Straight Wire and Loop Wire Inductance Calculation (9 pages) #02169D (00307D)
67/97 Single-Layer Solenoidal Air-Core Inductor Design (10 pages) #02168D (00308D)
67/97 Multilayer Solenoidal Air-Core Inductor Design (17 pages) #02167D (00309D)
67/97 Cylindrical Solenoid Design (19 pages) #02165D (00310D)
67/97 Cylindrical Coil Solenoid Analysis (21 pages) #02170D (00311D)
67/97 Magnetic Reluctance of Tapered Cylindrical Sections (8 pages) #02166D (00312D)

MATHEMATICS

67/97 Elliptic Integrals and Functions* (6 pages) #01616D (00313D)
67/97 Bessel Functions and FM or Phase Modulation Spectra (12 pages) #01850D (00314D)
67/97 Curve Fitting by the Cubic Spline Method* (13 pages) #01391D (00315D)
67/97 Multiple Linear Regression for Two Independent Variables (8 pages) #02173D (00316D)
67/97 2 × 2 Complex Matrix Operations, Part 1 (12 pages) #02171D (00317D)
67/97 2 × 2 Complex Matrix Operations, Part 2 (9 pages) #2172D (00318D)

NAVIGATION

67/97 Cable Catenary Scope and Cable Touch-down Latitude and Longitude (7 pages) #02253D (00319D)
67/97 Cable Cross Track Error and Distance To Go (7 pages) #02252D (00320D)

BUSINESS

67/97 Real Estate Investment Analysis* (9 pages) #00927D (00321D)

**These abstracts will be in Addendum 2. See "Library Corner."*

HP-67/97 "Ersatz" Continuous Memory

Translated from German to English that means "Substitute Continuous Memory." And when you read the following letter from Belgium, you'll know why we used that title!

Dear Editor:

When working in the field with my HP-67, I have found the following program useful to save the stack, the registers, and the program whenever it is necessary to change the battery pack.

First, take three blank magnetic cards and label the first one DUMP PRGM, the second one DUMP STK, and the third one DUMP REG. Next, on side 1 of the DUMP STK card, write the following program.

"DUMP"	STO 2	"LOAD"
LBL A	R↓	LBL B
W/DATA	STO 3	0
CL REG	LAST X	ENTER↑
P→S	STO 4	RCL 4
CL REG	2	+
STO 0	-x-	RCL 3
R↓	W/DATA	RCL 2
STO 1	CLX	RCL 1
R↓	DSP 0	RCL 0
	R/S	R/S

Now suppose the low power LED indicator glows while you are in the middle of a running program, and you *must* change batteries. Don't panic, it's easy!

1. Stop the running program.
2. Switch to W/PRGM.
3. Feed in side 1 of the DUMP PRGM card, then side 2 if needed.
4. Switch to RUN.
5. Feed in side 1 of the DUMP STK card. (The one on which you have written the above program).
6. Press [A].
7. The display shows **Crd.** Now, feed in side 1 of the DUMP REG card, then side 2 if **Crd** is still displayed.
8. The display will show a flashing 2, then **Crd** again. Feed in side 2 of the DUMP STK card.
9. The display will show 0, to tell you that the calculator may be switched off.

Replace the battery pack. Then, to reload:

1. Switch to RUN.
2. Feed in sides 1 and 2 of the DUMP STK card.
3. Press [B].
4. Feed in the DUMP REG card and then the DUMP PRGM card.

The HP-67 has no function that gives access to the current value of the program address, therefore it is necessary to manually introduce this address before resuming program execution. Thus, you will have to know where your program stopped, then use the GTO .nnn function to return to that point. This must **not** be done if the calculator was not running when you initiated the "dumping" procedure.

I always carry these three cards, in the same holder with my cleaning card and my diagnostic card. And, although very elementary, I think this procedure could be of some help to your readers.

Yours sincerely,
Pierre Flament, Brussels.

Now you see why we used that title. And, although the HP-67/97 truly cannot retain a program in memory when shut off, its "smart" card reader gives you an *ersatz* Continuous Memory!

Relieve Congestion in Your I-Register

Dear Editor:

This letter is about HP-67/97 indirect storage, relieving congestion in the I-register, and saving steps in long and/or involved programs. In my struggle with the multiple use of the I-register, such as indirect recall inside a DSZ loop, it frequently occurred to me that it would be nice to have two or more indirect registers. Therefore, with the following routines, any register can be used indirectly for storage and recall. They do use the I-register, but this is not apparent because the I-register is restored to its original value.

Let's suppose it is desired to use register 5 indirectly with instructions like RCL (5)* and STO (5), where RCL (5) means recall the register specified by register 5 and STO (5) means store the contents of x in the register specified by register 5. Routine 1 will implement the RCL (5) instruction.

	RCL (5)	Final Stack Contents
1.	LBL 1	T = (5)
2.	RCL 5	Z = y
3.	x ≒ I	Y = x
4.	RCL (i)	
5.	x ≒ y	X = RCL (5)
6.	x ≒ I	
7.	R↓	x = original
8.	RTN	contents of X, etc.

Note that T does not contain z but the contents of register 5. All other registers are

(Continued)

undisturbed. Steps 5 and 6 restore I to its original value.

Similarly, routine 2 implements STO (5).

	STO (5)	Final Stack Contents
1.	LBL 2	T = (5)
2.	RCL 5	Z = z
3.	x ≒ I	Y = y
4.	R↓	X = x
5.	STO (i)	
6.	R↑	
7.	x ≒ I	
8.	R↓	
9.	RTN	

Of course, any primary register can be used for this purpose, not just register 5. But things become interesting when the RCL 5 instruction (step 2 of routines 1 and 2) is replaced with RCL (i). This causes routine 1 to RCL ((i)), that is, recall indirectly from the register specified by the I-register. This is a powerful instruction, but alas, the I-register is burdened with the task of continually pointing to the register desired for indirect recall. The same problem exists for routine 2 when it becomes STO ((i)).

One recourse for this predicament is to write a routine to RCL ((x)) instead of RCL ((i)). Surprisingly, routines 3 and 4 are only 2 steps longer than 1 and 2, respectively. Routine 3 recalls indirectly from the register specified by X.

	RCL ((x))	Final Stack Contents
1.	LBL 3	T = (x)
2.	x ≒ I	Z = z
3.	RCL (i)	Y = y
4.	x ≒ I	X = ((x))
5.	R↓	
6.	RCL (i)	
7.	x ≒ y	
8.	x ≒ I	
9.	R↓	
10.	RTN	

Note that the original value of X (the pointer) is replaced by the recalled number, and that the T-register is modified.

Routine 4 stores the contents of Y indirectly into the register specified by X.

	STO ((x))	Final Stack Contents
1.	LBL 4	T = (x)
2.	x ≒ I	Z = x
3.	RCL (i)	Y = z
4.	x ≒ I	X =y
5.	R↓	
6.	{↓	
7.	STO (i)	
8.	R↑	
9.	x ≒ I	
10.	R↓	
11.	RTN	

The original contents of Z and Y are moved down for subsequent calculations, displacing the pointer (which ends up in Z). Again, T is modified.

As an example of routine 4, put 6 in register A, 1 in T, 2 in Z, 576 in Y, and 20 in X. Execute GSB 4, storing 576 indirectly in register 20 (register A). Since A contains 6, 576 is stored in register 6. Now check the stack and then RCL 6. To illustrate routine 3: Modify register 6 with STO+6, key in 20 and GSB 3 to recall 1152 (the number in register 6). Register 20 has been used as if it were another indirect register.

Keying in 20 before each subroutine call can be expensive in a program, so use the smaller numbered registers. This expense in steps can be traded for one register (like E, for example) by inserting RCL E as the first step following the label in routines 3 and 4. This gives RCL((e)) and STO((e)) routines, where E points to the register to be used indirectly.

In summary, routines 1 and 2 allow a particular primary register to act as a register for indirect storage and recall. Routines 3 and 4 allow *any* register (specified by x) to act as such. By adding one step to routines 3 and 4, the job of specifying this indirect register is given to a different (primary) register, instead of X. In all six routines the I-register is restored to its original value and the LSTx register remains intact throughout, just like the normal STO and RCL instructions.

I hope others find these routines helpful in structuring the use of the I-register, as I have. Perhaps with the "new instruction set," programs with still greater capability are possible.

Sincerely,

Emerson J. Perkins
Huntington Beach, California

**(Very good, Mr. Perkins! We'll add but one note: Some folks might not know that computer symbology you use. For example, R is a register; (R) is the contents of register R; and ((R)) is the contents of register (R). Ed.)*

The Replete Traveler

Although we have not gotten complaints about the type of problem outlined in the following letter, it is entirely possible that such a thing could happen. So if you travel a lot, perhaps you should heed the writer's warning.*

Dear Sir:

Since my job entails considerable travel, my HP-65 calculator and I pass through many X-ray machines at various airports. While the X-rays may not affect the magnetic tapes during a single pass, I found that after several trips the quality of the recordings begins to deteriorate. For some unknown reason this was more prevalent with those I recorded myself, rather than the pre-recorded ones.

My solution is to always carry my calculator and tapes inside one of the bags used to protect camera film. The bag I use is called *Filmshield* and is manufactured by Sima Products of Lincolnwood, Illinois. However, most any camera store carries it. This bag is lead-and-barium-lined vinyl that easily holds my calculator. Since using this bag I have had no further problems.

I believe this information may be of interest to other HP calculator users who travel throughout the country. The use of a bag of this type is considerably easier than having to re-record the tapes after several trips.

Sincerely,

George R. Fisette, Hackensack, NJ.

**(It is probable that the tapes are being altered by a magnetic device,* not *by X-rays. However, the letter was printed here to warn you that magnetic devices used by airports can, and will, alter the magnetic particles on a card and thus destroy your recorded program. Ed.)*

A Notation From Poland

Occasionally, someone will forget to press one of the prefix keys and find, to their amazement, that the correct key code or function appeared in the display. For example, check page 232 in your *HP-67 Owner's Handbook* (page 207 for the HP-97), and you will find that the (i) and RCL (i) keystrokes are described as performing the same function. Try it. (However, STO (i) remains a two-key code on both calculators.)

When we designed the keyboards for the HP-67/97 calculators, a few decisions had to be made. The keyboards, for example, were quite different, so the keycodes necessarily had to be different. However, we did not want the two machines to be imcompatible. Thus, a few "oddities" exist. Many of you have noticed these "shortened" keycodes and have written to us about them. The first letter was from Konstantly Boufal, of Warsaw, Poland, who no doubt had some "expert" help when he found the keystroke-saving codes, as Mr. Boufal also sent a photo to show us his "assistant," probably the world's youngest HP fan and User. In his words: "My lovely daughter, Magdalen, 8 months old, has perfected one operation on my HP-67 ...CLx!"

In w/PRGM mode on the HP-67 and HP-97, you can save one keystroke for GSBa commands. On the HP-67, instead of g GSB f a for 32 22 11, *you can always press* f a and still get 32 22 11. And so on through GSB b, c, d, and e. On the HP-97, instead of GSB f a for 23 16 11, *you can always press* f a and still get 23 16 11.

This trick also works in W/PRGM mode for GSB A through E. On the HP-67, instead of

f GSB a for 31 22 11, *you can always press* A and still get 31 22 11, **except for the first step of program memory.** It will not work then because the default functions are automatically reset when you turn on the calculator. On the HP-97, instead of GSB A for 23 11, *you can always press* A and still get 23 11.

These are handy tricks when editing a program because they save keystrokes. But don't use them if they confuse you. Remember, the factory-authorized keystrokes were devised to prevent errors and to save having to memorize a lot of rules.

There are a few other keystroke-saving codes, but since they involve being useful *only* at the first step of memory, they tend to be impractical and cause more errors than benefits.

For "Mark-Elangelos"

As part of a continuing effort to try to please everyone, here are some more products found by readers to be good card-marking devices. We cannot guarantee their success, but we do know that they worked for the following people.

Gentlemen:

I have found a better marking pen than the SHARPIE, which has a blunt tip and produces relatively coarse markings. A much better result can be obtained from the Schwan STABILO Pen 96P (fine). I found this pen advertised for the purpose of permanently marking magnetic cards. It can be obtained in many colors. I have the following source information:

Schwan Pencil Co., Inc.
221 Park Avenue, South
New York, NY. 10003

Distributed by:

Federal Sales Service, Inc.
1008 North Randolph Street
Suite 104
Arlington, VA. 22201
Phone (703) 525-5215

The set of four colors (red, blue, green, and black) is called No. 9607P *Fine Tip Pens.* It sold some time ago for about $3.

Regards,
H.P. Stratemeyer, Hollis, NH.

Gentlemen:

I believe I've stumbled onto another way of temporarily marking magnetic cards. Although other brands probably are available, I've found the 0.5 mm Pentel PF335 lead for "film" to be superior to graphite for marking cards on a temporary basis.

I understand that this lead is designed to write on mylar stock used in drafting work, and consequently it smears much less than ordinary pencils. I've found markings made with this lead to resist smearing by greasy fingers. (I went so far as to rub one marked card with butter and alcohol.) However, the markings come off very easily with a conventional pencil eraser, but I prefer the "plastic" type of eraser.

Sincerely,
Larry Browning, W Lafayette, IN.

We also have run across another finer-tipped permanent marker. It is marked: *PILOT SC-UF Ultra Fine Point Permanent,* and it can be obtained in most office supply or artist/drafting supply stores. It might even come in colors.

Of course, not everyone has trouble marking cards. For instance, here's a letter we received *over two years ago!**

I have been reading with some surprise about the problems of marking program cards. In my naiveté, I didn't realize that a problem existed. Since the only fine-tipped pen I owned is a *CASTELL TGH* No. 0, which was filled with *CASTELL TG BLACK MAGIC* ink, that is the one I used.

No surface preparation was used prior to writing and no coating was applied afterward. One card, recorded on both edges, has been run between 300 and 400 times and is still perfectly legible.

Sometimes ignorance is bliss.

Sincerely yours,
J.C. Hanselman, San Diego, CA.

**(Actually, 2 years and 8 months ago. Right, Mr. Hanselman? And I'll bet you thought I had ignored your letter or forgotten it! And what do I use? Okay, I'll confess. Since I get samples either from you or from the stores, I use* all *of them. Nothing like being a nonpartisan, right? Ed.)*

Flags Revisited

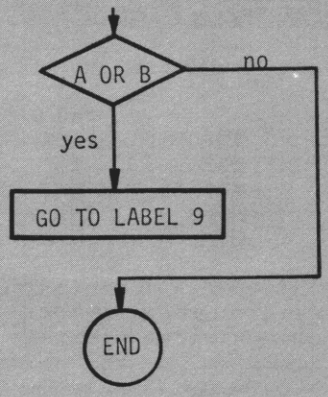
In the October 1977 issue (Vol. 1 No. 3) we printed an article, "On Understanding Flags," by **William M. Kolb** of Annapolis, Maryland. Some people did not understand the table accompanying that article, so here is an explanation graciously furnished by Mr. Kolb.

The table lists various keystroke sequences which are the equivalent of the logic equation at the top of the column. The equation $\bar{A}$ (not A), for example, can be programmed at least three different ways:

F3?	F0?	CFO
F3?	F3?	F1?
	F0?	F0?
	F3?	

Which sequence you use will depend on how many steps you are trying to save and what flags are available in your program. The question marks used in HP's documentation after all tests were left out to save space in the table. Two logic equations appear at the top of each column. One is the opposite of the other and is listed for convenience. If you prefer to think about the conditions under which you must skip a step rather than the conditions under which the next step is executed, use the second equation to find the appropriate keystroke sequence. The letter in parentheses after some keystrokes tells you which flag represents which variable in the logic equation.

These explanations may be easier to follow with an example. The letters A and B will represent two conditions that are to be tested by some undetermined keystroke sequence. In this example, we will determine if either condition A or condition B is true at the end of our main program. If it is, we will branch to LABEL 9; if neither condition is true, we'll halt and end the program. The flowchart for this logic would look like this:



The program corresponding to this flowchart has some unknown steps combined with the two desired results:

```
*
*
*
?
?
GTO 9
RTN
```

The table is designed to help you fill in the missing code required. In this example, we want the non-skip case whenever A or B is true. Reading across the top line of the table for the non-skip equations, we find "A OR B" listed and choose any of the sequences shown; e.g.,

```
F0 (A)
SF1
F1 (B)
```

The program is now completed by inserting these keystrokes:

```
*
*
*
F0?
SF1
F1?
GTO 9
RTN
```

We must remember to include whatever code is necessary to set flag 0 when condition A is true and flag 1 when condition B is true. In this particular example, we could just as well have selected an alternative keystroke sequence and used flags 0 and 3. The code would be:

```
*
*
*
F3?
F3?
F0?
GTO 9
RTN
```

Suppose condition A had the following context: Set when new data is entered, clear otherwise. Condition B has this context: Set when R8 is non-zero, clear otherwise. At some point in the program, it will be necessary to test R8 and set flag 0 if it is not zero. If R8 is in the X-register at the time of the test, however, we can avoid using

(Continued)

flag 0 by substituting x≠0 for flag 0 (condition B). Both methods are illustrated:

*	*
*	*
RCL 8	*
x≠0	*
SFO	*
*	*
*	RCL 8
F3?	F3?
F3?	F3?
F0?	x≠0
GTO 9	GTO 9
RTN	RTN

Note that we didn't worry about setting flag 3 for condition A because it is automatically set when new data is entered via the keyboard.

In general, flag 2 and flag 3 are interchangeable within the table. Flag 0 and flag 1 are also interchangeable and may often be replaced by a relational test as in this example.

Where-To-Find-It List

Because it is frustrating to be unable to acquire for your calculator an accessory you need (or want) in a reasonable time, we are starting a new service that will alleviate this problem. As of the first week in June, a list of all dealer outlets in the U.S. that participate in our Accessory Promotion Plan will be available to our WATS operators (phone number 800-648-4711, or in Nevada, 800-992-5710). The list also will be available to all of our Sales Offices, and to our Customer Support group and the Service Center at the factory in Corvallis, Oregon. The telephone number for the factory is 503-757-2000, **and this is not a WATS line.**

The dealers on this list will have committed to continually keeping in stock those batteries, rechargers, thermal paper, software, and blank cards needed to adequately support our calculators. And to keep this service as good as possible, we would appreciate feedback on how well this service works.

HP KEY NOTES

May 1978 Vol. 2 No. 2

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

Hewlett-Packard Company
Editor, HP KEY NOTES
1000 N.E. Circle Boulevard
Corvallis, Oregon 97330 USA

Hewlett-Packard S.A.
Users' Library
P.O. Box 349
CH-1217 Meyrin 1/Geneva
Switzerland

Double Stick Revisited

Dear Sirs:

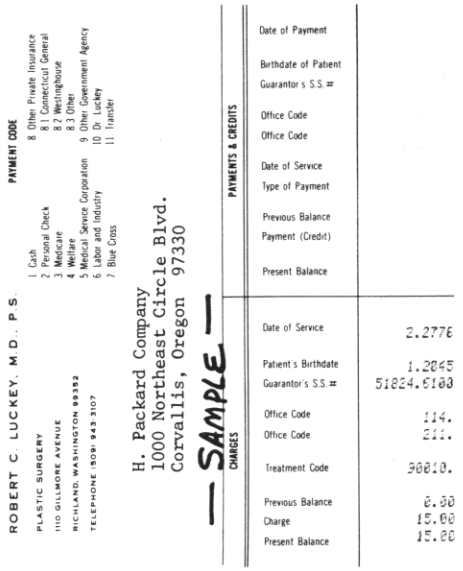
The February 1978 issue (page 8) referred to the use of *Scotch*® Double Stick tape for mounting HP-97 program tapes. It did not mention use of the *Scotch*® C-12 double thick tape applier. This makes perfect application of the tape a reality. We use the HP-97 for all statement receipts, ledger cards, and ledger book entries.

Sincerely,

Robert C. Luckey, M.D.,
Richland, Washington

Thanks for the information, Dr. Luckey, and thanks for the sample ledger card, which is reproduced here so that other readers can see how handy the HP-97 tapes can be for business purposes.

®*Scotch is a registered trademark of the 3M Company.*



Pac Corrections

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

HP-67/97 CE PAC

Program CE1-02A2, "Section Properties," has been found to contain an error. If I_x equals I_y you will not get a correct answer. To correct your book, add the following steps. On page L02-04, after step 178 (RTN), add:

*LBL8	X⇄Y	*LBL9
X⇄Y	X=0?	0
9	GTO9	RTN
0	X⇄Y	
CHS	RTN	

On page L02-03, after step 66 (x≠0?) add:

x = 0? and GTO 8

To receive a revised card (CE1-02B2), **you must mail your old card to: HP Service Department, P.O. Box 999, Corvallis, Oregon 97330.** This new card will be available on May 29.

Program CE1-04A, "Stress on an Element," also contains an error. You will not get a correct answer when S_x equals S_y. To correct your book, add the following steps. On page L04-02, after step 164, add:

*LBL8	X=0?	÷
X⇄Y	GTO9	GTO7
9	x	*LBL9
0	LSTX	0
X⇄Y	ABS	GTO7

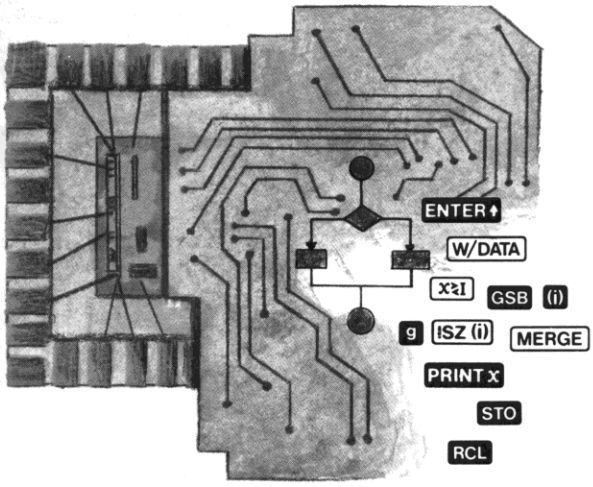
After step 125 (TAN^{-1}) add: LBL 7. Replace step 123 (x≠0?) with: x=0? and GTO 8.

To receive a revised card (CE1-04B), **you must mail your old card to: HP Service Department, P.O. Box 999, Corvallis, OR 97330.** This new card will be available on May 29.

Address Correction Requested
Return Postage Guaranteed

BULK RATE
U.S. POSTAGE
PAID
PERMIT NO. 814
PORTLAND, OR

Printed in U.S.A.



Featuring, this issue:

HEWLETT hp PACKARD

HP Key Notes

August 1978 Vol. 2 No. 3

Calculators in Continuing Education

Occasionally, we hear about progress being made in the use of calculators in the classroom. This is gratifying because, like you, we believe that calculators can make life easier, more useful, and less constricted.

Here's a letter to our HP-67/97 Product Manager.

Dear Sir:
Recently, Louisiana Tech's Division of Continuing Education conducted a week-long workshop on Heat Transfer for the Industrial Insulation Industry. The key to the program was your HP-97. Each participant was required to bring his own calculator to the activity.

You may be pleased to know that, in addition to the favorable comments about our program, each participant was very pleased with the operation and performance of the HP-97.

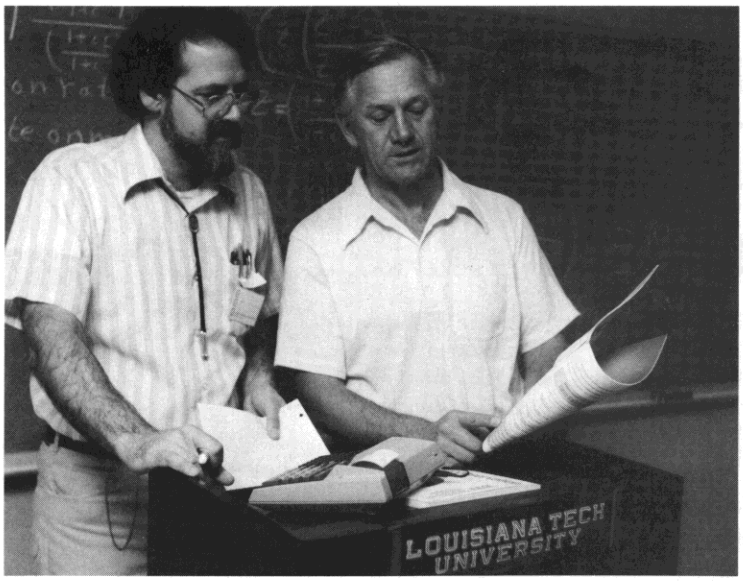
I am enclosing a couple of photos, obviously staged, of our instructor and some of the participants.

A second session of the Heat Transfer program will be held August 21-25, 1978. If you or any of your representatives are in the area, feel free to stop by our office for a visit and observation of the workshop.

In addition to the regular activity, we have scheduled a special HP-97 work session on Sunday, August 20, from 2:00 to 5:00 p.m. This session is for anyone who is unfamiliar with the operation of the calculator.
Sincerely,

John R. Williams
Dean of Continuing Education
Louisiana Tech University, Ruston, Louisiana

Thank you, Dean Williams, for sharing with our readers this news and the photos. As you can imagine, we thoroughly enjoy hearing about such workshops. And anyone in that area of the country will be interested to know that more workshops are being planned.



Dr. Ben Blackwell (Ph.D., Stanford), Course Director and Associate Professor in the Department of Mechanical Engineering and **Mr. Ray Wopperer** of Frontier Insulation in Buffalo, New York, discussing some aspects of the workshop. Mr. Wopperer is also Chairman of the Technical Committee of the National Insulation Contractors' Association.

Some Price Reductions...

That title looks out of place in the modern world of ever-increasing inflation! But it is a true statement. On August 1, 1978, Hewlett-Packard lowered the prices for the HP-19C and the HP-29C, as follows:

	OLD PRICE	NEW PRICE
HP-19C	$345.00*	$275.00*
HP-29C	$195.00*	$175.00*

And what is really nice is that this price reduction is just in time for the back-to-school season. So stop in at your local HP dealer and take another look at these two "mid-range" programmable calculators with *Continuous Memory*.

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

Another Timer Check

In the October 1977 KEY NOTES (Vol. 1, No. 3, p. 6) we published information about the National Bureau of Standards time broadcasts so that readers could get a very accurate check on "timer" programs. Here's another source.

Dear Editor:
It may be of interest to your readers who do not have access to a shortwave radio that the exact same *(WWV)* information is available via telephone from the National Bureau of Standards in Boulder, Colorado. The telephone number is (303) 499-7111.
Sincerely,
Richard V. Dutchik
W. Melbourne, Florida

(Thanks for the tip, Mr. Dutchik, and for the rest of your letter with the nice remarks about KEY NOTES. Ed.)

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

Library Corner

Despite the usual doldrums brought on by fair weather, summer fun, and vacations, you continue to pour a never-ending flood of programs into the Library. This issue includes quite a bunch of new ones, and we hope you will like at least a few of them.

HP-67/97 NEWS

Around the end of August, the Library will be sending out renewal notices for HP-67/97 Library subscriptions. If you haven't received a notice by the end of September and you think your subscription has expired, contact the Library.

We hate to tell you this, but...please do not request copies of HP KEY NOTES Vol. 1 No. 1 (January 1977). Supplies ran out some time ago, and there are no plans to reprint that issue.

But don't let that spoil your day; here is some good news:

FOUR NEW LIBRARY BARGAINS

Maybe these three sets of programs and one giant program will not appeal to a wide audience, but they *will* be a tremendous boon to anyone in the fields of Optometry or Fluid Mechanics, including students.

These Optometry programs were written by **Terry E. Cowgill, Tom Myslick,** and **Lee Nelson** as the basis for a thesis project, "Optometric Applications of Programmable Calculators," while they attended Pacific University's College of Optometry at Forest Grove, Oregon. They received an "A" for the thesis!

The fourth bargain, actually one gigantic program, was written by **Gerard A. A. Westen** of Newark, Delaware. It is the equivalent of six to eight ordinary programs.

Because of the unusual nature of these optometry programs, they are being offered in groups—or sets—and at reduced prices if purchased this way. (The group price includes magnetic cards.) And each **numbered** program is available as a separate purchase and under standard rules: a charge of $3 for a program and $5 for a program and magnetic card.

At the present time, **single programs are not available in Europe**; However, we will honor orders *from anywhere* for the four "67000-"type numbers if the order includes a negotiable check (or money order) in U.S. dollars, drawn on a U.S. bank. Here is the list.

I. #67000-99980
General Optometry $35*

02536D Effective Prism Power (23 steps, 4 pages)
02537D Crossed Prism Resultant (57 Steps, 4 pages)
02538D Lens Power Needed at New Vertex Distance (58 steps, 4 pages)
02539D Positional Effective Power (58 steps, 4 pages)
02540D Effective Power/Equivalent (46 steps, 4 pages)
02541D Minimum Blank Size (123 steps, 5 pages)
02542D Oblique Cylinder Sum (115 steps, 5 pages)
02543D Conversion: Keratometer Diopters to Radius, Radius to Keratometer Diopters (24 steps, 4 pages)
02544D Aniseikonia I (223 steps, 5 pages)
02545D Aniseikonia II (223 steps, 5 pages)
02546D Low Vision; Calculation of Needed Magnification Add, and Working Distance (35 steps, 4 pages)
02547D Low Vision; Determation of Acuity Demand from Letter Size, Working Distance (35 steps, 4 pages)
02548D Low Vision; Contact Lens Telescope Calculations (150 steps, 5 pages)
02549D Shape, Power, and Spectacle Magnification (51 steps, 4 pages)

II. #67000-99981
Optometry Case Analysis $18*

N/A OEP Analysis (OEP I) (999 steps, 8 cards, 41 pages)
02551D Pratt Sheard, Percival Methods of Near R_x (170 steps, 5 pages)
02552D Four Accommodative R_x's and Their Average (101 steps, 4 pages)
02553D Linear Transform of R_x^{16} to R_x^d (16 steps, 4 pages)

III. #67000-99982
Optometry Contact Lens $32*

02561D May-Grant Contact Lens of First Approximation (66 steps, 4 pages)
02562D Tabb Contact Lens of First Approximation (186 steps, 5 pages)
02563D Roggenkamp Specs. for Prism Ballast Front Toric or Prism Ballast Contact Lens (215 steps, 5 pages)
02564D Effective Power of Spectacle Lenses at Corneal Plane (35 steps, 4 pages)
02565D Back Vertex Power of PMMA Contact Lens (56 steps, 4 pages)
02566D Residual Cylinder Induced at Tear/Cornea Interface by Contact Lens (37 steps, 4 pages)
02567D Cylinder Induced by Toric Contact Lens (67 steps, 4 pages)
02568D Contact Lens Power Necessary to Correct Ametropia (72 steps, 4 pages)
02569D Toric Contact Lens Parameters (73 Steps, 4 pages)
02570D Extended Keratometer Range (19 steps, 4 pages)
02571D Magnification Difference Between Spectacle and Contact Lenses (11 steps, 4 pages)
02572D Sag Formula (25 steps, 4 pages)
02573D Brungardt I &II (189 steps, 10 pages)

IV. #67000-99983
Orifices For ME's $16*

N/A Orifice Program for Five Square-Edge Orifice Tap Types

This program solves the orifice equations for square-edged, flat plate, concentric orifices. Given two of the following three variables, the program calculates the third: meter differential, mass flowrate, and orifice hole diameter. The program is applicable in English, Metric and SI unit systems; for liquid, gas and steam service; for flange, radius, corner, vena contracta and pipe tap locations; and for drain/vent hole provisions; according to ASME/ISO equations. The program prints all input, intermediate, and final results. This printout tape can be attached to an HP-97 orifice calculation form to produce a permanent record of the calculation. The complete program has 6 cards, 1316 steps, and 44 pages.

N/A = Not available as a separate program.

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

ORDERING PROGRAMS

Any program you see in HP KEY NOTES can be ordered either from the Users' Library in Corvallis, Oregon, or from the Users' Library in Geneva, Switzerland. (Both addresses are on the back cover.) For most of the world, use the program number listed next to the program's title, then order it from Corvallis. The only exception is if you live in the European area; in that case use the number listed in italic type below the program abstract, then order it from Geneva. Payment for programs must conform with the instructions from *your* area Library. **Always use order forms if possible** or, better still, use the new order form in this issue, and be sure to include any state or local taxes.

NEW HP-67/97 PROGRAMS

Here are some new programs from recent submittals. Quite of few of these are actually sets of programs on the same subject, and they are highlighted here as fine examples of programming the HP-67/97 to fit the requirements of professional people. Also, we are happy to be able to include some programs from the Geneva Library. However, before you order *any* of these programs, please read the paragraph on **ordering programs.**

67/97 Crandall's Rule Auto-Adjustment (#01791D)*

This program provides traverse adjustment by the Crandall's rule method, without keyboard input. Program operation requires insertion of data cards (generated by the program below, "Traverse Computation and Storage"), and one initial keystroke. Adjusted data may be output in either "auto" (print) or "manual" (R/S) mode. (216 steps, 8 pages)

Author: **Earl L. Kubaskie, Jr.**
Juneau, Alaska

**In European areas, order by number 00322D.*

Continued on page 4

Letters To The Editor

When you consider the amazing number of card-programmable calculators we have sold, and then also consider that KEY NOTES is read all over the world, a startling statistic begins to emerge: *You* have *me* greatly outnumbered. Thus, if only one reader in 1000 decides to write a letter to me, my mail box is filled to the brim.

So..., much as I hate to do it, here's a new policy on letters to the editor:

Letters to the editor should be addressed to:

Henry Horn, Editor
HP KEY NOTES
Hewlett-Packard Company
1000 N.E. Circle Boulevard
Corvallis, OR 97330

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

At present, there is a huge backlog, but progress is steady. Just remember that I cannot answer many letters during the 2 weeks before and the 2 weeks after a KEY NOTES mailing. (Next issue is scheduled to be mailed on November 3.)

Now, please don't stop writing. Very few letters have NOT been answered in the last 4 years. (Has it been *that* long?) I thoroughly enjoy your letters and derive much pleasure from answering them—or in using them in KEY NOTES. And, as you can imagine, I get some of the most fantastic letters the world has ever seen.

Over the years, through our correspondence, I've met a considerable number of you; now *all* of you know who "Ed." really is. Don't be bashful; keep those cards and letters coming. Remember: I merely put it together; KEY NOTES is *your* newsletter.

Speaking of letters...here's a "tongue-in-cheek" letter no doubt precipitated by the article on 8-year-old Zvi Schreiber (in the last issue).

Gentlemen:

I have been so impressed with the programming accomplishments of some of your younger readers that I decided to give my son Gabriel (age 2) the same opportunity. To my surprise, he promptly noted that, on occasions when it is necessary to selectively reset particular storage registers before rerunning a program, it is possible not only to save program steps but to do so without disturbing the stack. When the contents of an accumulating register, for example, are recalled for final display, the storage register may be reset to zero with "STO-n", or, a register used as a counter may be initialized to the value "1" by executing "STO ÷ n". Similarly, he pointed out, a single register arithmetic statement may also be used, at any point within a program and without affecting the stack, to initialize registers with arbitrarily large or small values, in preparation for relational tests in a successive run.

Needless to say, I was impressed. Especially when, as I was attempting to install an HP-25C on the handlebar of his trike, he observed that it seemed illogical not to have "un-register arithmetic", such as "RCL x n", which would combine the two steps presently required. What a cute little guy!

Bruce J. Schaffer
University Hts., Ohio

How About HP NP Kits?

What is an NP Kit? Read on and you'll find out the same way we did. This is a letter we received 6 months ago, but it's better late than never.

Dear Henry,

Enclosed with this letter are some photos I took of one of my Christmas gifts this year. A needlepoint rendition of two generations of calculators!!

Starting with the sales pamphlet for the HP-67/97, my mother, Doris, had a woman at a local "handycraft" shop custom-draw the pamphlet cover on the needle-point gridwork (back plane?). She had intended it to be a "gag" gift, because she knows how I like calculators (of a certain manufacturer).

After working on it a bit, she didn't like how the HP-67 was coming out (since it was drawn on an angle), so Mom managed to find a pamphlet for the older HP-65, then redrew the unit on the "grid." Starting over, she matched the colors with available goods as closely as possible, and the results are what you see in my photos. Pretty darn good, isn't it?

Needless to say, this "gag" gift turned out to be one of my favorites, and I now have the frame proudly hanging in my office for everyone to see. (Maybe HP should offer needlepoint kits as well??)

Yours sincerely,
Craig A. Pearce
Berwyn, Illinois

(Yes, Craig, it's pretty "darn" good, and it is just a terrible shame that we can't produce it in the vivid, true-to-life colors of your photo. Ed.)

How to Clear g

Although the HP-67 handbook tells you how to clear an inadvertently pressed f-key or h-key, it does not do the same for the g-key. So thanks to **George E. Thatcher** (Staten Island, NY), who brought this to our attention, here is a method that will always work: Slide the W/PRGM-RUN switch back and forth, regardless of the mode it is in. You will cancel the unwanted g-key and not affect any other operation or function.

Enthusiast Becomes Author

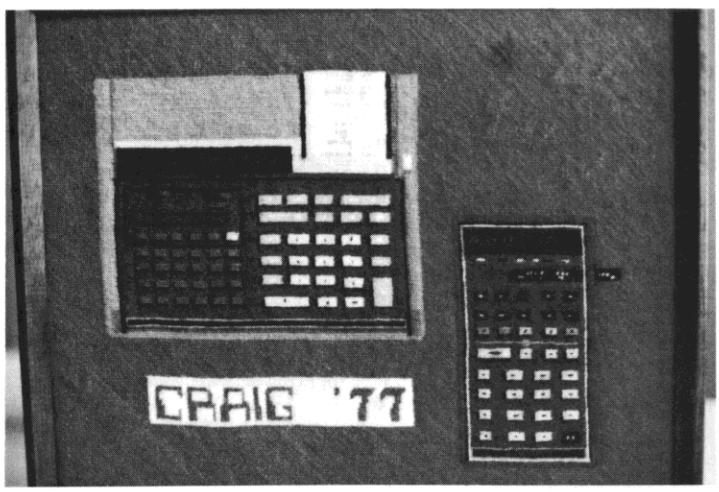
It is doubtful that any HP calculator owner is a greater HP enthusiast than **Craig A. Pearce** of Berwyn, Illinois. If you don't believe us, see, on page **3**, how his mother feels about it.

Anyway, Craig has written a very fine article on the HP-67/97 and has had it published, replete with photos, on pages 112-117 in the June 1978 issue of BYTE magazine. The article elaborates on some of the niftier features of the HP-67/97. It also includes the listing and instructions for Craig's inimitable "Pinball Wizzard" program. (They spell it with one "z" but Craig used two "z's" on the original.)

Craig also mentions the independent Users' Club and its PPC JOURNAL newsletter, plus some of the startling "advanced applications" the Club has found for our calculators.

Good reading, good article, good job, Craig. We're all proud of you. We cannot supply copies of the article, but here's the magazine's address.

BYTE Publications
70 Main Street
Peterborough, NH 03458



67/97 Compass Rule Auto-Adjustment (#01792D)*

This program provides traverse adjustment by the compass rule, without keyboard input. Program operation requires insertion of data cards (generated by the program below, "Traverse Computation and Storage") and one initial keystroke. Adjusted data may be output in either "auto" (print) or "manual" (R/S) mode. (117 steps, 8 pages)

Author: **Earl L. Kubaskie, Jr.**
Juneau, Alaska

**In European areas, order by number 00323D.*

67/97 Traverse Computation and Storage (#01793D)*

This program performs traverse computations from bearing or field angle data. Traverse courses and computed data are arranged by the program for storage on magnetic cards, in the form required for adjustment by either of the above two programs: "Compass Rule Auto-Adjustment" or "Crandall's Rule Auto-Adjustment." (162 steps, 13 pages)

Author: **Earl L. Kubaskie, Jr.**
Juneau, Alaska

**In European areas order by number 00324D.*

(Well done, Mr. Kubaskie! Excellent and neat documentation. These programs will save a lot of time, because adjustment is automatic, and there is no need to re-input all the coordinates. Ed.)

Now, here is a set of payroll programs that were developed for a tool company. If you have a small business and cannot afford a computer, let your HP-67 (or better still, an HP-97) do most of the work for you. And if some of these tax or deduction parameters have changed, just reprogram that part of the listing. Two of these programs have appeared in Library Catalogs. They are #01555D "Payroll With Tax Table Generator" (#00325D in Europe), and #01608D "Payroll Phase II Data Loader" (#00326D in Europe).

67/97 Payroll Phase II, Tax Deposit (#02209D)*

This program keeps a tab on payroll tax deposits to the State and Federal governments and avoids late tax payment penalties. Feeding in the "Payroll Phase II" payroll data cards lets you know at any time how much combined FICA, withholding, and State taxes are owed and if you are under or over the $2000 figure. Key in the amount you want to deposit, and the tax payment record is updated and retained on a separate tax data card. (173 steps, 13 pages)

Author: **Otto Barth**
Roselle, Illinois

**In European areas, order by number 00328D.*

67/97 Payroll Phase II (#2121D)*

This program does not require State and Federal tax tables. Prepared for each employee is a data card that contains wages/salary, dependent status, single or married, and the tax table. A running total is kept on FICA, Withholding Tax, State Tax, miscellaneous deductions, gross FICA limit, and even the total hours worked. After loading the data card, enter the hours worked (or gross pay). Gross, taxes, and net pay will be printed. Data cards are updated upon rerecording. (See also program #01608D or, in Europe, #00326D). (224 steps, 16 pages)

Author: **Otto Barth**
Roselle, Illinois

**In European areas, order by number 00327D.*

67/97 Payroll Phase II, Quarterly Summary (#2277D)*

This program transfers data collected from payroll data cards to quarterly summary data cards necessary for accounting and tax purposes in the "Payroll Phase II" payroll program. It clears certain registers of the payroll data cards for a new tax quarter. It sets up and updates quarterly summary data cards. It is necessary to acquire the "Payroll Phase II" payroll program and the data loader program before the "Quarterly Summary" program can be run efficiently. (213 steps, 21 pages)

Author: **Otto Barth**
Roselle, Illinois

**In European areas, order by number 00329D.*

(Outstanding, Mr. Barth! An elegant, neat, complete set of programs. They have already helped two or three small companies set up a payroll system on HP-97's.Congratulations! Ed.)

67/97 Simplified Flight Planning of Stored or Preferred Routes (#02406D)*

This program will enable the user to compute flight plans from routing information stored on data cards. Inputs are: fuel flow, true airspeed, wind, and variation. Outputs are: magnetic course, ground speed, distance, time, and fuel comsumption in gallons and pounds for any type of aircraft. Inputs may be altered for each leg of flight as well as a separate print option. Total running time is under 5 minutes, and maximum data is limited to the number of data cards available. (210 steps, 7 pages) (See also next program.)

Author: **Saul Gilman**
Brooklyn, New York

**In European areas, order by number 00330D.*

67/97 Flight Plan Data Card Programming (#02407D)*

This program was designed as an aid to #02406D. It enables the user to store airway routing information onto data cards in proper sequence, quickly and easily, prior to use in flight planning computations. (210 steps, 7 pages)

Author: **Saul Gilman**
Brooklyn, New York

**In European areas, order by number 00331D.*

(Very well documented, carefully described, and completely annotated. A superior set, Mr. Gilman, and an asset to any pilot. Well done! Ed.)

(And here is another set of programs that is absolutely top-notch! While not of universal appeal, I'll bet that **most** *engineers will want most or all of these programs. A superior accomplishment, Mr. Kuyt, in application, programming and documentation. Too bad I don't have space to include the projection drawing of your new house. What a fantastic and splendid piece of work! Mr. Kuyt's projection even "unearthed" an error in the architect's drawings! Congratulations! Ed.)*

67/97 Spiral Projections (#02400D)*

The program computes x and y coordinates of any points of 3-D projection views of two different types of spirals, as determined by their radius, the radial increase and number of points to be plotted per 360°, the tilt angle about a horizontal axis, swing angle about a vertical axis, and rotation angle about its own axis. The program also translates the calculations axially, to a parallel plane, and/or laterally in the same plane to allow plotting of associated projections. (135 steps, 6 pages)

Author: **Frits Kuyt**
McKinney, Texas

**In European areas, order by number 00332D.*

67/97 Flower Projections (#02421D)*

The program computes x and y coordinates of all points of 3-D projection views of shapes from a simple circle or polygon to multi-petal flowers. The program contains several routines, each performing its own specific flower-shaping function, and each of which can be used in different combinations to achieve various effects. The user selects the parameters of the flower (radius, depth, number of petals, number of plotted points, projection angle, etc.). (122 steps, 6 pages)

Author: **Frits Kuyt**
McKinney, Texas

**In European areas, order by number 00333D.*

67/97 Polygon Projections (#02422D)*

The program computes x and y coordinates of any points of 3-D projection views of a circle or polygon, as determined by its radius, the number of points per 360° to be plotted, the tilt angle about a horizontal axis, swing angle about a vertical axis, and rotation angle about its own axis. The program also translates the calculations axially, to a parallel plane, and/or laterally in the same plane to allow plotting of associated projections. (98 steps, 6 pages)

Author: **Frits Kuyt**
McKinney, Texas

**In European Areas, order by number 00334D.*

67/97 Projection of Points, Line Sections, Rectangular Shapes (#02423D)*

With given coordinates of a point on a plane, the program computes the new coordinates of this point after the plane has been tilted about a horizontal axis,swung about a vertical axis, or rotated in its own plane (or any combination of these three motions), as projected onto the

original plane. The program also translates the calculations axially, to a parallel plane, and/or laterally in the same plane to allow plotting of associated projections. (101 steps, 6 pages)

Author: **Frits Kuyt**
McKinney, Texas

**In European areas, order by number 00335D.*

67/97 Compound Angle Conversions for Projection Programs (#02424D)*

The program converts compound projection angles into their minimum included angle and incline angle; in other words, when isometric drawings require the use of an ellipse template, the program finds the ellipse angle as marked on the template, and its angular position on the drawing, or vice-versa. It also converts the contents of the data registers, resulting in a projection view turned 90° from the original. (85 steps, 6 pages)

Author: **Frits Kuyt**
McKinney, Texas

**In European areas, order by number 00336D.*

67/97 Helix Projections (#02425D)*

The program computes x and y coordinates of any points of 3-D projection views of a helix, as determined by its radius, the number of points per coil, coil spacing, and the two angles constituting the compound projection angle. The program plots projections of such helical shapes as coil springs, winding stairs, propeller blades, etc. It also translates the calculations axially, to a parallel plane, and/or laterally in the same plane to allow plotting of associated projections. (131 steps, 6 pages)

Author: **Frits Kuyt**
McKinney, Texas

**In European areas, order by number 00337D.*

(Although Mr. Kuyt has done a lot of research during compilation of the above programs, he would welcome communication with other engineers or educators who purchase these programs and have ideas to improve them. Ed.)

67/97 Aerobic Points for Running and for Walking (#02622D)*

Given the distance either run or walked and the elapsed time, this program calculates "Aerobic Points" (explained below) for all distances from one mile through the marathon and for all running speeds from 3 through 10½ miles per hour. All secondary storage registers and 100 program steps are available for use. (122 steps, 5 pages)

Author: **Hugo E. Mayer, Jr.**
Warrensburg, Missouri

**In European areas, order by number 00338D.*

(The body can store food, but it cannot store oxygen. Each exercise requires a certain amount of energy; consequently, a certain amount of oxygen. This oxygen requirement can be measured, and this is the basis of the point system. Each exercise is assigned a certain number of points, based on the amount of oxygen required to perform it. Ed.)

Next, a treat from West Germany. Here are two programs for you mathematicians who are curious about how it's done in Europe.

67/97 Exponential Integral, Integer Order (#02623D)*

The program calculates for integer order of $n>=0$ the exponential integral $E_n(x)$ very efficiently to 9-digit accuracy using a power series expansion for $x<=1$ and a continued fraction approximation for $x>1$. In all cases, accuracy and calculating time are dependent on the number of decimal places selected by the user. (159 steps, 6 pages)

Author: **Gunter Schnell**
Lilienthal, West Germany

**In European areas, order by number 51311D.*

67/97 Sine and Cosine Integral (#02624D)*

This program calculates, simultaneously, $S_i(x)$ and $C_i(x)$ for real $x>0$. For small x, power series expansion is used. For large x, the complex exponential integral $E_1(ix)$ is calculated, using a continued fraction approximation and is converted to the related sine and cosine integrals (complex computation is used only internally). Accuracy and calculating time are dependent on the number of decimal places selected by the user. (128 steps, 6 pages)

Author: **Gunter Schnell**
Lilienthal, West Germany

**In European areas, order by number 51253D.*

(Very good, Mr. Schnell! The documentation is excellent, expecially your program description. Ed.)

To wind up our column this issue, here is a set of programs from an HP-67 owner in a coastal city nearly 200 miles north of Lisbon. With this set of five programs, any polynomial curve fit problem can be easily solved (equally or unequally point spacing, scattered or not scattered points).

67/97 Approximation by Legendre Polynomials Up to Degree 7 (#02625D)*

This program approximates a function, defined by a set of equally spaced data points, by Legendre polynomials of any degree up to 7, using the least squares method. It offers simultaneous computation of up to 8 coefficients and of the sum of squared errors for each degree. There is also a choice between trapezium, Simpson, or Newton-Cotes (5) integration. Projections of y values can be made. The orthogonal Legendre functions avoid long matrix operations, so that the program is very short and safe. (223 steps)

Author: **Dr. Henrique E. Adler**
Oporto, Portugal

**In European areas, order by number 50520D.*

67/97 Conversion of Legendre Polynomials into Power Series (#02626D)*

This program is an optional complement to #50520D (02625D in U.S.), which gives the coefficients of a series of Legendre polynomials up to degree 7. This program converts those coefficients into the coefficients of an ordinary power series with argument x. (217 steps)

Author: **Dr. Henrique E. Adler**
Oporto, Portugal

**In European areas, order by number 50813D.*

67/97 First Order Smoothing of Unequally Spaced Data Points (#02627D)*

Data points that are scattered due to random errors of observation or other random influences should be smoothed before polynomial approximation or any other curve fit is carried out. This program was specially conceived for scattered data points that are not equally spaced, and it performs first-order single, double, or triple smoothing. (188 steps, 5 pages)

Author: **Dr. Henrique E. Adler**
Oporto, Portugal

**In European areas, order by number 51253D.*

67/97 Third Order Smoothing of Equally Spaced Data Points (#02628D)*

Very similar to the above program except that the smoothing is of third order. (180 steps, 5 pages)

Author: **Dr. Henrique E. Adler**
Oporto, Portugal

**In European areas, order by number 51254D.*

67/97 Legendre Approximation for Unequally Spaced Data Points (#02629D)*

This program approximates a function, defined by a set of unequally spaced data points, by Legendre polynomials of any degree up to 7, using the least squares method. It permits simultaneous computation of up to eight coefficients and of the sum of squared errors for each degree. A generalized Simpson formula giving third order approximation is used for the integrations. Projections of y values can be made. The program *can* be used for equally spaced points but #50520D (02625D in U.S.) would be better for that. (212 steps, 5 pages)

Author: **Dr. Henrique E. Adler**
Oporto, Portugal

**In European areas, order by number 51255D.*

(About this last program, Dr. Adler wrote, "The program is a novelty because the integration formula used in it is not generally known. I never found this formula anywhere in the literature; I had to derive it by myself." Perhaps some of our readers will be able to comment on that subject. Anyway, Dr. Adler, thanks for the contribution and for the good job of programming. Ed.)

Most Popular Programs?

Because a lot of readers ask us what are the most asked-for programs, we put the question to our all-knowing computer and came up with some surprises.

By far, the "best-selling" HP-65 program was #00268A "65-Stopwatch," by **Grant Munsey** of Sunnyvale, California. There were many, many "stopwatch" Programs and still are (see #2 below), but 00268A outsold all of them.

There is a different pattern for the HP-67/97 Library. The top 13 programs are listed below in order of quantity sold. The first on the list is almost 33% ahead of the second one, but only three times larger in sales than the lowest one.

1. **#00369D Star Trek, Advanced, *Larry G. Schneider*, Wilkes-Barre, PA.**
2. **#00192D 67/97 Timer, HP Users' Library***
3. **#00732D Curve Plotting Routine, *A. E. Anderson III*, Mt. View, CA**
4. **#00764D 97-Graph of a Function, *M. M. Breiner*, Cambridge, MA**
5. **#00179D Space War, HP Users' Library***
6. **#00191D Biorhythms, HP Users' Library***
7. **#00321D Pinball Wizzard, *Craig A. Pearce*, Berwyn, IL**
8. **#00162D Multiple Linear Regression for 3 Independent Variables, HP Users' Library***
9. **#00174D The Game of 21 (Blackjack), HP Users' Library***
10. **#00442D Telephone Directory, *R. J. Carril*, Glendora, CA**
11. **#00177D Submarine Hunt, HP Users' Library***
12. **#00785D 97-Plot Subroutine, *J. A. Weber*, Renton, WA**
13. **#00866D Traverse, Inverse, and Sideshots, HP Users' Library***

Congratulations to all of these authors for their "best sellers." Keep up the good work. All are outstanding programs.

(A lot of these earlier programs in the Catalog were written here at Corvallis. However, many were based on programs written by HP-65 owners. In particular,* **Walter Lee Gregory's** *#04200A "Space Ware," a monumental programming job by any standard, formed the basis for best-seller #5, above. Ed.)*

Author! Author!

Even when you treat computers with great care and respect and use correct software, they are still machines, and they sometimes embarrass us. Like, for instance, in the last HP-67/97 Library Catalog Addendum; there, the computer gave HP credit as the author for programs written by HP-67/97 owners in foreign countries. On checking further, we realized that, because our computer is programmed to accept only certain information, it regarded a foreign address as a particular programmed code we use to keep track of foreign subscribers to the Library. Thus, HP became the author of any program written by a non-U.S. author.

So please mark your Addendum 2 with the following *correct* and actual authors.
000961D, 000962D, 000963D, 01180D, 01449D—**Ian McKinnon,** Toronto Islands, Canada.
01089D—**Dick Jensen,** Parkville, Australia.
01102D, 01103D, 01104D, 01226D, 01618D—**Lorne J. White,** Winnipeg, Canada.
01111D—**Alan V. Fernihough,** Riverton, W. Australia.
01216D, 01621D, 01623D—**Naresh K. Sinha,** Hamilton, Canada.
01232D—**Wilic Gabrielian,** Teheran, Iran.
01282D, 01367D—**David B. Westcott,** Islington, Canada.
01366D—**Dr. Lee M. Wolfe,** Blacksburg, VA.*
01392D, 01393D—**Eli Cohen,** Vancouver, B. C.
01397D—**Masao Takahashi,** Tokai-Mura, Japan.
01423D—**R. Milton Johnson,** Carlton, Australia.
01433D—**Brian D. Kenn,** Turramurra, Australia.
01434D, 01542D—**Cedric A. Power,** Suva, Fiji.
01463D, 01464D, 01466D, 01625D—**Keith Neighbour,** Adelaide, Australia.
01467D—**William S. Anglin,** Prince George, B. C.
01531D—**Bruce D. Gough,** Ottawa, Canada.
01605D—**John Beckett,** Gore Hill, Australia.
01610D—**Shannon D. Holt,** Campbell River, B. C.
01615D—**Howard A. Bennett,** Vancouver, B. C.

** No, that's not a foreign address. We can't explain how this error occurred.*

How to Make a Million $

You've all seen those ads that claim *you* too can become a millionaire in real estate, in the stock market, or as a financial wizard. Well ... there's more to making a megabuck fortune than just reading a book or "following my foolproof formula." However, if financial computations and calculations have caused you some sleepless nights, here is a "foolproof formula" that will clear up your insomnia. Buy this new program and you might not be on your way to your first million, but you will be able to handle financial problems with verve, elan, and confidence.

#02630D HP Top-Row Financial Keys with Sign Convention (#00339D in European areas)

This program will show users who are unfamiliar with financial concepts the background they need in order to solve complex financial problems. The program duplicates the five top-row financial keys of current HP financial calculators (HP-92, -37E, -38E). The program uses the cash flow sign convention (+ or −) as well as the special store-or-solve capability of each of the financial keys. The BEGIN/END toggle, 12×, 12÷, and CL FIN (clear financial registers) complete the function set, and HP-97 users will appreciate LIST FIN (print financial registers) and the print/no-print option.

However, without some training in financial concepts, the program would not be useful for the financial neophyte. Therefore, 27 pages of documentation lead the user from the basics of percent to simple and compound interest and then to cash flow diagrams and the sign convention. Twelve examples allow the user to apply the concepts from the training section to real-world financial problems. This program should fill a real gap for users who have financial problems to solve but no financial background.

Author: **Eric L. Vogel**
Corvallis, Oregon

(Many of you have "met" Eric on the telephone or by mail. He works in our Customer Support group. Nice job, Eric. It looks like the answer to a long-standing problem. Ed.)

Software Flags

You might want to study this contribution from **Micky R. Burnette** of Anderson, South Carolina, if you need additional flags for some of your exotic programs. Here's his idea:

Up to 10 additional flags may be added to the HP-67 *(and HP-97)* by developing a software flag register. This scheme is more useful when input conditions must be saved for later use by the program. The ten flags are 0 to 9, and any memory register may be used, although the use of a primary register simplifies programming. Register R_9 will be used in the following example.

R_9 digit position: 10 9 8 7 6 5 4 3 2 1
Corresponding flag #: 9 8 7 6 5 4 3 2 1 0

Setting a flag: (stack X-register contains flag #) LBL A, 10^x, STO+9, RTN.

Interrogating a flag: (stack X-register contains flag #):

LBL B	RCL9	EEX	
1	x⇆y	1	
+	÷	×	
10^x	FRAC	INT	
		RTN	(X-register contains "1" or "0")

If LBL B were a subroutine, then the main program could perform a test (x=0, x≠0, etc.) to determine the state of the "flag," and the operation of the software flag would be similar to that of the hardware flag.

Since this routine uses little program memory, it should find many uses. One use for this routine would be for storing two "signed" numbers in one memory register. In that case, the software flag could be used for correcting the sign of one number.

HP-67 and HP-97 Accessories

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(HP-67) 110/220 Vac., Switchable	82002A*	$ 20.00
(HP-97) 110 Vac.	82058A	$ 12.50
(HP-97) Euro. 220 Vac.	82066A	$ 16.00
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Soft Case, Black Leather (HP-67)	82017A*	$ 10.00
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HP-97 Standard Pac	00097-13101	Math Pac I	00097-13121
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* Also usable on the HP-65.

You may order any of the HP-67 and HP-97 accessories and software shown by calling our toll-free number, 800-648-4711 (in Nevada 800-992-5710), and asking for the nearest Hewlett-Packard Accessory Dealer. (Toll-free number not available in Alaska or Hawaii.)
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NAME

_____
ADDRESS

_____
CITY STATE ZIP

"25 Words or Less"

You evidently like this column and want to keep it alive. Mail about "25 Words or Less" has been "more," not "less." So, as long as *we* get inputs, *all of you* will get outputs.

One of the contributors in the last issue sent another letter as a follow-on to his original contribution. From **Richard H. Baker** of Queen Creek, Arizona, came:

I finally got the May 1978 issue of HP KEY NOTES, and enjoyed it as I have every issue, especially since you included my store-in-order routine.

Only fair, though, to give you the routine that I use to get these out of the registers once you have them all in:

```
001   *LBL b      008    PRTX
002        0      009    ISZI
003    STOI       010    GTOB
004   *LBL B      011   *LBL 2
005    RCL i      012    PRTX
006    X=0?       013     RTN
007    GTO 2      014     R/S
```

As you will see, this is very similar to, but shorter than, the Schüle routine (May 1978, "What's in an HP-67 Register") for checking registers in an HP-67. Mine does not flash the number of the register, but HP-97 users would not need that since mine and Schüle's on an HP-97 will print the contents.

(Thanks, Mr. Baker. However, I must remind our readers that this routine will handle only 24 values. Ed.)

Next a clever routine from **Arnold M. Miller** of Des Plaines, Illinois.

I have a routine that I think would be appropriate for your column, "25 Words or Less." Many times I have found that it would be nice if the calculator cleared only a small group of registers; for example, the summation registers R_{s9} through R_{s4}, without disturbing any of the other registers. *(Whoops! Except the I-register. Ed.)* Here is a subroutine I have found to work well.

```
001   *LBL E      012      R↓
002        N      013    RCL I
003        N      014    X≤Y?
004    ENT↑       015    GTO 9
005        N      016     CLX
006        N      017    STO I
007      X≥I      018    ENT↑
008   *LBL 5      019    ENT↑
009     CLX       020    ENT↑
010    STO i      021     RTN
011    ISZI       022     R/S
```

Instead of putting the register locations in the program memory, they could be put in the stack, with y holding the highest register and x holding the lowest. Also, it is not necessary to clear the stack, but it is a good idea to clear the I-register.

From Santa Cruz, California, our next contributor, **Grant O. Heninger** sends us:

Re: "25 Words or Less" from J. S. Hayden, in the February 1978 KEY NOTES. Mr. Hayden's program, "Order and Store 23 Values," can be enhanced by adding a test zero before sorting. Since all registers (storage) should be cleared to start, about one-half of the execution time will be saved.

```
001   *LBL A      013    STO 0
002    STO 0      014      R↓
003        2      015    STO i
004        3      016    DSZI
005    STO I      017    GTO 1
006   *LBL 1      018   *LBL a
007    RCL i      019     RCL E
008    RCL 0      020         1
009    X=0?       021         +
010    GTO a      022    STO E
011    X>Y?       023     RTN
012      X≥Y      024     R/S
```

Only three steps are added to the original program. These are indicated by underlines.

Here is a routine that is somewhat similar to Mr. Hayden's original "Order and Store 23 Values." However, **George A. Furford** of Salinas, California, has a different slant on the routine, and his instructions and example are first-rate. Here's the routine:

```
001   *LBL A      013     F1?
002     CF 1      014    GTO A
003    RCL 0      015    RCL 0
004    STO I      016     RTN
005    RCL i      017   *LBL 2
006    DSZI       018    ISZI
007   *LBL 1      019    STO i
008    RCL i      020      X≥Y
009    X>Y?       021    DSZI
010    GSB 2      022    STO i
011    DSZI       023     SF 1
012    GTO 1      024     RTN
```

To use the routine, store random quantities, beginning with register 1, then up through register 24. Then store the number of random quantities in register 0. Execute the program, which will stop and display the number of quantities, which will have been rearranged so that the lowest value is in register 1, the next lowest in register 2, and so on. By pressing h REG (or f REG) you get a check on what is in the primary registers; then repeat those keys after an f P≥S and you see the contents of the secondary registers.

This routine is actually part of a complete SORT program that Mr. Furford uses. The program includes routines for storing data, recalling data, and inserting and deleting individual quantities. He also uses this routine as a subroutine in two other programs.

This contribution arrived slightly after we buttoned-up the last issue. It is from **Edward W. Tillitson** of Grosse Pointe Farms, Michigan.

A good idea, "25 Words or Less" deserves promotion. In connection with a sort program for up to 24 numbers, the following number entry routine works well. Key RTN, then the number of entries, "N" in your list, followed by R/S to initialize the routine.

```
001    STO 0      018    ISZI
002         1     011    RCL 0
003    STO 1      012    RCL I
004    DSP 0      013    X≤Y?
005   *LBL 1      014    GTO 1
006    RCL I      015     RTN
007     RTN       016   *LBL E
008   *LBL A      017    DSP 2
009    STO i      018     R/S
```

The initialization stops at LBL A. Each entry is then keyed in, followed by keying A. This routine *does not allow* more than "N" entries to be made, and prior to each entry, it displays the register number for the next entry. If the RTN at stop 015 is deleted, the balance of the program takes off automatically after n_N has been entered. If the balance of the program needs debugging, retain the RTN step until debugging is complete, record the list of entries on a data card and thereafter use it for making the entries after the initialization step, then press B.

Sorry about not making it in 25 words. However, I expect the editor is quite capable of appropriate condensations if necessary.

(No need to condense it, Mr. Tillitson, you did a good job, and I'd rather it was complete than compact. Don't take the column title too seriously. Ed.)

Now, how about a little longer one, actually a small program, from **James R. Grandstaff** of Oak Park, Illinois.

I have written a program to compute factorials of numbers larger than 69. The program uses only 45 lines of program memory.

```
001   *LBL A      016         6     031    ST+0
002     CLRG      017         9     032    DSZI
003     STO 9     018        N!     033    GTO C
004         7     019       LOG     034   *LBL D
005         0     020    STO 0      035    RCL 0
006      X≤Y?     021    RCL 9      036     INT
007     GTO B     022       LOG     037    STO 2
008      X≥Y      023    ST+0       038    LSTX
009        N!     024        F2?     039     FRC
010       RTN     025    GTO D      040     10^x
011   *LBL B      026   *LBL C      041    STO 1
012         -     027         1     042    PRTX
013     STO I     028    ST-9       043      R↓
014      X=0?     029    RCL 9      044    PRTX
015       SF 2    030       LOG     045     RTN
```

The program uses the log of 69!, then adds the log of 70 to it and loops, adding the logs of consecutive numbers until it reaches the input number. Numbers smaller than 70 use the calculator's built-in N! function. The answer is displayed (or printed) and stored in register 1 (N) and register 2 (exponent).

(It works, all right, but it does take a while. I clocked a bit over 8½ minutes to run the answer for N=521. Ed.)

From **Leslie D. Paul** of Madison, Wisconsin, came another contribution to this column. In his words: "The program really shows the power of RPN logic!"

t-Statistic for Two Means: Given the mean, standard deviation, and sample size from

independent random samples of two normal populations, the following program can be used to test the null hypothesis H_0: $\mu_1 = \mu_2$.

```
001  *LBLA     014   ST+9
002   CLRG     015   X≷Y
003  *LBL1     016   RTN
004    R/S     017    -
005     X²     018   GSB1
006    R/S     019   RCL9
007    1/X     020   RCL8
008   ST+7     021    ÷
009    1/X     022   RCL7
010      1     023    x
011      -     024   √X
012   ST+8     025    ÷
013      x     026   R/S
```

After keying in the program:

ENTER	PRESS	DISPLAY
$\bar{x}_1$	A	$\bar{x}_1$
S_1	R/S	S_1^2
n_1	R/S	$\bar{x}$
$\bar{x}_2$	R/S	$\bar{x}_1 - \bar{x}_2$
S_2	R/S	S_2^2
n_2	R/S	T

The program solves the t-statistic formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\frac{S_1^2(n_1-1) + S_2^2(n_2-1)}{n_1 + n_2 - 2}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

by efficient use of the stack, and with storage register arithmetic. The program can be used by itself or as part of a larger statistical program.

There are flag tests galore, but here is one we have not seen before. And it *is* short. It's from **J. David Byrd III** of Arlington, Virginia.

I have a submission to your "25 Words or Less" column. Unfortunately, it is the overworked "Flag Test Routine," but I think that the solution that I have reached is just about as short as you can get and still restore the *test cleared* flags (F2 and F3) to their proper status. As a matter of fact, if the user wishes to *install* this program in steps 001 through 018, he or she can even eliminate the label (LBL A) and access the routine *manually* by pressing RTN (to get to step 000) and R/S (to execute).

```
001  *LBLA     011   X≠0?
002      0     012    SF2
003    F0?     013      0
004   10ˣ      014    F3?
005      0     015   10ˣ
006    F1?     016   X≠0?
007   10ˣ      017    SF3
008      0     018   PRST
009    F2?     019    RTN
010   10ˣ      020   R/S
```

This Flag Test Routine (non-destructive) is the minimum-length version which, alas, annihilates the stack but does give a positive indication of each flag status in the printout, (or stack review) as opposed to only displaying those flags that are "set." A sample output is shown below: T=F0, Z=F1, Y=F2, and X=F3 (1 if set, 0 if clear).

```
1.   T   F0   "set"
0.   Z   F1   "clear"
0.   Y   F2   "clear"
0.   X   F3   "clear"
```

Only F0 is set.

```
1.   T
0.   Z   Flag 0 and
1.   Y   flag 2 set.
0.   X
```

Flag 2 and Flag 3 are reset to their prior state via the X≠0 test, which uses the number (1 or 0) resulting from the flag test itself as the test condition for setting or not setting the flag(s).

Non-Function Plotting Routine

Every so often, one of our readers comes up with a truly elegant routine or program. You are about to see one right here.

Just before the last issue went to press, we received the following letter. It was terribly tempting to make a last-minute effort to squeeze it into that issue, but to do so would have required some heavy editing. The routine was too good to do that, so we saved it, and here it is in its entirety. *Glückwunsch,* Herr Dr. Stöcklmair!

Dear Editor,

In the June 1977 issue of HP KEY NOTES, various plotting routines for the HP-97 printer were described. To work with these programs, always a function f(x) must be given, and only the graph of this function can be printed out.

In everyday life, often a sequence of data may appear that cannot be expressed by a function; e.g., production volumes, price movements, daily maximum temperatures, and a lot of other data series, where a graphical performance may be useful, because it will give a quick and clear impression of the actual variations.

In cases of that kind, the short program given below may be of some use. It consists of two parts: in the preparation routine (LBL a), the minimum and the maximum value determining the printout scale must be keyed in the Y- and X-registers (always enter the minimum value in the Y-register!); these values may be positive and/or negative. When "a" is pressed, the constants needed for the main routine will be stored in registers A and B (or any other registers available), and the maximum and minimum limits will be printed on the tape. After this preparation step, the given data can be entered in the X-register and key "A" must be pressed after each data input.

```
001  *LBLa     015   RCLB
002   STOA     016    ÷
003   PRTX     017      9
004   X≷Y      018    +
005   PRTX     019   DSP0
006      -     020   RND
007      9     021   10ˣ
008    ÷       022      9
009   STOB     023   1/X
010    SPC     024      8
011    RTN     025    +
012  *LBLA     026    x
013   RCLA     027   PRTX
014      -     028   R/S
```

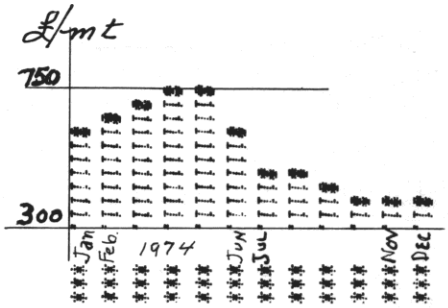
The program version in the sample offers a range of 9 intervals (10 print positions) and the printed values of the data input are represented by an "8" on top of a column of 1's. The range of the printout can be extended to 10 intervals (11 print positions), if the zero-line (minimum-line) is laid on the decimal point. To achieve this result, the figure "9" in step 007 must be replaced by the number "10" (the figures "9" in steps 017 and 022 remain unchanged!). In this program version, the minimum value in the printout will not be represented by an "8" but by a "1," thus indicating that this value actually belongs to the next print position on the right (= decimal point).

To achieve a correct sequence of the values in the printout, when the tape is turned by 90° (first value on the left side!), it is recommended to enter the data in reverse sequence, beginning with the last value of the given data series.

Zinc—Prices LME
(monthly averages)

Key in each value, press PRINT X, then max. & min. & again each value, followed by key A.

	£/mt	
Jan. 1974	596.6	
	664.9	
	694.7	
	727.4	
	736.3	
	588.4	
	458.0	
	453.4	
	392.7	
	353.1	
	341.0	
Dec. 1974	336.9	
Max.→	750.0	***
Min.→	300.0	***



Continued

The sample displays movement of zinc prices at the London Metal Exchange from January 1974 to December 1974.
Yours sincerely,
Dr. Hans Stöcklmair
Klagenfurt, Austria

Algorithms for RPN Calculators

The title of this column is in italic type because it is also the title for a new, spectacular, hardcover book by **Dr. John A. Ball.**

Dr. John A. Ball is a radio astronomer at the Center for Astrophysics (Harvard College Observatory and Smithsonian Astrophysical Observatory) in Cambridge, Massachusetts. He has a B.S. degree from the University of Nebraska (his home state) and a Ph.D. in astronomy from Harvard. With such a background, there is little wonder how he wrote such a fabulous book. It is 330 pages of pure delight for HP calculator aficionados. Herewith is a quote from the cover jacket:

"Few calculator users are aware of the computational power beneath their fingers. Algorithms designed for one of the many handheld calculators that use RPN (Reverse Polish Notation) can solve remarkably complex numerical problems, ordinarily given to large computers.

"This book explains how to write concise and elegant algorithms for meeting specific, individual needs and for solving numerical problems of surprising complexity. Using only an RPN calculator and the methods supplied, scientists, engineers, and students can numerically integrate differential equations, fit curves to data using least-squares techniques, solve transcendental algebraic equations, and evaluate many special functions (such as Bessel functions). In addition, existing algorithms can be simplified and streamlined.

"*ALGORITHMS FOR RPN CALCULATORS* progresses logically: you will understand and benefit from the first chapters even if your background includes only high-school mathematics; later chapters deal with more complex problems involving calculus. And, a large section of the book gives actual RPN algorithms for a variety of common problems. These are written to be readily adapted or directly used on any RPN calculator. This section alone constitutes a valuable practical reference.

"Each chapter ends with exercises (problems sets), and an appendix contains numerical answers. In addition, the book includes a critique of present calculator designs, with suggestions for future developments."

The book was published by:

John A. Wiley & Sons, Inc.
One Wiley Drive
Somerset, New Jersey 08873

If you cannot find it at your bookstore, write to the above address.

KEY NOTES extends hearty congratulations to Dr. Ball. When you see the book, you'll know why we are enthusiastic about it.

Computer Program For HP-67 Codes

About a month ago we received in the mail a large package that contained all of the information about a program in PL/I (Programming Language One) for the IBM 360-370 computers. The program translates HP-67 key codes to HP-67 keystrokes.

The program was written by **Dr. Allen Joel Harris** of Winthrop, Massachusetts, who stated that he finds this program useful for both debugging and documenting HP-67 programs.

Dr. Harris has stated that he would like to share his program with KEY NOTES readers who have access to computers with PL/I compilers. For the cost of materials and postage, he will mail the necessary listings and tab card decks, and will not limit his offer to the U.S. So if you are interested, contact Dr. Harris and include a stamped and self-addressed envelope for his reply to you. His address is:

Dr. Allen Joel Harris
600 Governors Dr., Apt. 32
Winthrop, Massachusetts 02152

Star Trek Complaints

We have had an unusual number of complaints about program #00369D, "Star Trek-Advanced." So we contacted the author, Larry Schneider. Here is a typical complaint, then Mr. Schneider's answer.

User: There is one important part of the program that is in need of revision. When an enemy ship is destroyed, it still registers on the sensor, and if you are too close you have to fight it all over again. This puts a damper on the game, so a revision would be greatly appreciated by all.

Mr. Schneider: I have been receiving many letters about this and other problems that users have been having with my program. They all occur because of something that each user is forgetting to do. And that is, setting the appropriate flags and display prior to recording the program on a card. For example, I will explain this user's particular complaint.

The program steps that flag the enemy ships upon destruction are 92 to 95 in program #5. Notice that the register is flagged with 1000 only if flag 0 is set. However, because this user neglected to preset the flag, his program doesn't work properly.

There are just too many users who have written for me to possibly respond to all of them. And 95 percent of the complaints are because of this flag and display presetting problem. I suggest that perhaps you might include an article in KEY NOTES. If I can be of any more help, please don't hesitate to contact me.

(Glad to help, Larry. We hope this clears up the complaints and satisfies our customers, and that it takes the load off of you. Thanks for the explanation, Larry. We also suggest that readers **always** *check the "Set Status" box at the bottom of the "Program Listing" page* **before** *they record any program onto a magnetic card. Ed.)*

Ersatz Memory Bursts!

On page 5 of the last KEY NOTES (May 1978, Vol. 2 No. 2), we printed a neat trick and called it "HP-67/97 'Ersatz' Continuous Memory." It was—and still is—a very good program. But two very astute and sharp-eyed individuals caught a sneaky problem in the program, one that eluded even our technical review.

The two letters about the problem are nearly identical, so we have printed the first one received. The second letter, from **Murray L. Lesser** of Yorktown Heights, New York, ends: "It is a lovely idea, but you should warn your readers not to count on it. And that should tell you something. But read for yourself:

Dear Editor:

In the last issue of KEY NOTES, there appeared an interesting technique, written by **Pierre Flament** of Belgium, that provides the HP-67/97 with a substitute (ersatz) Continuous Memory.

This technique caught my eye because it was very similar to one I devised a while back. Well, I hate to be a burster of bubbles, but, in this case, there is a big bubble that is just waiting to be burst! You see, Mr. Flament's routine (as well as mine or I suppose that of anyone else) just doesn't always work. When doesn't it work? Well, not for any program that possibly could be stopped in the middle of a subroutine; that is, before it reached the return statement of an internally called subroutine. Why? Because the subroutine return addresses cannot be stored on a card. Virtually everything else can be stored (as Mr. Flament showed us), but not subroutine return addresses.

Since neither Pierre Flament nor HP mentioned this fact, I felt obliged to alert fellow users to this limitation.

Because one never knows where a program will stop when R/S is pressed, I suggest not using any "continuous memory" technique for programs with subroutines. Do not despair, however, because many programs do not have any internally called subroutines.

I doubt the possibility, but maybe—just maybe—someone will discover a way around the limitations.

Sincerely,
Joseph V. Saverino
Brooklyn, New York

Calculators/Computers Magazine

Except for material published by HP or the independent Users Club (PPC), you can't find very much literature about calculators. There *is* a magazine, however, and here is a letter from the editor of that magazine.

Your readers may be interested in calculator material appearing in our magazine, *CALCULATORS/COMPUTERS.* Enclosed are the lead pages of two articles to appear this fall. We will be running a series by **Dr. John Wavrik,** on the use of the HP-25 in elementary schools.

Sincerely,
Don Inman, Editor

Continued

Thanks for the notice, Mr. Inman. The HP-25 articles by Dr. Wavrik are very good. The material was designed for a course for students (grades 4 to 6), accompanied by a parent, through the University of California, San Diego Extension. Dr. Wavrik is an Associate Professor of Mathematics at the University of California at San Diego.

Although a good bit of the calculator material in *CALCULATORS/COMPUTERS* is in algebraic notation, it is easily used with HP's RPN system, which is one of the assets of our system.

The magazine is published seven times a year (January through May, October and November) at the subscription price of $12* a year by:

DYMAX
P.O. Box 310
Menlo Park, CA 94025

Foreign rates are: $17* a year surface mail; airmail to Canada $23;* airmail to Europe and Pan America $28;* and airmail elsewhere $32.* Payment must be in U.S. currency.

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

Electronic Burp

We have an incredibly large number of name and address files on our computer. Therefore, it takes a special, coded program to obtain labels *only* for the people who get KEY NOTES. It was during one of these label runs, earlier this year, that a power failure occurred during the night, precisely when the labels were being updated and printed. Because of some electronic quirk, the computer did not indicate it had "lost" some files.

However, because of the number of queries we've had about the February 1978 (Vol. 2 No. 1) and May 1978 (Vol. 2 No. 2) issues, it leads us to believe that some files *were* dropped that night. So, if you missed one of those issues and we haven't already caught the omission and sent you the newsletter, please let us know.

New Book on Programming Calculators

A few months ago, we managed to discover that a book was being written about programmable calculators. In fact, we learned that the title was: *How to Program Your Programmable Calculator*, so we called the publisher and they graciously sent us a copy of the *manuscript*, because the book was still in production.

This book has been written by **Stephen L. Snower** and **Mark A. Spikell**, both of whom have extensive educational and teaching backgrounds,especially in mathematics. Mr. Snower presently teaches at Babson College in Wellesley, Massachusetts, and has taught at Michigan State University. He has a BS degree in mathematics from M.I.T. and has other degrees in teaching and mathematics (from Harvard). Mr. Spikell teaches at Lesley College in Cambridge, Massachusetts and is the author of other books on mathematics. He has an AB in mathematics from Miami University, an ED.M. from Xavier University, and an ED.D. from Boston University. As you can see, both authors have good credentials.

It would take a full issue of KEY NOTES to describe *How to Program Your Programmable Calculator*. To say the least, it is *complete*. It covers everything from the evolution of calculating machines to AOS and RPN calculators. Of course, of interest to *our* readers is the material on RPN calculators...and it is extensive. Basically, the book covers the least-expensive models of programmable calculators, including the HP-33E and HP-38E. Thus, it does not cover the incredible range of the HP-65/67/97 calculators. But, if you are wary of learning to program a programmable calculator, this is the book that can get you started. It gets into basics, flow charting, sample programs, how-to-do-it routines, and even gives answers to problems.

Or, if you have a youngster in school or a son or daughter in college, here is a most appropriate book for the upcoming back-to-school season or for a fine Christmas present.

The book will come off the presses in November or December and will be offered in both hardcover and softcover versions. If you can't at that time locate it at your bookstore, write to:

Prentice-Hall, Inc.
Spectrum Books Div.
Attn: Lou-Ann E. Leahy
Englewood Cliffs, NJ 07632

We Get Letters

Sometimes we like to share with you the lovely letters we get from satisfied customers. Here is one such letter.

Gentlemen:

I would like to pass on several comments to the Users' Library staff and to the readers of HP KEY NOTES.

I have just returned from an extended business trip to Europe. Naturally, I had my HP's with me (22 and a 67). For reasons unknown, several keys on the 67 lost the resistance that is normally present. It became uncomfortable to use, although it did continue to calculate properly.

I did a little research and discovered that HP had an office in Vienna, Austria. I adjusted my schedule and visited the office. I met Mr. Friedrich Ritter, Customer Service Engineer, who quickly assessed the problem and replaced the keyboard.

It's a very nice feeling to discover that HP service is available; and *that,* folks, is a very big plus. Needless to say, I'm one more of your very satisfied customers.

Kindest regards,
Robert E. Barbutti
Juneau, Alaska

HP KEY NOTES

August 1978 Vol. 2 No. 3

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

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

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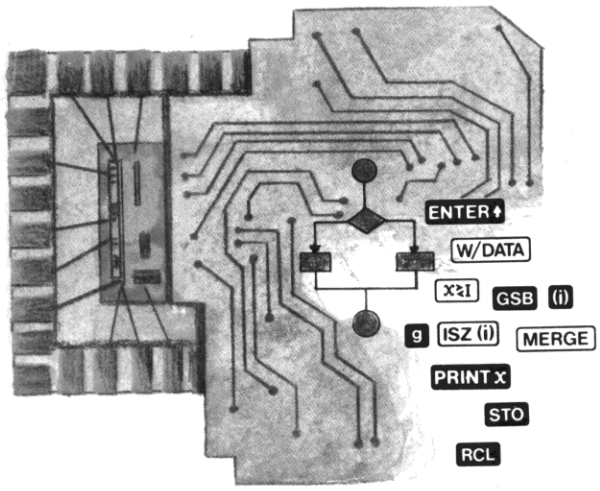

Featuring, this issue:

HEWLETT hp PACKARD

HP Key Notes

November 1978 Vol. 2 No. 4

One Winner Aids Another Winner!

When we announced the HP-97, we were nearly overwhelmed with orders. People wanted them long before they even *saw* one!

Well, if you read the papers at all or watch the news on TV, you will have known about a similar situation, but on a much, much larger scale. We're referring to the phenomenal success of the Boeing 767 commercial airliner (pictured here). Orders for the new airliner are *pouring* in, yet no one has even *seen* one, except, of course, in model form.

No, we aren't trying to sell aircraft! We introduced the above parallel because there is an unusual epilogue to all of this. Guess what product is being used to design and perfect the other one?

You are right! The HP-97 can shorten many of the long and tedious design tasks associated with bringing a new airliner from the drawing board to the day when it makes its first flight.

Recently, we received a letter and two programs from an engineer at Boeing. And to show you how HP-97's can be implemented in modern industry, here are the letter and the two programs.

The Boeing Commercial Airplane Company Preliminary Design Department is using the HP-97 portable scientific calculators to do many of the airplane engineering configuration and design jobs.

The HP-97, coupled with a training program, has proven to be a cost-effective application to this engineering work. Once initiated, the engineers are eager to expand the application of these efficient engineering tools. The features that make this calculator productive are: the printer, for program and data listing; the magnetic card, for program and data entry and recovery; and programmability, for tireless and reliable repetitive calculations.

I have submitted a couple of programs that we are just starting to use. These programs will record upper and lower airfoil contours (data points) on cards and produce printouts of these data scaled for chord length and percent thickness. One standard airfoil will fit on two data cards.

(97) Airfoil Coordinate Data (#02892D)*

This program, in conjuction with #02893D, will produce a printout of airfoil coordinate data from data cards. The printout may be scaled for chord length and percent thickness. The companion program, #02893D, must be used to generate the data cards. Up to 13 data sets can be printed from one side of a data card. (139 steps, 7 pages)

Author: **Gordon H. Cheney**
Seattle, Washington

**In European areas, order by number 00340D.*

(97) Generate Airfoil Coordinate Data Cards (#02893D)*

This program compresses a complete set of airfoil coordinate data onto two data cards. Data are compressed into the calculator's storage registers by means of a differencing/merging technique. The companion program, #02892D, is required to read and print the data to any desired scale. (104 steps, 11 pages)

Author: **Gordon H. Cheney**
Seattle, Washington

**In European areas, order by number 00341D.*

(Because of the vast amount of data that is useful only in printed form from the HP-97 printer, these programs are not practical for use on the HP-67. Ed.)

Photograph courtesy of Boeing Commercial Airplane Company

Library Corner

The best news any Library member can read is that a new Catalog Addendum is on the way. So that's the good news this time: Addendum 3 to the Catalog will be mailed in late November. However, *before* you start anticipating the arrival date at *your* house, remember that the Addendum is mailed at bulk rate, which is somewhat slow, and that the Christmas rush season has a disconcerting effect on mail delivery. So please wait until at least January 15, 1979, before you call or write.

Catalog Addendum 3 contains 950 new programs, covering program numbers 1801 through 2750. The format has been improved to ease reading the material, and spacing of names and numbers in the "Authors Section" has been improved. You'll like it!

ORDERING PROGRAMS

But for the exception noted in one article, any program you see in HP KEY NOTES can be ordered either from the Users' Library in Corvallis, Oregon, or from the Users' Library in Geneva, Switzerland. (Both addresses are on the back cover.) For most of the world, use the program number listed next to the program's title, then order it from Corvallis. The only exception is if you live in the European area; in that case use the number listed in italic type below the program abstract, then order it from Geneva. Payment for programs must conform with the instructions from *your* area Library. **Always use order forms if possible** or, better still, use the new order form in this issue, and be sure to include any state or local taxes.

NEW HP-67/97 PROGRAMS

Because the new *Catalog Addendum 3* is being mailed shortly after KEY NOTES, and because we've highlighted programs in other articles, there is only one program highlighted in this column. It's here because the algorithm is notable, the documentation is good, and the application is both topical and usable. And it is *very* versatile. We congratulate the author for a job well done.

67/97 Rate of Return for Odd Interval Cash Flows (Fisher Method) (02394D)*

Using Fisher's algorithm, you can find the exact rate of return on a stream of 20 transactions at any date after January 1, 1900, plus a final fund value and date. The program prints the return compounded continuously and converts this to the annual compound rate. Newtonian approximation is used to find the solution for continuous compounding. The program also tracks the number of iterations and has an autohalt on nonconvergence. It may be used for other rate of return problems; e.g., bond yield, etc. The program also permits error correction. (223 steps, 6 pages)

Author: **Kenneth A. W. Butcher**
Riverside, Connecticut

** In European areas, order by number 00342D.*

Editorial

Like to make sure you receive each issue of KEY NOTES, plus any other mailings, announcements, or special sales we might generate? *You* can help by keeping your address up to date. Try to send us the code numbers on your KEY NOTES label, because it saves a lot of time. Also, you are far more likely to receive your copy if you use your home address rather than a company address.

If you plan to buy accessories for Christmas presents, and you order from the KEY NOTES order blank, don't hesitate too long. There is always a mail-jam before the holiday season, but we will make a *special* effort to quickly process and ship all orders from KEY NOTES readers.

Because the next KEY NOTES won't reach you until sometime in February, next year, I'll use *this* occasion to wish all of you a happy and safe holiday season, and many thanks for all those lovely letters about KEY NOTES.

Letters to the editor should be addressed to:

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

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

Remember "Ersatz" Continuous Memory?

When we printed the "Ersatz" Continuous Memory article (May 1978, Vol. 2 No. 2) it seemed almost too good to be true. That suspicion became a reality when a problem was pointed out by **Joseph V. Saverino** in the August 1978 (Vol. 2 No. 3) issue. But, remember Mr. Saverino's last remark, "... maybe someone will discover a way around the limitations."? Perhaps that "someone" is **James C. Pittman, Jr.** He has found at least a partial answer to the problem, as follows:

Reference "HP-67/97 'Ersatz' Continuous Memory" in the May 1978 issue and "Ersatz Memory Bursts" in the August 1978 issue.

There is a way around the problem of using the Ersatz memory cards when the running program contains subroutines, but it requires advance preparation, some room for extra program steps, and an unused flag.

The method is to insert the two steps "h F? 0, R/S" *after* each subroutine call from the *main* program. As long as flag 0 is clear, the program runs normally.

If a program is running and the low-battery indicator comes on, press R/S, h SF 0, R/S and wait for the program to halt. Now follow the instructions given in the May article on the use of the Ersatz memory cards. When you have changed batteries and are ready to re-start your program, first you will have to key h CF 0.

Obviously this method will not work with all programs that contain subroutines, depending on how much time is spent in a subroutine or how many times a subroutine is called by the main program. For certain programs, however, it will get around the specific problem noted in the August issue.

Incidentally, whenever a running program is stopped by using the R/S key, a possibility for error exists if constants are entered by means of program steps. That is, if the R/S happens to occur in the middle of a string of digits, then the string will be broken into two strings when the program resumes by using R/S. A possible solution to this error is to use the SST key while reading the program code, to be sure you are at a safe place to stop.

Bargain Sale For K.N. Readers

In this age of inflation and upward-spiralling prices, you rarely see the word "bargain" anymore. So, maybe this is one of your last chances to take advantage of the word.

We have a limited supply of items 9320-2940 HP-55 Programming Pad and 82012A Soft Black Leather Case, and we want to offer them first to our KEY NOTES readers before we offer them elsewhere.

The HP-55 Programming Pad is fairly adequate for HP-25 programming use. And the soft leather case accommodates the models: HP-35, HP-45, HP-70, HP-80, and all of the new Series E calculators: HP-31E, -32E, -33E, -37E, and -38E.

Option 1) 5 HP-55 Programming Pads
1 Soft Black Leather Case
(Value at last list price: $16.25)
Option 2) 10 HP-55 Programming Pads
(Value at last list price: $16.50)
Option 3) 2 Soft Black Leather Cases
(Value at last list price: $16.00)

Any of these options, NOW ONLY $5.00!*

You have to admit that these are bargain prices. The only stipulations are: You must order by option number (on the attached KEY NOTES order form), and the offer is good only in the Continental U.S., Alaska, and Hawaii. **Orders with combinations other than shown above will not be accepted.** Orders will be shipped on a first-come first-served basis because supplies are limited. So place your order today!

Christmas is just around the corner. Here's one way to fill a few stockings!

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

Watch Your Step!

If you saw the correction to CE Pac program CE1-02A2 on the back page of the May 1978 issue (Vol. 2 No. 2), you saw a slight—but nasty—typographical error. Our statement "... after step 66 ($x \neq 0$?) add: X=0? and GTO 8" should have been "... replace step 66 ($X \neq 0$?) by X=0? and GTO 8."

We want to thank **Prof. Dr. C. J. Bouwkamp** of Eindhoven University of Technology in The Netherlands for bringing this to our attention.

And while we're at it, here is another correction to the last issue. It was immediately noticed by **James F. Key,** Professor of Mathematics at George Peabody College for Teachers in Nashville, Tennessee. The t-statistic formula in the first column on page 10 somehow lost the square-root radical over the entire denominator!

Stick With Glue!

If you don't like "rubber" cements, two-sided sticky tapes, and other such products for attaching HP-97 tapes to program forms, here is another product that might appeal to you. This is an excerpt from a letter from **J. David Byrd III** of Arlington, Virginia.

For HP-97 users, a nifty way to attach the program printout strips to the programming forms is with the use of a paper adhesive marketed as Dennison "Glue Stick," and which is available in supermarkets, drug stores, etc. It is clean, neat, and even allows you to reposition the strip. It holds well and, in a pinch, it is even possible to remove the strip of paper without destroying the Program Description form itself. The stuff doesn't "ooze through" the paper as does "rubber" cement or the like, and it isn't as "instantly permanent" as double-stick tape.

(Thanks for the tip, Mr. Byrd. I'm pretty sure that the same type of product is made in Germany and perhaps in other countries. Ed.)

Calculator Calculus Notes

The Naval Postgraduate School in Monterey, California, has done a superb job of integrating programmable calculators into the educational environment at that facility. Much of the credit for this belongs to **Prof. Rex H. Shudde** and **W. Max Woods,** Director of the Office of Continuing Education.

One of the books used there is a collection of notes entitled: *Calculator Calculus for the HP-67 Programmable Calculator*. The material was developed first by **Herbert D. Peckham** and **Maurice D. Weir.** It was then adapted for the HP-67 by Professor Shudde, who authored this book. And it just *has* to be good! Herb Peckham is a long-time HP computer fan. He is in the Physics Department at Gavilan College in Gilroy, California. Maurice Weir is in the Department of Mathematics at the Naval Postgraduate School. Rex Shudde, who is well-known for his many Users' Library contributions, also works at the School, in the Department of Operations Research.

The book is in 8-1/2 x 11-inch format, stapled at the binding edge. Copies may be obtained by requesting same from: Office of Continuing Education; Code 500; Naval Postgraduate School; Monterey, CA 93940. The supply of books available to the public is very limited. So *please* don't order one unless you have a definite need or use for it.

What *Is* in an HP-67 Register?

We received a lot of mail about **Paul Schüle's** "What's in an HP-67 Register?" article in the May 1978 issue. Mostly, the letters offered slight modifications to his routine. Others proposed virtually all-new ways to check the registers. But here is a really different approach.

Dear Editor:

I am writing in regard to Mr. Schüle's HP-67 register-checking routine published in May 1978 KEY NOTES. I have attached two routines below which perform the same function except that the I-register also is checked.

Routine #1 checks from register zero to the I-register, which is the same order as Mr. Schüle's routine. The same number of labels are used but the routine is longer (34 steps vs. 26 steps).

```
001 *LBLE 013    R↓ 024   RTN
002     0 014  ISZI 025 *LBL8
003   X≠I 015  GTO9 026  X=0?
004     2 016 *LBLE 027   RTN
005     5 017    R↓ 028    R↓
006 *LBL9 018    R↓ 029  DSP0
007  RCLI 019  STOI 030   PSE
008  X=Y? 020    R↑ 031    R↑
009  GTOE 021  X≠Y 032  DSP9
010  RCL; 022  GSB8 033  PRTX
011  GSB8 023     0 034   RTN
012    R↓
```

Routine #2 checks from the I-register to register zero. This routine is one step shorter and uses one less label than Mr. Schüle's routine.

```
001 *LBLE 010   PSE 019    -
002     2 011  X≠Y 020  X≠I
003     5 012  DSP9 021  RCL;
004  RCLI 013  PRTX 022  X≠Y
005 *LBL9 014 *LBL9 023  X≠I
006  X=0? 015  X≠Y 024  X≠Y
007  GTO9 016  X=0? 025  GTO9
008  X≠Y 017   RTN 026   R/S
009  DSP0 018     1
```

Sincerely,
David D. Loeffler
Glen Burnie, Maryland

Application Pac Corrections

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

HP-67/97 NAVIGATION PAC

Program NAV-11A, "Fix From Two Lines of Position," sometimes gives you an incorrect azimuth for a diagonal of the error trapezoid. To receive a revised card (NAV-11B), **you must mail your old card to: HP Service Department; P.O. Box 999; Corvallis, Oregon 97330.**

Program NAV-12A, "Radar Plotting: Closest Point of Approach," has been found to return reciprocal bearings under certain circumstances. Few users have experienced any trouble, but for the sake of correctness, a new version of the program is being made available. To receive revised card (NAV-12B), **you must mail your old card to: HP Service Department; P.O. Box 999; Corvallis, Oregon 97330.**

We want to give special thanks to **John B. Harrell,** Lieutenant, U.S. Navy, who first informed us of the problem, and then figured out a solution as well.

HP-67/97 ME PAC

Program ME1-02A2, "Section Properties—Output," generates unreasonable answers in the special case when $I_{\bar{x}}$ equals $I_{\bar{y}}$. To receive a revised card (ME1-02B2), **you must mail your old card to: HP Service Department; P.O. Box 999; Corvallis, Oregon 97330.**

Program ME1-03A, "Stress on an Element," generates an unreasonable answer when S_x equals S_y. To receive a revised card (ME1-03B), **you must mail your old card to: HP Service Department; P.O. Box 999; Corvallis, Oregon 97330.**

Tip From a User

From St. Louis, Missouri, came the following idea which, by the way, works well. It was donated quite a while ago (bet you thought we forgot you!) by **Alfred A. Speer.**

Readable electrostatic copier (like Xerox) duplicates can be made from HP-97 tapes by the use of a simple color filter. Direct copies of the blue symbols are sometimes indistinct. Buy a yellow mylar "report cover" that is sold in office stationery stores. Slip your tape(s) in the transparent plastic cover before copying. Image enhancement is caused by the yellow screen filtering out much of the reflected blue image.

(Thanks for the tip Mr. Speer. Sorry it took so long to get it in KEY NOTES. Now you can believe that we try our very best to save and include as many ideas as possible. Ed.)

A "REEL" Neat Device!

There are a lot of HP-97 owners among our readers, and this article is for them. It's a very neat device, but it takes some tools and materials to make it. Still... it works, and very well!

Dear Editor:

Often in our work, problem solutions require a long printout tape which, during execution, must be kept reasonably straight and continually rolled up or we end up with a tangled mess. At the end of execution, reading a long tape requires some dexterity to manage two loosely rolled-up ends while searching back and forth for a particular part of the solution.

After pondering the problem of long tapes, we came up with a simple device that solves most of our problem. The device, shown in figure 1, consists of a slotted U-shaped bracket and two take-up reels, each of which consists of a rod with two large disks and a thumb-wheel. On each rod is a used paper-tape core in which a narrow groove is cut along its length for inserting the leading edge of the paper tape. The paper-tape core can be either a snug fit or glued to the rod.

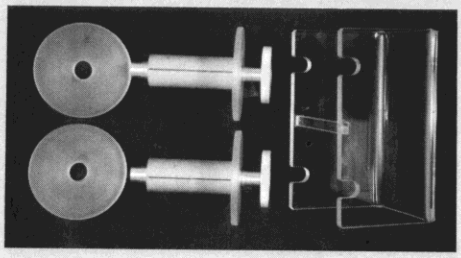

Figure 1

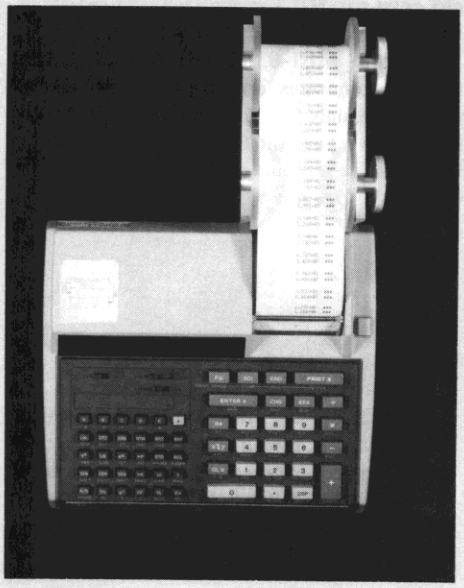

Figure 2

During execution the device sits behind the calculator and the paper tape is taken up on the rear reel, which is occasionally rotated by hand, as needed. As shown in figure 2, the device keeps the paper tape neat and manageable. After program execution, the other end of the tape is inserted in the front reel and, as shown in figure 3, the tape can now be easily searched from one end to the other as needed.

Sincerely yours,
Richard J. Simms & Paul D. Fairchild
Ann Arbor, Michigan.

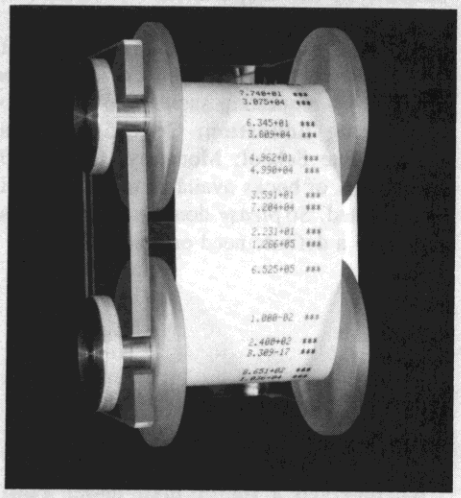

Figure 3

New Book For Airplane Engineers

We've recently come across a new booklet that should appeal to engineers or other professionals in the aircraft industry. Written by **Windsor L. Sherman,** the booklet is entitled, *"Airplane Stability Calculations With a Card Programmable Calculator."* Mr. Sherman works at NASA's Langley Research Center in Hampton, Virginia.

Actually a Technical Memorandum written for NASA, the booklet is in 8- by 10-1/2-inch soft-cover format and contains 60 pages.

Programs are presented for calculating airplane stability characteristics with an HP-67. These calculations include eigenvalues of the characteristic equations of lateral and longitudinal motion as well as stability parameters such as the time to damp to one-half amplitude or the damping ratio. The effects of wind shear are included. Background information and the equations programmed are given. The programs are written for the International System of Units, the dimensional form for the stability derivatives, and stability axes. In addition to the programs for stability calculations, an unusual and short program is included for the Euler transformation of coordinates used in airplane motions.

Price of the booklet is $5.25, and it may be ordered as "Report No. NASA TM-78678" from: National Information Service; Springfield, Virginia 22161. Sorry, this offer is good only in the Continental U.S., Alaska, and Hawaii.

"25 Words" (More or Less!)

Now that this column is pretty well established in KEY NOTES, we are getting some duplication of ideas and routines. So, if you send in an entry for this column and you see one just like it in print, buy *not* yours, don't be dismayed. We use the one with the earliest postmark. Also, some variations are so slight, we hesitate to print them and, instead, elect to choose one different than the others.

But keep those cards and letters coming. We'll try to print as many new ideas as space permits.

From **Sutton Redfern** (Lacey, Washington) comes the first routine for this issue.

I believe the attached program for clearing any sequential set of registers without disturbing the contents of all other registers is shorter and more direct than the one proposed by Mr. Miller in the August 1978 KEY NOTES.

This program will clear any sequential group of registers. As written it will clear secondary registers R_4 through R_9. Any other group can be cleared by using the (i) address of the lowest register to be cleared instead of 14 and the (i) address of the highest register to be cleared instead of 19. The program can be readily modified to initialize any group of registers with any desired value, or it can be used with print statements to print out the contents of all or any group of registers and is then a variation of Mr. Schüle's program given in the May issue.

```
001  *LBLE      008   ISZI
002       1     009      1
003       4     010      9
004    STOI     011   RCLI
005   *LBL9     012   X≤Y?
006       0     013   GTO9
007    STOi     014    RTN
```

Next, a neat routine from **John S. Prigge, Jr.** (Buena Park, California):

GREATEST COMMON DIVISOR (gcd). This 15-step HP-67/97 routine uses only one label and no storage registers. The two values for which the gcd is to be found must be in the X and Y stack registers. (One less computational cycle is required if the value in the Y-register is larger than the value in the X-register.) All the stack registers contain the gcd when the routine is done.

Example: gcd(466560,1679616) = 93312

```
001   *LBLA      009     R↑
002    ENT↑      010      x
003    ENT↑      011      -
004     CLX      012   X≠0?
005       +      013   GTOA
006     R↓       014      +
007       ÷      015    RTN
008     INT
```

The deletion of steps 12, 13, and 14 results in the modulo function: i.e., Y modulo X. For example: 75 modulo 6=3.*

**(This routine gives you the modulo function only if both arguments have the same sign; otherwise, it gives the remainder function. Ed.)*

Now, from the land of excellent cheeses and other dairy products comes a routine by **Bjorn Engsig** (Allerod, Denmark).

The INT and FRAC routines incorporated in the HP-67/97 don't work quite right for negative arguments.* For example, INT -2.8 gives -2 and FRAC -2.8 gives -0.8. This is right in some applications but wrong in others.* For the latter, INT -2.8 should be -3 and FRAC -2.8 should be 0.2. I've written two 10-step routines to do this. They both save x in the LAST x register, but in the INT routine the T-register is lost.

LBL A, INT subtracts 1 from the value of the built-in INT function if the value of the built-in FRAC function is less than zero. The subtraction is done in the I-register using DSZ I, so that LAST x is not lost. The DSZ I will never skip the next instruction.

LBL B, FRAC adds 1 to the built-in FRAC function if the value of the latter is less than zero.

LBL B, FRAC, using the ISZ I function, adds 1 to the built-in FRAC function if the value of the latter is less than zero. In this case, the ISZ I will always skip the next instruction; thus the extra SPC.

```
001  *LBLA    011  *LBLB
002    INT    012    FRC
003    X≷I    013   X<0?
004   LSTX    014   X>0?
005    FRC    015    RTN
006   X<0?    016    X≷I
007   DSZI    017   ISZI
008     R↓    018    SPC
009    X≷I    019    X≷I
010    RTN    020    RTN
```

**(The calculator's preprogrammed functions DO work properly, Mr. Engsig. You are over-simplifying some functions. "Floor" and "ceiling" are terms appropriate here. "Floor" x means: greatest integer less than or equal to x. "Ceiling" x means: smallest integer greater than or equal to x. Ed.)*

Here's a *continuation* of a previous routine in this column. It was submitted by **Prof. Dr. C. J. Bouwkamp** (Eindhoven, The Netherlands).

Browsing through Vol. 2 No. 2 of KEY NOTES, I came across the routine (by Richard Scott) that is suggested for determining the smallest number of three stored in registers 1, 2, and 3. There is no need for the labels and go-to's. My solution is: RCL 1, RCL 1, x>y?, R↓, RCL 3, x>y?, R↓. Also, if you want the greatest of these numbers, the following lines will do: RCL 1, RCL 2, x≤y?, R↓, RCL 3, x≤y?, R↓. Notice that you are allowed to permute the three RCL's in six different ways! Generalization to four numbers and more is obvious.

x: = min. (x,y)

```
001  *LBLA
002   X>Y?
003     R↓
004    RTN
```

x: = max. (x,y)

```
005  *LBLB
006   X≤Y?
007     R↓
008    RTN
```

x: = min. (R_1, R_2, R_3)

```
009  *LBLC
010    RCL1
011    RCL2
012   X>Y?
013     R↓
014    RCL3
015   X>Y?
016     R↓
017    RTN
```

x: = max. (R_1, R_2, R_3)

```
018  *LBLD
019    RCL1
020    RCL2
021   X≤Y?
022     R↓
023    RCL3
024   X≤Y?
025     R↓
026    RTN
```

The next contribution is from **Thomas T. Hirata** of Anaheim, California.

I have been using a routine to interpolate tables and I have yet to see it published. It takes advantage of HP's LAST x register and the four stack registers. As an example, assume we are given x = 5.67 and want to find y with the following table:

x	y
5.23	4.63
6.01	7.57

My routine is:

```
001  *LBLA    013     .    025     .
002      5    014     0    026     6
003      .    015     1    027     3
004      6    016  LSTX    028  ENT↑
005      7    017     -    029   R↓
006   ENT↑    018     ÷    030     -
007      5    019     7    031     x
008      .    020     .    032     +
009      2    021     5    033   R/S
010      3    022     7    034   RTN
011      -    023  ENT↑
012      6    024     4
```

(Notice here that, although Mr. Hirata's routine works, it uses a lot of memory. Keyed in, as-is, it would use 33 lines, including a LBL at the beginning and a RTN at the end. By storing the digit-entries in registers, as follows, you can reduce the routine to 16 lines, providing, of course, you have registers to spare. Ed.)

```
001  *LBLA    007     -    013     -
002    RCL1   008     ÷    014     x
003    RCL2   009  RCL4    015     +
004     -     010  RCL5    016   RTN
005    RCL3   011  ENT↑
006   LSTX    012   R↓
```

Answer is: 6.29

Now, for a change of pace, here is a clever routine from **Thomas B. Cadwallader** of Great Falls, Montana.

When a program is on three or more cards that are to be run in series, at least two problems are encountered by the programmer/user:

1) Flag status is not remembered from one card to another; and
2) While the programmer must provide a "call" for the desired card, the user might ignore the message and read the wrong card, which would produce erroneous results.

In the following program segments these problems are avoided. Card (N-1) remembers flag status in the Y, Z, and LAST x registers and calls for Card (N). Card (N) or (?) tests (using the X and Y registers) to see if it was being called; if not, the stack is restored and the call for (N) is made again. If Card (N) was the correct card, the Z, T, and LAST x registers are tested and the appropriate flags are set.

CARD (N-1):

```
212  *LBL4
213      0
214    F0?
215    10ˣ
216      0
217    F1?
218    10ˣ
219      3
220    F2?
221    ABS
222  *LBL5
223    PSE
224    GTO5
```

CARD (N):

```
001      3
002   X=Y?
003   GTO0
004     R↓
005   GTO5
006  *LBL0
007     R↑
008   X≠0?
009    SF0
010     R↑
011   X≠0?
012    SF1
013      3
014   LSTX
015   X=Y?
016    SF2
017   R/S
      ↓
222  *LBL5
223    PSE
224   GTO5
      ↓
     R/S
```

And here is another neat "idea," although not particularly a new one. However, we don't recall ever publishing it. Submitted by **Herb Chong** (Waterloo, Ont., Canada).

Something that "games" programmers should know about occured to me while experimenting with my HP-67. A user-defined subroutine, or any subroutine, when entered by pressing any of the user-definable keys or GSBn, where n is a label number, while the calculator is executing a "pause," will return to the pause command and continue executing the program from the next statement after the pause. For example:

```
LBL A          LBL B
PSE            RTN
GTO A
```

With these two short routines loaded in program memory, execute A. When the calculator pauses for display, press B. You will notice that after B is executed, the display continues to blink zero's at you. This can sometimes be used to avoid using a label or a GTO command, or to make a subroutine *not* return to the pause

loop unless it is called from a running program. A limited use, I admit, but perhaps someone can find a use for it.

Note that the subroutine called from the pause loop must have *only* two levels of subroutines if LBL A containing the pause loop is not itself a subroutine.

Of course, if the pause loop is within a subroutine itself, only one subroutine is allowed in the called routine. This is also true for further levels of subroutines containing the pause loop.

Also, this idea works if the pause command is a solitary pause.

Next, we hear from **Ernesto Málaga**, who sent these routines all the way from Lima, Peru.

NESTED LOOPS: This powerful programming tool, available on such desktop "minicomputers" as the HP 9830, *can* be used on the HP-67/97, even though you think it cannot be done. When you make a single loop, you need only one "index" register (I-register) and the DSZ instruction. For a nested loop, you'd need more than one "index." For those cases, we have the DSZ (i) instruction.

But suppose you need two loops, one within the other? The outer loop must be executed 10 times, and in each one of those 10 times, the inner loop must be run 20 times. So it's obvious you'll need two index registers. Pick R_8 and R_9 for this purpose, then store 10 in R_8 and 20 in R_9, and use the following program skeleton:

```
*LBLA     *LBL1     GTO1
   .         .        .
   .         .        .
   .         .        .
   1         9        8
   0      STOI     STOI
 STO8     DSZi     DSZi
*LBL0               GTO0
   .                  .
   .                  .
   .                  .
   2                RTN
   0
 STO9
```

The outer loop begins at LBL 0, after storing 10 in R_8. Within this loop we find 20, STO 9, and then the beginning label of the inner loop, LBL 1. Later, 9, STI, DSZ (i) decrements R_9 and tests it against zero, just as DSZ does with I. The DSZ (i), GTO 1 signals the inner-loop lower limit. When this loop is "satisfied" (run 20 times), GTO 1 is skipped and so the sequence 8, STI, DSZ (i) is reached, decrementing R_8 and testing it against zero.

This same technique can be used for multi-level loops. For the special case of two-level loops, the program skeleton can be simplified to: LBL A ... 8 STI, 10 STO 8, LBL 0 ... ISZ, 20 STO 9, LBL1 ... DSZ (i) GTO 1 ... DSZ, DSZ (i) GTO 0 ...RTN. This second model has a pleasant feature: It's faster! But it's restricted to two-level loops.

BEYOND THE BASIC EXCHANGES. The HP-67/97 have three different preprogrammed exchanges: the most-known x⇄y, the powerful P⇄S, and the special X⇄I. But, sometimes, they are not enough! Here are some "exchange" sequences that could be useful for special applications:

$R_m \rightleftarrows R_n$:	RCL_m, RCL_n, STO_m, x⇄y, STO_n.
x⇄R_n:	RCL_n, x⇄y, STO_n.
x⇄T:	R↑, x⇄y, R↓.
x⇄Z:	x⇄y, R↓, x⇄y, R↑, x⇄y.

Now we move quite a few thousand miles north, to hear from **Terry Mickelson**, of Duncan, B.C., Canada.

Here's an input on the double two-way data-test routine:

```
001   *LBLA      010    GTO0
002     SF2      011     F2?
003    RCLA      012     F2?
004    RCLB      013     SF2
005    X>Y?      014   *LBL0
006     CF2      015       1
007    RCLC      016     F2?
008    RCLD      017     CHS
009    X>Y?      018     RTN
```

This routine outputs a +1 if the relationship of A to B is similar to that of C to D and a −1 if either pair is different from the other. Using X≤Y instead of X>Y in both places will give the same results! Another series of tests makes use of the X=Y test in both locations, and here again both X=Y and X≠Y will give the same results. Finally, a useful flag reversal may be had in the three steps: F2? F2? SF2 (or F3). This essentially toggles F2 (F3) on and off while avoiding the use of labels and other conditional testing, as is the case for F0 and F1.

(Mr. Mickelson ends some of his letters with, "Reply not requested." A nice touch, Mr. Mickelson, and one that saves much time. Ed.)

How about an "idea" for a change? Rather than a routine? Here's a neat one from **Charles H. Ware** (Fresno, California).

When a program requires more than 16 data storage registers, the secondary storage registers may be used. The key entry symbol for interchanging secondary with primary registers is "P⇄S."

I assume that when I turn on my HP-67, it wakes up with primary registers ready for direct use.* When I need to make a direct transaction with a secondary register, I show the key entry symbol as "P→S." To resume the use of primary registers, I show the key entry symbol as "P←S." In both cases the key code is "31-42" (16-51 on the HP-97). The advantage of this simple technique is in being certain which bank of registers is in direct use. This has facilitated my "debugging" process in lengthy or complex programs.

**(The HP-67/97 "wakes up" with 16 data storage registers ready for use. When you press [P⇄S], all you really do is "shift" a block of 10 registers to the side so you can re-use those 10 registers as "secondary" data registers. When you shut off the calculator, ALL registers are "erased," whether primary or secondary, and you start the process all over again. Ed.)*

Next, two contributions from the same person: **Oliver J. Olson** of Mountain View, California. Mr. Olson sent these to us quite some time ago, and they have finally found a home in this column.

(1) The following program demonstrates subroutine operations; particularly GSB within GSB. As a result, it provides a more vivid insight than if it would be described literally.

After running the program, I was confused when the final results displayed #16. Tracing through the program I was finally convinced that the machine steps backwards (or upwards) which, in this case, is the first encounter to the step following the last GSB command label. After completing the return path it will again step backwards (or upwards) to the preceding GSB label, which requires that it must also repeat the operation for the one following.

The program also demonstrates the GSB limits, since the return path for the first GSB B was not completed.

```
001   *LBLA      011      +
002       1      012   GSBD
003    ENT↑      013   *LBLD
004    GSBB      014       1
005   *LBLB      015      +
006       1      016   GSBE
007      +       017   *LBLE
008    GSBC      018       1
009   *LBLC      019      +
010       1      020   RTN
```

(2) There have been occasions when I wanted to divide (or multiply) the contents of the registers by a constant. However, the f DSZ I skip-on-zero prevents the operation to be performed on R_0. The following program was used to overcome this. It required an extra branch instruction; otherwise it would have to repeat the operation outside the loop. (The program assumes that the constant is stored in R_A and that R_I is initialized.)

```
001   *LBLB      007    X=0?
002    RCLi      008     RTN
003    RCLA      009    DSZI
004       ÷      010    GTOB
005    STOi      011    GSBB
006    RCLI      012     RTN
```

Accessory Service and Warranty Policies

Our Service Center has asked KEY NOTES to print the following notice to let you know about a change in the Service Policy for accessories.

ACCESSORY SERVICE POLICY: The U.S. Service Center in our Corvallis, Oregon, plant does **not** normally repair accessories; it *replaces* them. Because of this, proof of purchase *is absolutely required* to effect a replacement of accessories still in warranty.

If your accessory is out of warranty and you need a replacement, *we recommend that you purchase the replacement from one of our*

Continued

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Description	Model Number	Price
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Reserve Power Pack (HP-97)	82037A	$ 35.00
Security Cradle (HP-67)	82015A*	$ 30.00
Security Cable (HP-97)	82044A	$ 10.00
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(HP-67) 110/220 Vac., Switchable	82002A*	$ 20.00
(HP-97) 110 Vac.	82058A	$ 12.50
(HP-97) Euro. 220 Vac.	82066A	$ 16.00
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Battery Pack (HP-97)	82033A	$ 18.00
Soft Case, Black Leather (HP-67)	82017A*	$ 10.00
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Soft Case, Synthetic (HP-97)	82035A	$ 10.00
Thermal Printing Paper, 6 rolls (HP-97)	82045A	$ 6.00
Program Pad (HP-67 & HP-97)	00097-13154*	$ 4.00
3 Program Card Holders (HP-67/97)	00097-13143*	$ 10.00
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40-Card Pac with Holder	00097-13141*	$ 20.00
120-Card Pac with Holders	00097-13143*	$ 45.00
1000-Card Pac	00097-13206*	$195.00

HP-67/97 Application Pacs Each $35.00

HP-67 Standard Pac	00067-13101
HP-97 Standard Pac	00097-13101
Business Decisions Pac	00097-13144
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Math Pac I	00097-13121
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Stat Pac I	00097-13111
Survey Pac I	00097-13175

HP-67/97 Users' Library Solutions Books Each $10.00

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Astrology	00097-14014

* Also usable on the HP-65.

You may order any of the HP-67 and HP-97 accessories and software shown by calling our toll-free number, 800-648-4711 (in Nevada 800-992-5710), and asking for the nearest Hewlett-Packard Accessory Dealer. (Toll-free number not available in Alaska or Hawaii.)
Or you may use the convenient order form on the reverse side and mail to: Hewlett-Packard Co., 1000 NE Circle Blvd., Corvallis, Oregon 97330.

NOTE: All Users' Library Programs mentioned in Key Notes can be ordered on this order form. Simply note the appropriate Program Number and fill in the description and price. All programs with pre-recorded program cards are available at $5.00 each.

Hewlett-Packard reserves the right to make changes in materials, specifications, and prices without notice.

Orders cannot be shipped to any European countries.

HEWLETT-PACKARD ORDER FORM

HP CODE NO. 3002A

Model Number or Program Number	Description	Qty.	Price Each	Total Price
Please enter my one-year subscription to the HP-67/97 Users' Library:	☐ For US, Puerto Rico or Virgin Islands		**$15.00**	
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* For all orders shipped outside US please add $5.00 shipping charge.

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☐ **CASH PAYMENT.** Check or money order enclosed in US dollars drawn on US bank. (Please be sure to include your state and local sales taxes.)

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Your credit card account will be billed when your order is shipped.

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dealers. Our Sales Offices, Customer Support, and the Answering Services* will assist you by directing you to the nearest dealer who stocks accessories.

ACCESSORY WARRANTY POLICY: Accessories have a one year limited warranty, whether purchased with the calculator or separately. Proof of purchase is required. Usually, such proof is a dated sales slip, receipt, or invoice.

If **we** elect to *replace* your accessory when you send it to us for repair, the warranty is 90 days or the remainder of the original warranty period, whichever is greater.

* Toll Free 800-648-4711
(In Nevada, call 1-702-323-2704 collect)

Software Flags Revisited

In the last issue (Vol. 2 No. 3) we ran an article about "additional" flags. In fact, it went on to show how 10 more flags could be added to the HP-67/97. But it did end just there. Now, from **Walter L. Allen,** of Montreal, Canada, we get a follow-on to the subject. We received several letters about this subject, but Mr. Allen's arrived first.

I was intrigued by **Mickey R. Burnett's** routine for software flags in the August 1978 KEY NOTES. However it would be in trouble if, in a very exotic program, the same flag was set more than nine times; and, of course, there is no way to clear flags. The following program removes these difficulties.

As before, the 10 flags are 0 to 9 and, except for registers 20 through 25, any memory register may be used. Register R_9 is used in the example:

R_9 digit position:	10 9 8 7 6 5 4 3 2 1
Corresponding flag #:	9 8 7 6 5 4 3 2 1 0

For each of the following labels, the stack X-register contains the flag number.

SET	INTERROGATE	CLEAR
*LBLA	*LBLB	*LBLC
ENT↑	1	ENT↑
GSBB	+	GSBA
X≠0?	10^x	R↓
RTN	RCL9	10^x
R↓	X≷Y	ST-9
10^x	÷	RTN
ST+9	FRC	
RTN	EEX	
	1	
	x	
	INT	
	RTN	

After interrogating, the main program must perform a test ($x = 0$, $x \neq 0$) to determine the state of the flag. Be careful not to use the above "clear" routine beyond the first branch of nested subroutines.

It should be noted that if only one or two flags are required beyond the four hardware flags in the calculator it is sometimes possible to use a hardware flag more than once. Even if this requires more program steps, a saving may be made on the three labels and 29 steps in the software flag program above.

Factorials Revisited

On page 9 (right column) in the August issue (Vol. 2, No. 3), we printed **James R. Grandstaff's** small program for computing factorials of numbers larger than 69. It must have hit a nerve, or perhaps people are highly interested in this subject. Anyway, we received a lot of mail, and one letter was from an "old" friend, 14-year-old **Ronnie van Thielen** (Belgium), who appeared on page 3 of Vol. 2 No. 1. He called our hand on the term "small" program. Mr. Grandstaff's program used 45 lines (including RTN). Ronnie's does the same thing in 35 lines of memory. However, both programs take about the same amount of time (8-1/2 minutes) to calculate 521! Here's Ronnie's program.

001	*LBLA	019	1
002	CLRG	020	ST+1
003	STO0	021	RCL1
004	7	022	LOG
005	0	023	ST+2
006	X≤Y?	024	RCL1
007	GTO0	025	RCL0
008	RCL0	026	X≠Y?
009	N!	027	GTO1
010	R/S	028	RCL2
011	*LBL0	029	FRC
012	1	030	10^x
013	-	031	PRTX
014	STO1	032	RCL2
015	N!	033	INT
016	LOG	034	PRTX
017	STO2	035	R/S
018	*LBL1		

But out of all the letters—and we thank everyone who wrote—one stood out. It was from **Richard S. Brokaw** of Lakewood, Ohio. Here it is.

This short program for calculating factorials of large numbers was inspired by the submission of James R. Grandstaff, HP KEY NOTES, August 1978, Vol. 2 No. 3, page 9. I enclose a program listing. The program will calculate and print factorials from 69+! to 10^{97}! in 7 seconds, using no storages other than those in the stack. Assuming that 8-1/2 minutes to calculate 521! represents 521−69=452 times around a loop, or about one second per loop, I estimate Mr. Grandstaff's program would require about 10^{89} years to calculate 10^{97}!. *Why* anyone would want to calculate 10^{97}! is another question!!!

My program actually uses Stirling's approximation to calculate $\ln\Gamma(N+1)$ starting at step 009 (LBL B). The approximation is very good for large arguments—the fractional error is 1.3×10^{-8} for 69! (probably due, mainly, to a loss of significant figures in manipulating logarithms).

This Stirling approximation is not bad even for small arguments. For example, by entering the appropriate argument and pressing B, one obtains 0!=1.0023, 1!=1.0003, 2!=2.0002, 3!=6.0003, 4!=24.0005, etc. Thus, the program can be used to calculate $\Gamma(N+1)$ for non-integral arguments to within a few parts per thousand, even for small arguments.

001	*LBLA	023	∫X
002	6	024	LN
003	9	025	-
004	X≷Y	026	X≷Y
005	X>Y?	027	1
006	GTOB	028	2
007	N!	029	x
008	RTN	030	1/X
009	*LBLB	031	+
010	1	032	1
011	+	033	0
012	ENT↑	034	LN
013	ENT↑	035	÷
014	LN	036	INT
015	1	037	LSTX
016	-	038	FRC
017	x	039	10^x
018	X≷Y	040	PRTX
019	2	041	X≷Y
020	÷	042	PRTX
021	Pi	043	RTN
022	÷		

(After I wrote to him about the program, Mr. Brokaw further elaborated on it in another letter, as follows. The first sentence is rather clever! Ed.)

Thanks for your letter of September 22; I am flattered that my letter KEYed a response which will be duly NOTEd!

Actually, if one is concerned with factorials of large numbers, one would normally deal with lnN!. The program starting at 009 (LBL B) has calculated lnN! at 031. That, with a RTN statement, would qualify for your "25 Words or Less."

I'm surprised that none of your readers invoked Stirling's approximation. It is well known in Statistical Mechanics and Statistical Thermodynamics, where factorials of large numbers (e.g., 10^{23}) are required.

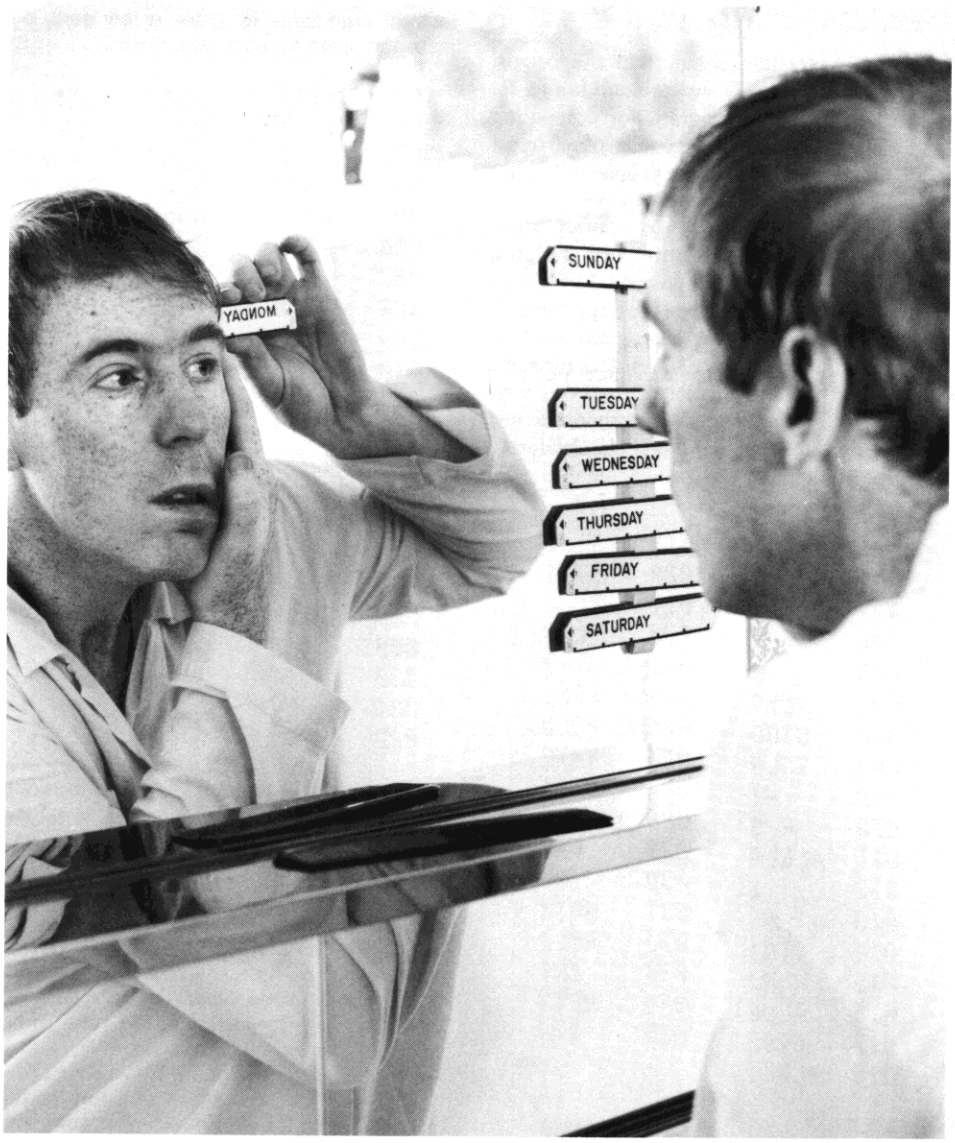
SS=Satisfaction

The "SS" was used to catch your attention. It stands for "set status."

Most of the time when we get a complaint that a Library program will not work, the trouble is traced to the small block of information at the lower right corner on the final page (Program Listing II) of the *Program Submittal* form. Yep! The **Set Status** block.

For example, a couple issues ago, we highlighted the excellent programs written by **Bruce K. Murdock.** A lot of people ordered them. Some told Mr. Murdock they wouldn't produce correct answers. The problem? You guessed it; people forgot—or missed—the angular mode setting that was called for in the **Set Status** block.

How do you find a way to remember this? Easy! **SS = Set Status = Satisfaction. DSS = Don't Set Status = Dissatisfaction.**



Photograph courtesy of William M. Kolb

Homo Programmus?

That title won out over "Tired of the Same Old Routine?", both suggested by the photographer.

Back in September, 1977, when we ran **Bill Kolb's** excellent "On Understanding Flags" article, we asked him for a photo of himself so we could print it with the article. He sent *two* photos. You've seen one already; here is the other one. We got such a "kick" out of it that we wanted *you* to enjoy it.

We make a very good card-reader/memory mechanism, but no one has ever designed one to beat the one atop a human neck. A very clever photo, Mr. Kolb; it has brightened many a day. Thanks for allowing us to print it.

Price Reduced on HP-19C

Effective October 23, 1978, the price of the HP-19C was reduced to $225.* That's just in time for Christmas!

If you now own an HP-97, you know how convenient it is to print out your programs for editing or for a permanent record for future use. It is a convenience that's hard to beat. Then, add to that the Continuous Memory capability of the HP-19C, and you have a complete "system" for the college student, for the high school student, or maybe just for yourself.

Next time you are at your local HP dealer, take another look at this calculator. For size, price, capabilities, and convenience, it is an unbeatable combination.

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

New Programming Journal

We have recently seen Volume 1 Number 1 of a new publication called *The Recreational Programmer*. It is a novel, small journal for sophisticated users of computers and programmable calculators. The charter issue contains 32 pages on 8-1/2 by 11-inch paper. Below is a press release on this new publication.

The owner who enjoys games, graphics, astronomy, sailing, amateur radio, or recreational mathematics and programming puzzles will find *The Recreational Programmer* a source of usable, well-documented programs and articles.

Each program features a flow diagram written in English, and patterned as a BASIC program. This allows the user of any computer programmable in BASIC to easily use any program on his or her machine.

Programmable calculator owners will find that each useful flow diagram is accompanied by a thoroughly annotated listing for any of a variety of personal calculators.

The Recreational Programmer is published bimonthly (six issues a year) by Programmers Publishing Co.; 3013 Cameron Street; Kalamazoo, Michigan 49003. Tel: (616)343-3546.

Readers interested in subscribing may send $12 ($15 outside the USA and APO's) to *The Recreational Programmer;* P.O. Box 2571; Kalamazoo, Michigan 49003.

Flag Status Made Easy

There has been a lot of mail about routines and programs that can check flag status. And we thank all of you for your contributions. But this letter from Doetinchem, Netherlands, pretty well puts the subject to rest.

Dear Editor:

The state of flags seems to be a problem, as this subject appears in practically every issue of KEY NOTES. Why cannot it be done by keyboard testing? In RUN mode, pressing the keys for any conditional (including flags) increments the line-number only when the condition is NOT met.

So, my suggestion is, press:

1) BST, and hold the key long enough to read the line-number (Lo).
2) F?0
3) BST, and note the line-number (L1).
   If L1 = Lo, flag was not set.
   If L1 = Lo-1, flag was set.
4) F?1, BST, F?2, BST, F?3, BST.

Eventually, restore the state of flags 2 and 3 by pressing SF2, SF3. Now, by pressing GTO. (Lo+1), your calculator is, in all respects, in the original condition. No registers (including LAST x) are in disorder. No program steps are needed.

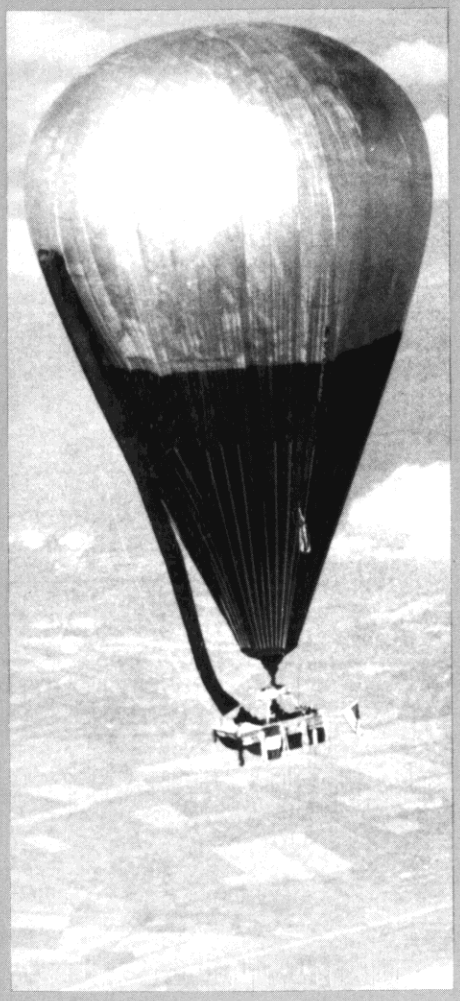
Simple or not?

Sincerely,

J. van der Waals

Double Eagle Soared With HP-97

In spite of having lined up the most sophisticated communications system ever used for a balloon flight, Double Eagle put an HP-67 programmable pocket calculator and Navigation Pac to critical use last August in achieving the first successful Atlantic crossing by balloon. That use came shortly after leaving the coast of Newfoundland. A storm was approaching, and both the air crew and ground crew needed to know its relationship to the craft. The normal procedure of relying on satellite information from Goddard Space Flight Center as radioed by passing aircraft could take 6 to 7 hours —much too late even for a wind-driven vehicle. Navigator Maxie Anderson took sextant readings of Venus and Polaris, calculated their position with the aid of his HP-97, and reported by radio to the ground crew, all in a few minutes. Thereafter the same procedure was followed each morning and evening. And even when most everything else had been tossed overboard in the interest of staying aloft, Anderson held onto his navigator's tools. They and other Double Eagle paraphernalia will eventually reside in the Smithsonian Institution's National Air and Space museum—an honor well deserved.



UPI PHOTO

Stars in His Eyes!

When some people want something with enough fervor, they usually get it—even if it takes a huge effort to do so. One of those devoted people is **Herman R. Dittmer** of Seattle, Washington. He wanted to make his own telescope, including the lenses, and you can see that he "made" his goal. Mr. Dittmer did his first calculations with an HP-45, then graduated to the HP-67 and began developing programs on it. These programs are now gathered together to make a set that can be ordered at a reduced price. (See below.)

Mr. Dittmer is an amateur astronomer with no formal training in optics. He developed these interrelated programs to aid in designing and building a telescope for Astro-Photography. (All of the photos shown here were taken by Mr. Dittmer.) The set contains programs for both skewed and meridional ray tracing in spheric or aspheric lenses. The programs can be used to check the design of existing systems from the beginning and can be used on simple two-element lenses or on more elaborate systems. Arrangement of the programs allows changing lens elements one at a time to determine the effect on the design.

The set of Mr. Dittmer's programs is titled "Trigonometric Ray Tracing for Lens Design." There are 10 programs, as listed below, and the price of $26* includes prerecorded cards. To order the complete set, use order number 67000-99984 and use the order blank in this KEY NOTES. And each **numbered** program is available as a separate purchase and under standard rules: a charge of $3* for a program and $5* for a program and a magnetic card.

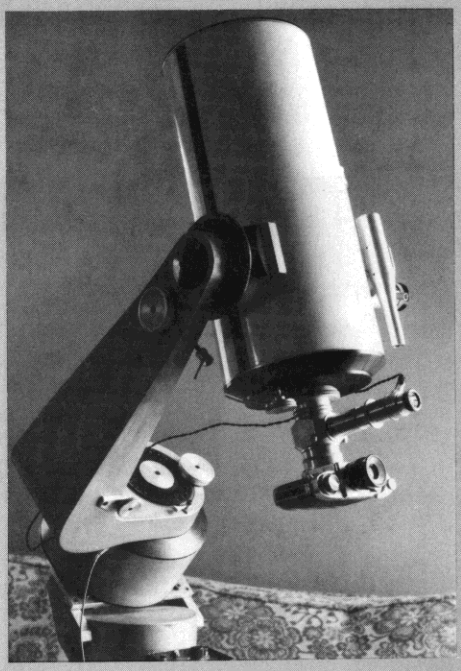
At the present time, **single programs are not available in Europe;** however, we will honor orders *from anywhere* for the 67000-99984 set if the order includes a negotiable check or money order in U.S. dollars, drawn on a U.S. bank. If you want to see the Abstracts before you buy the set, request them from the Users' Library in Corvallis. Here is the list.

67000-99984 Trigonometric Ray Tracing for Lens Design $26*

02175D Aspheric Geometry—Series Expansion Terms (203 steps, 5 pages).
02176D Skewed Aspheric Ray Trace (224 steps, 6 pages).
00437D Optical Ray Traces, Paraxial and Meridional (223 steps, 7 pages).
02458D Skewed Spherical Ray Trace (223 steps, 7 pages).
02459D Coddington Trace for Astigmatism (219 steps, 7 pages).
02495D Coma Ray Traces (222 steps, 7 pages).
02496D Chromatic Ray Traces (224 steps, 6 pages).
02641D Skew Trace—Aspheric on a Sphere (214 steps, 7 pages).
02642D Skew Trace Aberrations (110 steps, 7 pages).
02894D Cemented Achromatic Lens—Thin Lens Calculation (224 steps, 5 pages).

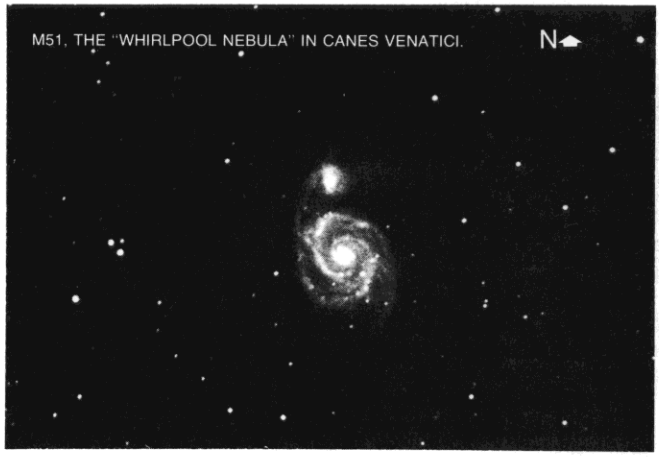
There you have it, 10 programs, 64 pages, 2086 steps; and all very neat and well documented. Congratulations, Mr. Dittmer; you've done what most of us only *think* about doing. And an excerpt from one of his letters says it all: "I'm sure when more HP users realize the potential of the HP-67/97 for this kind of work, they will want to try it. It is difficult to get started, but having an HP-67 or HP-97 is a big step. My first effort, using trig tables and logs, took days, and errors were easy to make but very hard to find. The calculators don't make mistakes, and they free one to concentrate on developing the design."

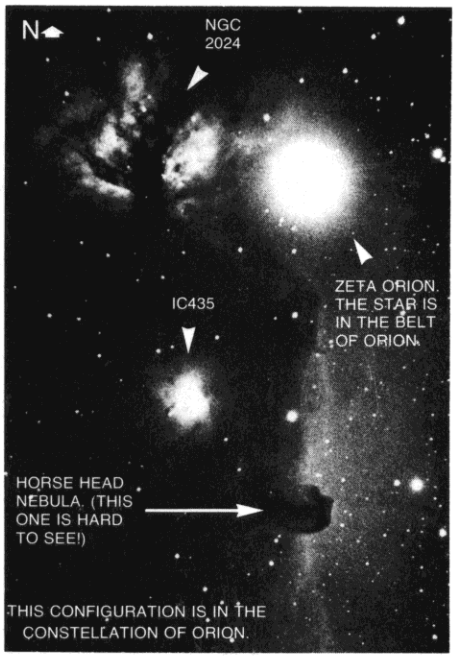
** U.S. dollars. See note at bottom edge of cover.*

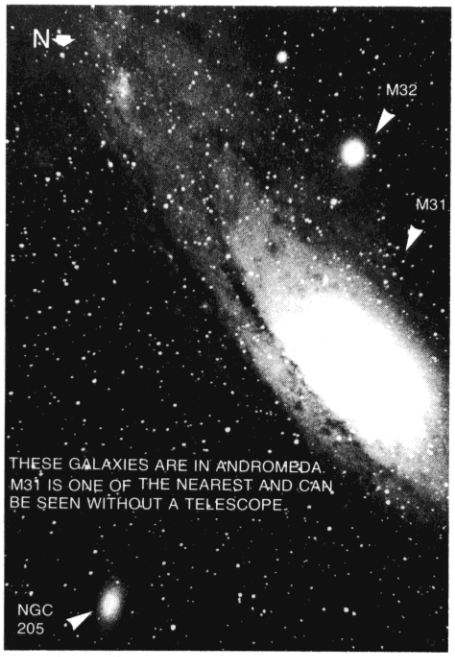


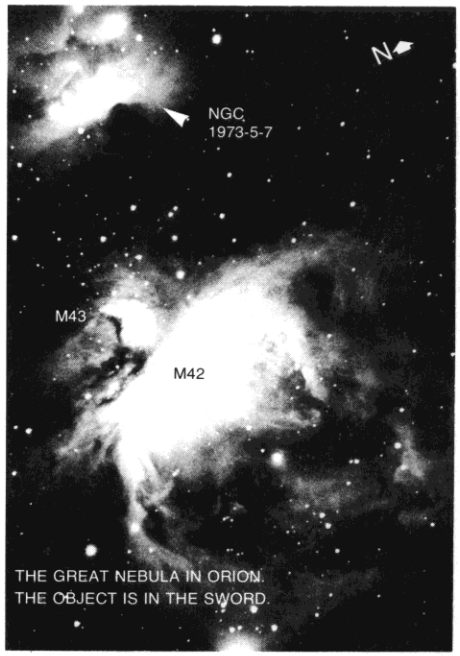
The 6½-inch Maksutov Cassegrain telescope used in making the photos and designed with the HP-45 and HP-67 calculators. The guiding eyepiece (just above the camera) contains an illuminated reticule that permits tracking a star just out of the photo field. Corrections for polar misalignment, atmospheric refraction, gear drive errors, etc., can then be made during the long exposures, which can run 2 hours or more. With the camera removed, an eyepiece may be installed for visual work. A "finder" telescope is mounted atop the barrel of the telescope. The effective focal length of the telescope is about 65 inches. The "power" of the telescope depends on how one defines the term. The effective focal length is about 65 inches. A photographer might say the power is 32.5. The astronomer "makes" his power with the eyepiece. A 1-inch eyepiece gives 65 power; a ½-inch eyepiece gives 130 power, etc. Practically, 30 times the diameter in inches is a good power for observing detail. (About 200 power.)

Additional photos, made through this home-built telescope, appear on the back cover of the newsletter.









HP KEY NOTES

November 1978 Vol. 2 No. 4

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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