HP-65

KEY NOTE

for HP-65 owners

HEWLETT **hp** PACKARD
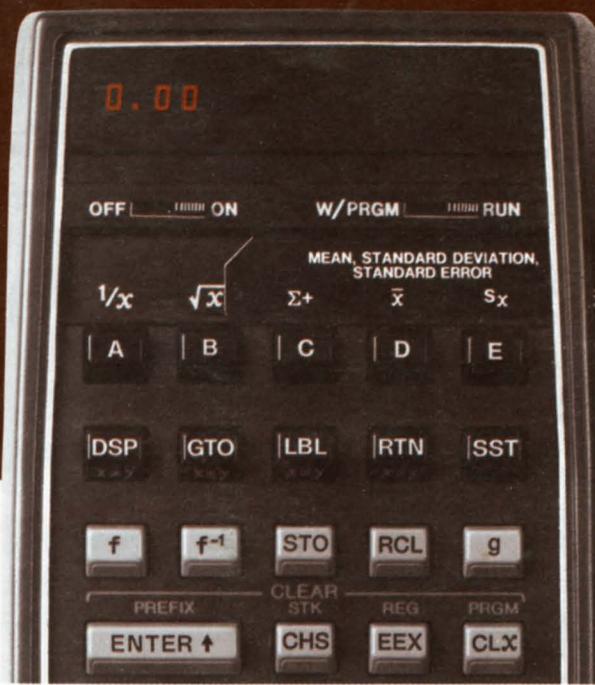
Was HP Really First?

We *thought* we were. When HP introduced the HP-35 hand-held scientific calculator, it revolutionized the calculator industry. But a letter from *Dean A. Sanborn* of Sante Fe, New Mexico, made us take another careful look at the facts. While going through a book titled *The Ancient Maya* (Stanford University Press), *Mr. Sanborn* made a ''Chariot-of-the-Gods'' type of discovery that suggests that the Mayan civilization may have scooped us.

What *Mr. Sanborn* brought to our attention was a picture (below) from a Mayan vase. The picture shows a seated figure (on the right) holding something in his hand, pushing keys, and counting objects in the basket. A handheld calculator? Well, consider this: the vase was excavated in Guatemala and judged to be about 1200 years old (790 A.D.)!

We asked the opinion of an anthroplogist at the University of California at Irvine. She replied, ''I think you are superimposing your computer-oriented framework onto the Mayan context—it does not fit. The Maya represent a complex civilization. They were innovators of hieroglyphic writing, calendrics, the development of the zero, mathematics, astronomy, and monumental architecture. . .If the fellow is counting, he could be using an implement like an abacus.''

While the Mayans were advanced mathematically, their technology was primitive. Metal was apparently unknown and when it did begin to appear, they used it only as jewelry and ornaments. Metal tools were completely unknown; they used stone tools. The Mayans also had no knowledge of the wheel.

So, despite the uncanny resemblance of the painting to our modern calculators, thanks to Hewlett-Packard's superior research and development, it looks like we really were first after all.

Reprinted with permission of the publisher from THE ANCIENT MAYA, THIRD EDITION, by Sylvanus Griswold Morley: revised by George W. Brainerd (Stanford: Stanford University Press, 1956), Plate 93, p. 400

Library Corner

The new loose-leaf *Catalog of Contributed Programs* was mailed in mid-May; you should have it by now. And we're sure you'll like the new format, especially since it will make it far easier and faster to keep you up to date on new programs. For example, the first update, or supplement, to the Catalog will be mailed by mid-August, and it will contain at least 800 new programs.

RENEWALS

A lot of you who have been members of the *HP-65 Users' Library* for a year or more have been asking about renewing your subscription. Well, we have worked out a plan that will be equitable to all members after their free subscription runs out. It includes an offer of one free program to every member who renews a subscription. At present, we are setting up the mailing list, so you should hear from us soon. Meantime, you are all still members; no names are being dropped because one year has transpired.

QUESTIONNAIRE

If you recently received a questionnaire asking you why you didn't join the Library, don't be alarmed. A very few members' names were still on the list of owners who *did not* send in their free subscription card. As you well know, no computer mailing list is 100 percent correct, and ours is no exception.

By the way, an overwhelming majority of HP-65 owners who got the questionnaire now want to join the Library. We haven't assessed the survey yet, but reasons for not sending in the free subscription card range from "I lost it" to "I never saw it" to "I simply did not read it."

NEW PROGRAMS

By now many of you have received the latest *Catalog of Contributed Programs.* We would like to draw your attention to certain program authors who have made outstanding contributions in particular areas.

First, *James Neely* has contributed 26 programs addressing the astronomical mathematics of astrology; 18 of these are in the new Catalog. With the *Neely* pro-grams, one can prepare a person's complete astrological chart (except for the positions of the three outer planets). The astrologer may choose from among 12 different methods of computing house cusps, including those of Campanus, Placidus, Alcibitus, and others. The programs that do not appear in the new Catalog are those that find the positions of the sun, moon, and planets: Astro III, 02534A, for use with the following programs; Sun, 02535A; Moon, 02679A; Mercury, 02536A; Venus, 02537A; Mars, 02673A; Jupiter, 02674A; and Saturn, 02680A.

Another significant contributor is *Captain K.R. Orcutt,* whose seven programs comprise a navigation system. One of these programs was not included in the new Catalog: program 02564A, "Radar Plotting, Collision Avoidance." This program solves the same problem as the collision avoidance program in *Navigation Pac 1,* but the input data is structured differently and only two cards are required rather than three.

Dr. Harold Frost has written what one might call an Osteology Pac, a set of 12 multicard programs that are mostly interchangeable solutions among measurable and predicted parameters of lamellar bone. *Dr. Frost* stresses in his documentation the educational value of the programs when used to simulate the behavior of human bone.

With over 30 programs to date in the Users' Library, *Charles Campbell* is the most prolific contributor of well-documented, useful surveying programs. They really are exceptional programs. Not in the new Catalog are:

02064A	Bearing Traverse/Curves
02065A	Curve Thru Point
02092A	Ground/Grid Conversions
02093A	Geo-Grid AZ Conversions
02094A	EDM Stakeout Two
02210A	Station/Offset Calculations
02211A	Special Angle Computation, Case 3
02212A	Building Radial Stakeout
02217A	Azimuth Traverse/Inverse
02225A	Distance-Distance Intersect
02226A	Azimuth-Distance Intersect
02227A	Azimuth-Azimuth Intersect
02228A	Special Angle Computation, Case 1
02229A	Special Angle Computation, Case 2
02296A	Special Distance Computation, Case 1
02297A	Special Distance Computation, Case 2
02298A	Special Distance Computation, Case 3
02360A	Curve from 3 Points
02361A	Stadia Reduction
02362A	Angles to Azimuth
02363A	Tangent Elevations
02380A	Vertical Curve Elevations
02381A	Curve Stakeout
02382A	EDM/Radial Curve
02405A	Cord Offsets
02406A	Curve-Stake from PI
02407A	Tangent Offsets

Randal O'Toole has quite an interest in forestry, with seven programs submitted so far in the field. Programs that do not appear in the present Catalog are:

02521A	Cruiser's Stick for Forest Mensuration
02522A	True Productivity of a Natural Coniferous Forest
02541A	Mean Annual Increment of Larch and Redwood Forests
02542A	Mean Annual Increment of Douglas-Fir and Certain Pine Forests
02713A	Mean Annual Increment of Various Forests

Although you now have over 2000 programs in your Catalog to choose from, we know you are always looking for new and better ways to utilize your trusty HP-65. So. . .here are some interesting programs that were submitted after the new Catalog was printed.

If possible, use an order form from the Catalog to order these programs. **Use the program number shown here.** Send only checks or money orders, payable to Hewlett-Packard Company. Be sure to include any state or local taxes. (Each numbered program has a nominal charge of $3.00.)

Arithmetic Teaching Machine (Order # 02725A)

For simple arithmetic programs, this program compares the student's answer to the correct answer. If the student is correct, he is rewarded; if not, he suffers an unfavorable response (in the display of the HP-65).

Author:
William Broenkow, Pebble Beach, California

Basic Astrophotography (Order # 02153A)

Given the focal length of a lens, the declination angle of the star field to be photographed, and a film tolerance, the optimum exposure time can be found where star movement will not register on the film: $T = TOL/(FL) (.00007) (\text{Cos Dec}°)$. For a given exposure time, focal length of lens, and declination angle, the program computes the length of the star trail and compares it against a film tolerance. $L = (FL) (\text{Time}) (.00007) (\text{Cos Dec}°)$. As long as the exposure time is within the film tolerance, whole constellations can be photographed. The number of stars registered depends on the speed of the film and the maximum aperture of the lens.

Author:
Peter A. Guerard, New Britain, Connecticut

Win, Place, and Show (Horse Race) (Order # 02091A)

A game in which the player places a bet on the horse of his/her choice: $, ENTER, # horse (win, place, or show). The player may choose different horses, put all three bets on the same horse, need not bet all three, etc. At the start of the race the HP-65 displays 0.000000. When **A** is pressed, one horse advances one furlong. A typical display might be 0.134365 (horse #5 has gone six furlongs and is ahead). When a horse crosses the finish line, its number changes from 8 to 0. After three horses have finished (or bettor has no further interest), pressing **E** displays the winnings. "Win" pays $12 for a $2 bet, "place" pays $6, and "show" pays $4.

Author:
John K. Appeldoorn, Bernardsville, New Jersey

Small-Arms Ballistic Parameters (Order #02740A)

A program that computes the kinetic energy of a projectile. Provision is made for reiterative operation involving delta velocity and delta projectile mass. Computation of a lethality coefficient allows a rational matching of a weapon with the game being hunted. The program computes the weapon recoil velocity and the free recoil energy of the weapon for any particular cartridge.

Author:
Robert C. Wyckoff, Tujunga, California

Application Pac Corrections

If you own some of our application pacs, check the following corrections and mark them in your copy. If your copy is correct, you have a later, revised issue of the book and/or card.

SURVEYING PAC 1

Field Angle Traverse, SURV 1-01B, and *Bearing Traverse*, SURV 1-02A, pages 8 and 12, may give inaccurate solutions for areas in cases where large coordinate systems are used. To correct this problem, we have printed a small folder, SURV (1517), and issued two revised, prerecorded magnetic cards, SURV 1-01C and SURV 1-02B. The folder contains two new *User's Instructions* and two new *Program Listings*. With this correction package you can compute areas by the method of double meridian distances, independent of the coordinate size. If you have this pac and need the corrections, send in your old cards and order the folder and new cards (by number) from APD Customer Communications (address on back cover).

CHEMICAL ENGINEERING PAC 1

Fanning Friction Factor and Conduit Flow, CHM E1-07A, page 32. In *Example 1* on page 36, the statement "Since f and v are stored from previous calculations..." is incorrect. The velocity v is no longer stored; it must be input. The key sequence following the statement should be:

10 **E** **B** ──────▶ 5429.223 (ft²/sec²)

In the following lines, the second "divide" key should be a "multiply," and the "See Displayed" column should reflect the change above—as follows:

62.4 ⊡ 32.2 ⊡ ⊠ ─▶10531.039 (lb/ft²)

144 ⊡ ──────────▶ 73.064 psi

Then, on page 35, in step 7 of the User's Instructions, delete: "(only if step 2 was skipped)."

Heat Exchanger Analysis, CHM E1-10A, page 46. The second card in this series, *Heat Exchanger Heat Transfer*, CHM E1-10A2, contains an error in the computation of outlet temperature. The code in the second column of the listing on page 115 should be as follows:

| RTN		24
LBL		23
E		15
D		14
RCL 3	34	03
÷		81
RCL 2	34	02
+		61
RTN		24
LBL		23
E		15
RCL 1	34	01
RCL 6	34	06
RCL 4	34	04
÷		81
−		51
RTN		24
g NOP	35	01
etc.		etc.

Revised cards numbered CHM E1-10B2 are available and may be obtained by sending your "A" version card to APD Customer Communications (address on back cover).

Programming Tips

A TRIANGLE TRICK

If you work a lot with triangles, you'll like this tip. Here's a slick way to evaluate the law of cosines:

$$c = \sqrt{a^2 + b^2 - 2ab \cos \theta}$$
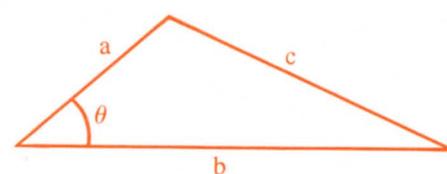
Suppose a, b, and θ are stored:

$$R_1 = a$$
$$R_2 = b$$
$$R_3 = \theta$$

The keystrokes would be:

RCL 3
RCL 1
f⁻¹
R→P
RCL 2
−
f
R→P → c

By the way, you can get

$$\sqrt{a^2 + b^2 + 2ab \cos \theta}$$

by simply replacing the ⊟ with a ⊞ in the keystroke routine.

CARD-STORED CONSTANTS

Here's a time-saver you'll enjoy; that is, if you haven't already discovered it. If you have a program that uses a series of constants and must constantly(!) key in those constants, you can store them on a separate card. Just key in LBL A , (constant) STO 1 , (constant) STO 2 , etc, etc, then RTN . When running your program, read in this card instead of keying in constants every time. But there is one precaution: make sure your program does not use the storage registers you use for constants. Be especially careful with register 9; it's often used for comparisons and trigonometry functions. Otherwise, this works fine—and saves time.

Now, here are some tips from HP-65 owners.

THAT R→P KEY AGAIN

From *Charles Campbell* of Indianapolis, Indiana, we received a tip on the "up-shift" part of the HP-65's number 1 key. "Besides the more obvious uses for the R→P key, here's one for the square root of the sum of the squares. Say you have four terms in the X-, Y-, Z-, and T-registers. For example, key in 2 ENTER↑, 4 ENTER↑, 6 ENTER↑, 8. Then, press f R→P g R↑ f R→P g R↑ , and f R→P . You will see 10.95, which is the square root

of the sum of the squares of the four terms in the stack. You also will have three unwanted angles in the Y-, Z-, and T-registers."

TWO IS BETTER THAN ONE

From Billings, Montana, the home of *Ed Puckett*, came this tip. "I have found a way to use the A – E keys for two functions instead of one. Also, you can use the R/S key as a sixth user-defined key. This is the format:

f₁	f₇
*	*
*	*
*	*
GTO	GTO
0	0
LBL	LBL
A	A
f₂	f₈
*	*
*	*
*	*
GTO	GTO
0	0
*	*
*	*
*	*
LBL	LBL
E	E
f₆	f₁₂
*	*
*	*
*	*
LBL	GTO
0	0
R/S	

When a user-defined key is pressed, the HP-65 goes to the first matching label it comes to. In this program, each RTN is replaced by a GTO 0. This sets the calculator after each function to access the second set of labels. To access the first set, press RTN , followed by the appropriate key. Thus, the RTN acts like an f key for the user-defined keys. By putting functions at the beginning of the program and after the R/S at LBL 0, RTN R/S and R/S can access two more functions. Although this method uses much space, it is handy for putting many short functions in a single program."

EASY FIBONACCI NUMBERS

John Taylor of Boulder, Colorado wrote to us about this trick. "In calculating the Fibonacci sequence, I began wondering if it was possible to use only the four-register stack for holding the intermediate steps (i.e., avoid using LST X or STO and RCL). It turns out that it is possible because there is both a roll-up and a roll-down command for the stack. (This wouldn't work on my HP-35!) The program is:

LBL	ENTER
A	g R↓
1	+
ENTER	R/S
R/S	ENTER
ENTER	g R↑
LBL	GTO
B	B
+	
R/S	

Start the program by pressing A . It then displays succeeding numbers of the Fibonacci sequence each time R/S is pressed."

HOW TO STOP R/S

"It is exasperating if you press one more R/S after the last one in a series of computations that employs R/S 's as intermediate stops. A positive stop at a preselected R/S (thus avoiding "over-shooting") can be implemented as follows. This way, pressing R/S would not execute the steps beyond.

*
*
*
R/S
*
*
*
LBL
0
R/S*
GTO
0

*Where you would like to have a positive stop."
(*Notice that the LBL 0 and GTO 0 prevent executing the step beyond this point. Ed.*)

(From: *Tak Y. Lee*, Wellesley, Massachusetts.)

Questions—and answers

Most of the questions we get concern the small magnetic cards for the HP-65. And since there haven't been many other questions lately, here are some more details on those all-important cards.

Question: *Can something besides a spray coating be used to cover the notations on cards?*

Answer: Yes. This letter from *Craig Pearce* of Berwyn, Illinois, will answer that question most accurately.

"I have been reading much on the various methods of marking on the magnetic cards, and I think you might be interested in the method I use.

I decided, long before I even had an HP-65, that I would only use rub-on letters, to give the neatest appearance. Unfortunately, the internal rollers eventually rub the letters off. I tried using an aerosol spray coating with less than spectacular results. Then, I ran across a product called FORMATT*.

FORMATT is a thin acetate material (12/10,000 of an inch thick) with a low adhesive (which appears as though it will not leak, at least not so far). While one can use the prelettered material (each letter must be cut separately from the large FORMATT sheet), I prefer using the thin, unmarked sheet that is available, for 60¢ per sheet.

Myself, I use rub-on letters to label the card, then cover the lettering job with a narrow strip of clear FORMATT material. Thin enough not to interfere with the card feeding mechanism, the material puts a perfect cover over the letters.

Of course, for an even less bulkier covering, the cards could now be labeled with pencil, then covered with FORMATT, which may be peeled up at any time.

Another interesting way to use the clear FORMATT material is to type on it, cut it, then rub it on.

In any case, I use a smooth, flat edge to press the acetate as secure as possible. So far, I've experienced no problems using my method and I believe others might be interested in the FORMATT product. (Just in case anyone was wondering, I am NOT in any way affiliated with the FORMATT Company.''

FORMATT is the registered trademark of Graphic Products Corporation, Rolling Meadows, Illinois 60008, U.S.A.

Question: *Whatever happened to the "new, all-white" cards you discussed in* Winter KEY NOTE?

Answer: Whoops! We got caught in a supply/production problem and the cards have not been delivered to us. In an effort to keep you well-informed, we jumped the gun on announcing the new cards. But, yes, they are a reality—as the photo attests. However, one small problem persists. The cards will *not* be available until *after* August 1. So don't order before that date...and check the next question.

New Card

Old Card

Question: *What CAN be ordered in the way of magnetic cards?*

Answer: There are two order numbers for blank magnetic cards, and they are shown on the Order Form accompanying this KEY NOTE. Do not use the old order number 00065-67032 (for 100 cards @ $40); it is obsolete (because a case was not included). The pack of 40 cards (00065-67010) includes a clear plastic case; the 120-pack (00065-67054) includes three cases.

Question: *With the calculator in place, how many plastic card cases can be carried in the HP-65's soft leather carrying case?*

Answer: That's a loaded question (pardon the pun), and here's a loaded answer. With only the calculator in the case, you can easily carry four plastic card cases: two in the Quick Reference Guide pocket, one in the front card case pocket, and (we'll bet a lot of you never thought of this) one in the belt loop on the back of the case. You *can* get three cases in the Quick Reference Guide pocket, but not without stretching it.

Question: *What is the purpose of the small, square, white dots along the top edge of the prerecorded magnetic cards?*

Answer: They are code marks for an optical card reader/recorder. The first mark is a "start" mark, used for alignment, or registration. The next twelve marks are the last three digits of the card's part number. These codes are used during the recording function so that the right data is recorded on the right card. (Single cards cannot be ordered by the code/part number.)

More About Pens

In the following letter it is obvious that *William S. Boulton* of Spokane, Washington, has done some research about marking cards, and he thought the information would be useful to other HP-65 owners. We thank you, *Mr. Boulton.*

"A felt-tip pen inscribed "FLASH 30" on the pocket clip—no other markings—works pretty well, and seems to wet out the plastic surface of the card so the ink doesn't bead up as you use the pen.

Ordinary India ink doesn't wet the surface of the card unless you abrade it slightly with an abrasive typewriter eraser or use "pounce", a product manufactured by Keuffel & Esser Co. for use on tracing paper. But you have an easier time if you use India ink which is designed for use on plastic film. The brand I used is PELIKAN Drawing Ink T for Plastic Sheets, color #17 Black, manufactured by Gunther Wagner, Germany. It is available in all good engineering supply houses, and can be used either in a quill pen or in a late model Rapidograph or Mars drawing-ink fountain pen. Be careful if you have an older model pen, as the ink will etch the barrel.

This ink flows well on the card and doesn't rub off readily, as does ordinary India ink. It is still necessary to make sure the card is clean by working it over with
(continued)

5

an eraser, but the problem isn't as great.

To erase, use the eraser designed for the purpose, which is A.W. Faber #1960, "Peel-off Magic-Rub". The secret is to lick the tip of the eraser to wet it slightly, as it doesn't work dry. The ink will roll right off. That eraser also works well with marks from felt-tip pens.''

Pocket *ENIAC?*

If you want to impress someone with the incredible power of your HP-65, study the following facts. This article appeared in NC↑5's December 1974 Newsletter (Northern California Community College Computer Consortium).

"The incredible changes in computer technology that have taken place over the past 28 years were recently highlighted by *George Otto* and *George Miller,* system programmers at the Moore School of Electrical Engineering at the University of Pennsylvania. The two programmers compared characteristics of ENIAC (the first full computer ever built) to the new Hewlett-Packard HP-65 programmable pocket calculator.

For each of the characteristics used in the comparison, the ratio of performance or capability of the ENIAC to the HP-65 was computed. The performance ratios are: data memory capacity—2 to 1; program memory capacity—8 to 1; read rate—4 to 1; manual switches—140 to 1; power requirements—100,000 to 1; and size—270,000 to 1. According to *Otto* and *Miller,* what we have now is essentially an ENIAC that is battery powered and will fit in one's pocket. They point out that this technological advance has taken place in the relatively short period

of 28 years, and it is anyone's guess what will take place in the next 28.''

Horse Trade?

Being owners of the incredible HP-65, you know firsthand what it was like to first desire the calculator and to then make the decision to purchase one. All very straightforward, right? Well, here's an offer that was pretty far-out but, nonetheless, really serious. "Beautiful black 7-year-old nonregistered thoroughbred-type mare in foal by registered quarter-horse stud—will swap for HP-65. Foal may be registered as half-quarterhorse.'' An interesting offer; too bad we had to turn it down. But here's the real kicker; at the bottom of the letter was: "P.S. Have other horses.''

The HP-65 Babysitter!

In Houston, Texas, *Mr. Joseph Hatfield* has an assistant operator for his HP-65. His 5-year-old daughter, Jennifer, likes to play with the HP-65. She has learned to make the display blink by performing an illegal operation. She also enjoys "loading" the programs and running the *User Diagnostic Programs.* Recently, *Mr. Hatfield* keyed in the following program, which *Jennifer* also enjoys.

f PRGM	Switch to RUN
LBL	9
A	EEX
g	9
DSZ	STO 8
GTO	
A	

Then press **A** and watch a very interesting display.

The 65 Has Arrived

Hewlett-Packard finally made the *Encyclopedia Britannica.* The 1975 supplement includes our HP-65 programmable calculator. In the "Computer" section, the *Britannica* states that "the introduction of the handheld computer'' (the HP-65) is one of the "significant developments of 1974.'' A photograph and half a page of text are devoted to the many outstanding features of the spectacular HP-65.

Depth of Field
(Order #03135A)

When a photographer focuses a camera at a particular distance, some distance in front of and behind this point will also be acceptably sharp. Photographer supplies (1) desired near distance of focus, (2) desired far distance of focus, (3) diameter of circle of confusion on negative, and (4) focal length of camera lens. Calculator then supplies relative aperature (f/stop) and distance-setting to achieve the desired objectives.

Author:
David G. Wolter,
Stockton, California

Simplified Roulette
(Order #03076A)

Allows user to bet any amount on either a number or on "odd" or "even." Payoff is 1:1 on odd or even, 32:1 on a number. Zero to 33 is generated by a random number generator, with 33 simulating double zero. Bets accumulate. An optional initialization routine is included to change the sequence of "spins."

Author:
William A. Sholar,
APO, New York

Load or Torque in Bolts or Screws
(Order #02214A)

The tightening torque required to produce a predetermined tension load in bolts or screws used in assemblies of parts is a function of thread form and friction forces existing during assembly. This program solves the equations relating the tightening and/or stress torque to the desired tension force for given or assumed friction coefficients acting on screws. Alternatively, the bolt tension force and stress torque can be found for a predetermined tightening torque.

Author:
Robert S. Savage,
Huntsville, Alabama

Bell-Fruit:
Standard Slot Machine
(Order #03044A)

A "dime slot machine" on one card, that pays on standard slot machine combos. Deducts dime on each play. Pays 10 dimes on three of a kind or on two of a kind followed by a "bar." Two "cherries" wins 5 dimes, one "cherry" wins 2 dimes. Three "bars" wins a jackpot of 10 dollars. An improvement over other slot programs in that standard combos pay out standard amounts (all on one card!), thus duplicating real slot machines.

Author:
Craig A. Pearce, Berwyn, Illinois

(Note: #03044A is not only a superb program but also an example of superb documentation. Ed.)

Replacement Value of a Home
(Order #02717A)

This program takes the year in which a house was built and the amount paid for it, and gives the replacement cost estimate in 1973. The program contains multipliers provided by *Marshal* and *Swift,* giving an estimated amount in 1973 for houses built in year x. Years programmed in are 1950, 1955, 1960, and 1963 thru 1973. House built in years other than these must be set to the nearest one of these. No statistical table has been completed since 1973, so output will only approximate current replacement value in 1973. The 1975 value would be even higher.

Author:
*E. Wayne Brasch, Columbus, Georgia*

Residential Air Conditioning
Design (Order #02849A)

By inserting the total square feet of area to be cooled, the program will calculate the required amount of air conditioning in tons and in B.T.U.'s, and will calculate the required main and branch duct sizes (in square inches) for all room sizes.

Author:
Harvey C. Ferber, N. Miami Beach, Florida

The Sensational HP-25 Debuts

By now you've probably heard about Hewlett-Packard's newest contribution to the world of programmable scientific calculators—the sensational $195.00 HP-25! And we do mean "sensational."
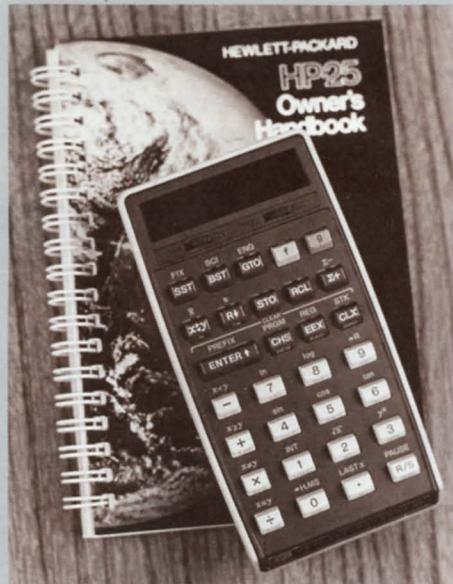
When you've studied the features listed below and re-examined the price above, you'll realize why we've chosen "sensational" as the word to describe this remarkable instrument. And only Hewlett-Packard could put such a bargain at your fingertips.

How many times have you wished you could buy something like your HP-65 for your son or daughter. . .for school, for college, for business, for a fabulous gift? And how many times has the price of an HP-65 stopped you? After all, it *is* a premium calculator; in fact, the very best of the pocket calculators. Well. . .wish, want, and wait no longer. Here is a calculator to gladden the heart of anyone—even yourself!

Worried about programming? Think your son or daughter wouldn't be able to program the HP-25? Well, worry no more. *Included* in the price, besides an unusually thorough but easy-to-understand *Owner's Handbook,* is a 161-page book called *HP-25 Applications Programs.* It contains over 50 programs to solve the most common problems in math, statistics, finance, surveying, and navigation, as well as three games. Eight programs, one at the front of each chapter, are documented quite exten-

sively so that novice programmers can study the structure of these programs and enrich their programming vocabulary and skills.

It would take an entire KEY NOTE to list all of the features and details of this incomparable new programmable calculator. Here are just some of the more exciting details. See your nearest HP dealer and get *all* the details. . .and soon, because they'll sell as fast as we can make them. Better still, order one now by phone. Call TOLL-FREE 800-538-7922 Ext. 1000 (in California, 800-662-9862) and charge it to your credit card.

49-Step Keystroke Programming
All Merged Keycodes
Program Steps Displayed (for Editing)
8 Addressable Memory Registers
Full Register Arithmetic
8 Relational Tests

Conditional and Direct Branching
Extra Statistical Capability
Engineering Display Notation
Pause Key
Back Step Key
Angle (Time) Conversions
And many, many more features!

ANOTHER STELLAR PERFORMANCE!

Dateline Palo Alto, June 23. *"An 11-ounce, $795 pocket calculator that can be programmed like a computer will play an important role in the historic Apollo/Soyuz rendezvous in space on July 17.*

The Hewlett-Packard HP-65 fully programmable pocket calculator will be used to calculate two critical mid-course correction maneuvers just prior to the linkup of the U.S. Apollo and the Russian Soyuz spacecraft. These maneuvers will take place 12 and 24 minutes after terminal phase initiation (the beginning of the last part of the flight before rendezvous.)

It also will be used as a backup for Apollo's onboard computer for the final maneuvers prior to rendezvous and docking. The first use will be for the coelliptic maneuver (putting both spacecraft into the same orbit) when the vehicles are within approximately 100 miles of each other. The second will be for the terminal phase initiation calculations when Apollo is 22 miles from Soyuz. In both instances, the HP-65 will be used to solve the problems, and its answers will be compared with those of the onboard computer.

In the event of an onboard computer failure, however, the HP-65 will have the only available solution for the mid-course maneuvers, since the spacecraft will not be in communication with ground stations at that phase of the mission.

A third set of calculations to be performed by the battery-powered HP-65 will allow the astronauts to precisely point Apollo's high-gain antenna at an orbiting satellite to assure proper communications with Earth.

NASA scientists have written programs of up to 1,000 steps and recorded them on the HP-65's magnetic cards (100 steps per card) that the astronauts will feed into the HP-65 to automatically perform the critical calulations. In previous space flights, backup maneuver calculations were made manually, using charts. The HP-65 will substantially reduce the time needed to make the complex calculations and improve the quality, accuracy, and confidence in resulting solutions.

Two HP-65's will be taken on the space flight, along with four sets of program cards and six spare battery packs.

The HP-65 is not the first HP pocket calculator to venture into space; an earlier model, the HP-35, went along on the Skylab missions."

Talk about an honor!! This is quite a fabulous testimony to the quality and reliability of our most famous calculator. And you haven't yet heard the last word on the HP-65. There'll be more startling news about it as scientists and explorers push further at the bounds of our world.

NASA Johnson Space Center. D. Mosel, of NASA (center) and G. Riddle (left) and M. Mines, both of McDonnell Douglas Corporation, display the HP-65 calculator that will be carried aboard the Apollo Command Module during the upcoming Apollo/Soyuz Test Project scheduled for launch on July 15, 1975. The 10-day mission is to demonstrate and test a common docking system and the performance of joint experiments between the American and Soviet crew members. (NASA Photo)