Science Issue

HOT CoCo®

A WAYNE GREEN PUBLICATION
May 1984 USA $2.95

THE MAGAZINE FOR TRS-80 COLOR COMPUTER®, MC-10 AND DRAGON™ USERS.

See the Secrets of the Universe

On Your CoCo

Find Out Where The Money Goes with FTT

The CoCo As A Lab Instrument

OS-9—Should You Buy It?

Sight for Your CoCo

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A 74470 12067

Plus: A Look at Some Great Games

The HJL-57 Keyboard

Compare it with the rest. Then, buy the best.

If you've been thinking about spending good money on a new keyboard for your Color Computer, why not get a good keyboard for your money?

Designed from scratch, the HJL-57 Professional Keyboard is built to unlock ALL the potential performance of your Color Computer. Now, you can do real word processing and sail through lengthy listings...with maximum speed; minimum errors.

At $79.95, the HJL-57 is reasonably priced, but you can find other CoCo keyboards for a few dollars less. So, before you buy, we suggest that you compare.

Compare Design.

The ergonomically-superior HJL-57 has sculptured, low profile keycaps; and the three-color layout is identical to the original CoCo keyboard.

Compare Construction.

The HJL-57 has a rigidized aluminum baseplate for solid, no-flex mounting. Switch contacts are rated for 100 million cycles minimum, and covered by a spill-proof membrane.

Compare Performance.

Offering more than full-travel, bounce-proof keyswitches, the HJL-57 has RFI/EMI shielding that eliminates irritating noise on displays; and four user-definable function keys (one latchable), specially-positioned to avoid inadvertent actuation.

Free Function Key Program

Your HJL-57 kit includes usage instructions and decimal codes produced by the function keys, plus a free sample program that defines the function keys as follows: F1 = Screen dump to printer. F2 = Repeat key (latching). F3 = Lower case upper case flip (if you have lower case capability). F4 = Control key; subtracts 64 from the ASCII value of any key pressed. Runs on disc or tape; extended or standard Basic.

Compare Installation.

Carefully engineered for easy installation, the HJL-57 requires no soldering, drilling or gluing. Simply plug it in and drop it right on the original CoCo mounting posts. Kit includes a new bezel for a totally finished conversion.

Compare Warranties.

The HJL-57 is built so well, it carries a full, one-year warranty. And, it is sold with an exclusive 15-day money-back guarantee.

Compare Value.

You know that a bargain is a bargain only so long as it lasts. If you shop carefully, we think you will agree...The HJL-57 is the last keyboard your CoCo will ever need. And that's **real** value.

Order Today.

Only $79.95, the HJL-57 is available for immediate shipment for either the original Color Computer (sold prior to October, 1982) or the F-version and TDP-100 (introduced in October, 1982), and the new 64K CoCo. **Now also available for CoCo 2.**

Order by Phone Anytime

716-235-8358

24 hours, 7 days a week

Ordering Information: Specify model (Original, F-version, or CoCo 2). Payment by C.O.D., check, MasterCard or Visa . Credit card customers include complete card number and expiration date. Add $2.00 for shipping ($3.50 for Canada). New York state residents add 7% sales tax.
Dealer inquiries invited. For dealer information in Eastern U.S. and Canada, call collect: 617-586-7614, Advanced Computer Services (distributor), 74 Plain Street, Brockton, MA 02401.

440

HJL PRODUCTS INC.
955 Buffalo Road • P.O. Box 24954
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'REAL TALKER'

HARDWARE Voice Synthesizer

NEW from COLORWARE.. only...$59.95

THINKING OF BUYING A COCO VOICE SYNTHESIZER?

READ THIS....

Making your computer talk couldn't be any easier! 'Real Talker' is a full featured, ready to use, HARDWARE voice synthesizer system in a cartridge pak. It uses the Votrax SC-01 phoneme synthesizer chip to produce a clear, crisp voice.

FREE TEXT-TO-SPEECH

Included free with 'Real Talker' is Colorware's remarkable Text-to-Speech program. This is a truly powerful machine language utility. What it does is automatically convert plain English to speech. And it has an unlimited vocabulary! For example, use it in the direct mode: Type in a sentence or a paragraph, even mix in numbers, dollar signs, etc., then press enter. The text is spoken. At the same time a phoneme string is generated which can be saved to cassette or disk, modified or used in a Basic program.

We originally planned to sell this major piece of programming for about $40.00 but decided it was so useful that no 'Real Talker' user should be without it. Besides, it really shows off the capability of 'Real Talker'.

Also included with 'Real Talker' is our unique Phoneme Editor program. It allows you to explore and create artificial speech at the phoneme level. Phenomes are the fundimental sounds or building blocks of word pronunciation. There are 64 different phenomes, as well as 4 inflection levels at your disposal. Creating and modifying speech at the phenome level is both fascinating and educational. The Phenome Editor may also be used to customize the pronunciation of speech produced by the Text-to-Speech program.

You don't have to use any of our utility programs though. If you write your own Basic Programs, you will find the pocket sized Votrax Dictionary (included free) is all you need to make your own Basic programs talk. This dictionary gives you quick access to the phenome sequences used to create approximately 1400 of the most used words in the English language.

How about compatibility? 'Real Talker' is compatible with any 16K, 32K, 64K, Extended or non-extended Color Computer. It works with any cassette or disk based system, with or without the Radio Shack Multi-slot expander. No other synthesizer under $100 can make this claim. Most other CoCo voice synthesizers require an expensive Multi-slot expander in order to work with the disk system. 'Real Talker' requires only an inexpensive Y-adapter. This is an important consideration if you plan on adding a disk or have one already.

'Real Talker' comes completely assembled, tested and ready to use. It is powered by the CoCo and talks through your T.V. speaker so there is nothing else to add. Price includes Text-to-Speech and other programs on cassette (may be transferred to disk), User Manual and Votrax Dictionary. ONLY $59.95

'Y-BRANCHING CABLE' For disk systems. This 40-pin, 3 connector cable allows 'Real Talker' to be used with any disk system $29.95

YOU DECIDE....

Order yours today on our Toll-Free Order Line. If you are not delighted with your 'Real Talker' system, simply return it within 30 days for a prompt, courteous refund.

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HOT CoCo

Where Does the Money Go?—p. 44

ARTICLES

This symbol indicates the program's placement on the Instant CoCo loader, available on cassette. See our Instant CoCo ad for details.

Cover art by Richard Hernandez

Snark—p. 70

DEPARTMENTS

Vol. 1 No. 12 May 1984

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DIGRESSIONS

THE READERS SPEAK

If you've used our Reader Service cards, you know that we include a questionnaire concerning your interests in the Color Computer and in our magazine. I want to discuss some of the results from our most recent questionnaire. I think you'll find them as surprising as we did.

First, let me explain some of the caveats of making assumptions from such data. This is not a random sampling of our readers. These responses are from readers who take the time to fill out the Reader Service cards. These people usually have a high interest in the industry or are seriously shopping for specific products. Also, these particular results are preliminary; we won't have a final tally until a month from this writing. However, I think the percentages will not change significantly between now and then. This sampling represents 862 responses.

The first question asked was "How many articles do you read in each issue of *HOT CoCo*?" The results showed that most of you read eight or more (59.9 percent). Only 9.5 percent read just one or two. One respondent said he read nothing in the magazine. Oh well, I guess you can't please everyone.

The question that surprised us the most was "Which model (of the Color Computer) do you own?" It looks like you readers like to get the most out of your CoCos, because 44.9 percent of you said they had 64K of memory. Another 22 percent have 32K, and 34.2 percent have 16K. Only 1.3 percent claimed to have 4K. Over three-quarters of you (75.6 percent) have Extended Color Basic.

Many of you are planning to make major investments in your system. Nearly 50 percent of the respondents are shopping for disk drives, and 48.9 percent want printers. Another 37 percent are looking to get into the telecommunications boom by buying modems.

For software interests, the hobby/game (51.6 percent) and utility/programming (50.1 percent) categories were the leaders. But the business category was strong at nearly 30 percent, as was the home-management/finance category at the same percentage. The scientific category was also surprisingly strong at 27.1 percent.

We also asked you to rate our regular features and columns. This part of the questionnaire gets a lot of attention from *HOT CoCo*'s editors. When a column comes up for review, the decision to continue or end it is based heavily on the responses we get to this question.

What's the "most-read" column? Doctor ASCII with an amazing 67.1 percent of the respondents having a high interest in it. Next is Reviews at 64.5 percent, followed by Product News at 64.1 percent and Reader's Forum at 60.4 percent. The Basic Beat was also high with 41.5 percent, as was Graphically Speaking at 40.3 percent. Re:FLEX scored the lowest with 23.7 percent, but this is still a respectable percentage when you consider that the column is intended to serve a special-interest group.

Unfortunately, this column, Digressions, also scored low (27.2 percent). Perhaps if I included a program listing or two—maybe even a schematic. I might as well face it: Editors aren't meant to be seen or heard. They just do their job quietly and let others take the spotlight.

Reader Service responses are eagerly awaited by us each month. In many ways they are the rulers by which we measure our performance in the eyes of the readers. If you don't fill out those questionnaires, please do so. Your opinions will determine the direction of this magazine, so turn to page 130, complete the questionnaire, and do yourself a favor.—*M.N.* ■

Telewriter-64™

the Color Computer Word Processor

- **3 display formats: 51/64/85 columns × 24 lines**
- **True lower case characters**
- **User-friendly full-screen editor**
- **Right justification**
- **Easy hyphenation**
- **Drives any printer**
- **Embedded format and control codes**
- **Runs in 16K, 32K, or 64K**
- **Menu-driven disk and cassette I/O**
- **No hardware modifications required**

THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Telewriter gives the Color Computer a 51 column by 24 line screen display with *true lower case characters*. So a Telewriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Telewriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Telewriter surpasses all others for user friendliness and pure power.

Telewriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Telewriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

...one of the best programs for the Color Computer I have seen...
— Color Computer News, Jan. 1982

TELEWRITER-64

But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

64K COMPATIBLE

Telewriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Telewriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24!! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPVII/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

File and I/O Features: ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette auto-retry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

Editing features: Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

Insert or delete text anywhere on the screen without changing "modes." This fast "free-form" editor provides maximum ease of use. Everything you do appears immediately on the screen in front of you. Commands require only a single key or a single key plus CLEAR.

...truly a state of the art word processor... outstanding in every respect.
— The RAINBOW, Jan. 1982

PROFESSIONAL WORD PROCESSING

You can no longer afford to be without the power and efficiency word processing brings to everything you write. The TRS-80 Color Computer is the lowest priced micro with the capability for serious word processing. And only Telewriter-64 fully unleashes that capability.

Telewriter-64 costs $49.95 on cassette, $59.95 on disk, and comes complete with over 70 pages of well-written documentation. (The step-by-step tutorial will have your writing with Telewriter-64 in a matter of minutes.)

To order, send check or money order to:

Cognitec
704 N. Nob St.
Del Mar, CA 92014 ↙ 121

Or check your local software store. If you have questions, or would like to order by Visa or Mastercard, call us at (619) 755-1258 (weekdays, 8AM-4PM PST). Dealer inquiries invited.

(Add $2 for shipping. Californians add 6% state tax. Allow 2 weeks for personal checks. Send self-addressed stamped envelope for Telewriter reviews from CCN, RAINBOW, 80-Micro, 80-U.S. Telewriter owners: send SASE or call for information on upgrading to Telewriter-64. Telewriter-compatible spelling checker (Spell 'n Fix) and Smart Terminal program (Colorcom/E) also available. Call or write for more information.)

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The left bracket, [, replaces the up arrow used by Radio Shack to indicate exponentiation on our printouts. When entering programs published in *HOT CoCo*, you should make this change.

Article submissions from our readers are welcomed and encouraged. Inquiries should be addressed to: *HOT CoCo* Submissions Editor, 80 Pine Street, Peterborough, NH 03458. Include an SASE for a copy of our writer's guidelines. Payment for accepted articles is made at a rate of approximately $50 per printed page; all rights are purchased. Authors of reviews should contact the *HOT CoCo* Review Editor, 80 Pine Street, Peterborough, NH 03458.

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HOT CoCo is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 44 computer publications in 18 major countries. Nine million people read one or more of the group's publications each month. Members of the publication group include: Australia: *Australasian Computerworld, Micro Magazine*; Argentina: *Computerworld/Argentina*; Brazil: *DataNews, MicroMundo*; Denmark: *Computerworld/Danmark, MikroData*; France: *Le Monde Informatique*; Germany: *ComputerWoche, MicroComputerWelt, PC Welt*; Italy: *Computerworld Italia*; Japan: *Computerworld Japan, PC Japan*; Mexico: *Computerworld/Mexico*; Norway: *Computerworld Norge, MikroData*; People's Republic of China: *China Computerworld*; Saudi Arabia: *Saudi Computerworld*; Spain: *Computerworld/Espana, MicroSistemas*; Sweden: *ComputerSweden, MikroDatorn, Min Hemdator*; United Kingdom: *Computer Management, Computer Business Europe*; United States: *Computerworld, HOT CoCo, inCider, InfoWorld, Micro MarketWorld, Microcomputing, PC World, 80 Micro, RUN,* and *jr.*

Instant CoCo

Instant CoCo Directory—May

SIDE A

ARTICLE NAME/AUTHOR	FILE	PAGE #	SYSTEM
Copyright Statement	TITLE	---	All
Where Does the Money Go?/Barbarello	FTR TALLY	44	16K Ext
10 Seconds to Touchdown/Krueger	LUNAR	58	16K Ext
Otho 3,6/Dussault	OTHO 3,6	60	16K Ext
Snark/Meredith	SNARK	70	16K Ext
Are the Stars Random?/McLaughlin	STARS VIEW	90	16K Ext

SIDE B

Kan Yu Spel?/Jack	SVP	96	32K 2-Disk
It's Sidereal Time/Burzynski	SIDTIME	100	16K Ext
Mendeleev Meets the Computer/Dangler	MENDEL	105	16K Ext
Multiple Pendulums/Giovanoni	MULTPEND	126	16K Ext
Elmer's Arcade/Ramella	ELMERS	18	16K Ext

The symbol (m) in the Article Name column indicates the program is machine-language and must be loaded using the CLOADM command. Additional preparatory commands are listed under the article name where appropriate. CSAVEM addresses are listed for your use with the machine-language programs.

If Our Programs Don't Work

Having trouble entering our listings from the magazine? Here are a few tips that might help.

First, we print all our Basic listings in the CoCo's 32-column format. This means that each line should appear the same on the screen as it does in the magazine. If a line on your screen does not match the same line in the magazine, reread what you typed; you might have made an error.

Second, make sure the program is for your computer. Read the System Requirements box. The information in this box represents the minimum system configuration needed to run that particular program. Also, read the article thoroughly before typing in the program. Sometimes the article contains instructions vital to making the typed-in listing work. For instance, some CoCos will not accept the high-speed POKE (POKE 65495,0). The article for a program using this POKE will tell you to change those POKEs to 65494,0 if your computer will not work at the faster speed.

Some CoCos are sensitive to spacing in the program lines. Occasionally a computer will read a line such as FORR = 1TO20 incorrectly, interpreting the FOR not as a keyword, but as a variable. If you've removed spaces from a program listing to save space, and that program will not work, reinsert those spaces.

If everything is okay so far, check the published listing with what you've typed. Common typing errors include confusing a zero with the letter O, a one with the letter I, or a colon with a semicolon. DATA statements are particularly tricky because of the long lists of numbers. Be very careful with these.

Anyone who owns the new CoCos with the 1.2 ROMs, have noticed poor keyboard response in some published programs. To solve this, you can insert this line: FOR Z = 1TO4:POKE340 + Z,255:NEXT after any line that makes reference to PEEK 338-345.

This loop will slow down a Basic program. Another way is to directly insert a POKE xxx,255, where xxx is any keyboard location between 338 and 345. Example: IF PEEK(341) = 251 THEN Y = Y – 1. Change to: IF PEEK(341) = 251 THEN POKE341,255:Y = Y – 1.

Assembly listings usually require an editor/assembler to enter them into your CoCo. The two most common editor/assemblers are Radio Shack's EDTASM+ and The Micro Works' SDS80C. An Assembly listing assembled using the SDS80C will probably not run under EDTASM+.

If all the above fails, send us a printout or a detailed description of the problem you experience along with any error messages. We'll try to work it out for you. We cannot help you if you have modified the original program in any way. ■

WORKBASE

MORE THAN JUST A DATABASE

- CREATE
- UPDATE
- REORGANIZE

- SELECT AND
- SORT

- CALCULATIONS
- REPORTS

- DEFINE & SAVE CALCULATIONS AND REPORTS

- MOVE DATA BETWEEN FILES

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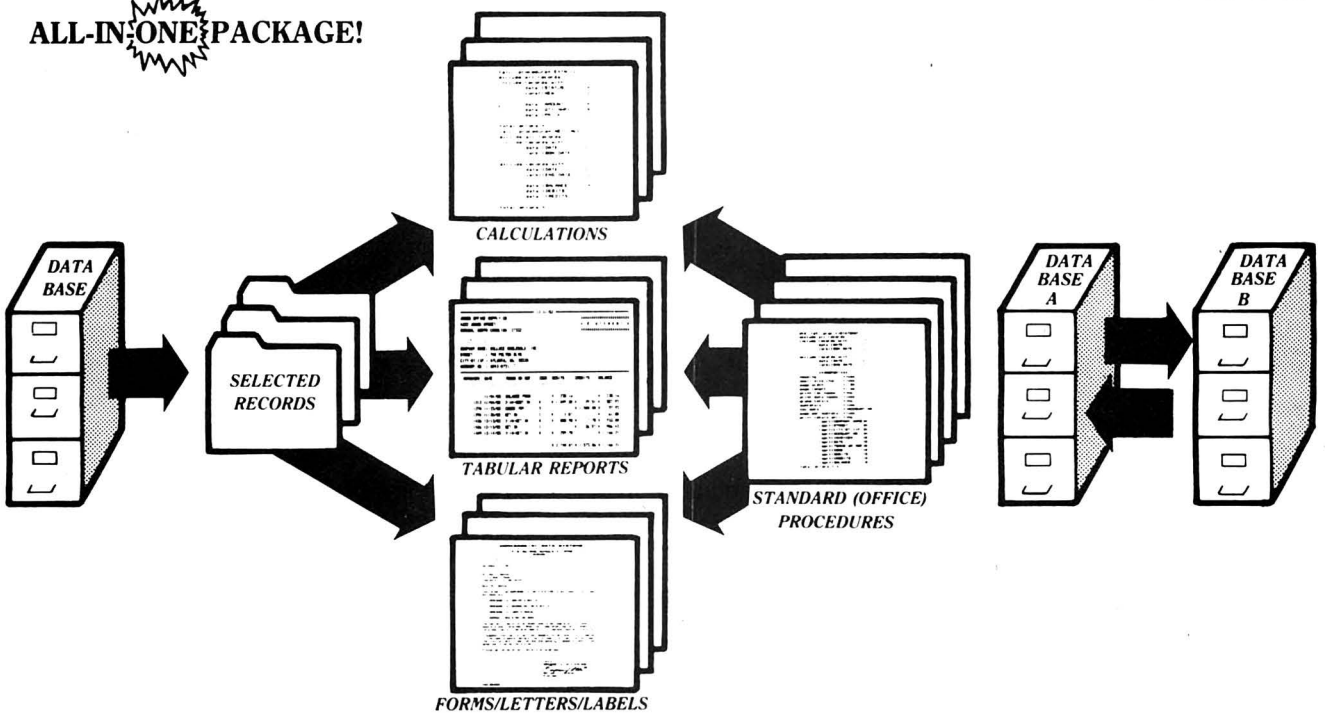

- CALCULATOR MODE
- ADD, DELETE, OR REARRANGE DATA FIELDS

- SORT ASCENDING OR DESCENDING
- SELECT OR SORT USING ANY DATA FIELD
- MULTIPLE SELECT MODES

- DEFINE SEVERAL CALCULATIONS OR REPORTS WITH SELECTION CRITERIA
- USE CALCULATION RESULTS AS SELECTION CRITERIA OR OTHER CALCULATIONS
- MERGE DATABASE WITH TEXT

- CHANGE SELECTION/CALCULATION VARIABLES OR ENTER DATA AT EXECUTION TIME
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✓359

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✓ See List of Advertisers on page 131

From Sesame Street to Outer Space...

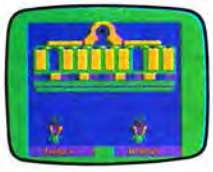
Radio Shack Has and Entertainment

The CTW Software Group, a division of Children's Television Workshop, brings you ten game-style educational programs. Each one encourages children to experiment, explore and solve problems while having fun.

For TRS-80® Color Computers with Extended BASIC

19.95 Each

Grover's Number Rover.™*** Grover's rover is ready to blast off! Hop aboard and help him play with Twiddlebugs and numbers! A Basic Skills Game for ages 3-6. #26-2522.



Grobot.* How well will your astro-garden grow? Plant, protect and harvest—it's up to you and Grobot. A Creative Exploration Game for ages 10 and up. #26-2527.

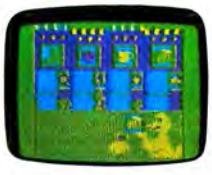
Taxi.* Kids earn fares and tips as they drive through six cities from New York to Shanghai. A Cooperative Strategy Game for ages 7 and up. #26-2509.

Ernie's Magic Shapes.™*** Ernie wears the top hat, but you're the magician. Help Ernie match shapes and colors in six different ways. A Basic Skills Game for ages 3-6. #26-2524.

Time Bound.* Race through time and learn about history, in hot pursuit of your hapless assistant, Anacron. Creative Exploration Game for ages 10 and up. #26-2528.

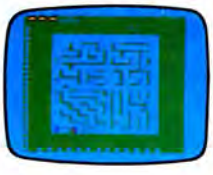
Peanut Butter Panic.* The sky's the limit as players cooperate to catch stars, make sandwiches, and win. A Cooperative Strategy Game for ages 7 and up. #26-2523.

Big Bird's Special Delivery.™*** Help Big Bird deliver the mail! Match the pictures and bring each package to the right store. A Basic Skills Game for ages 3-6. #26-2525.

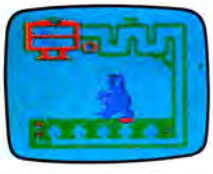


Flip Side.* Stake your claim, surround the squares, and watch the screen flip colors! Planning is the key. A Creative Exploration Game for ages 10 and up. #26-2529.

Star Trap.* Players must race through a maze to trap a slippery star before time runs out! A Cooperative Strategy Game for ages 7 and up. #26-2510.



Cookie Monster's Letter Crunch.™**** It's Cookie Time! Help Cookie Monster match words and letters to bake and eat cookies! A Basic Skills Game for ages 3-6. #26-2526.



*Joysticks required. **Cassette recorder required.
***Joysticks and cassette recorder required.

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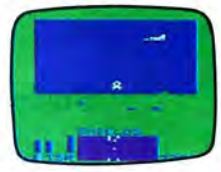
Gomoku and Renju. The classic oriental game of strategy! Block your opponent while attempting to place five of your own men in a row Hours of fun. #26-3069. **$19.95**

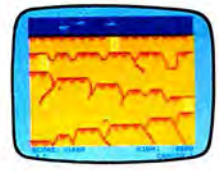
Slay the Nerius.* Defend your submarines against deadly starfish and the ancient seaworm—the fearsome Nerius, a creepy nemesis from the Deep. #26-3086. **$24.95**

Double Back.* As you "double back" to catch your own tail, try to encircle the "safe" screen objects to gain points in this tricky game. Challenges mount as you play. #26-3091. **$19.95**

Star Blaze.* Protect the Milky Way! Radar shows menacing vessels nearby. Seek, destroy and check radar again. Red alert! There's no let up in the excitement. #26-3094. **$19.95**



Canyon Climber.* An action game with a difference. As a cliff hanger, you're challenged by one test after another—kicking goats, zinging arrows and falling objects! #26-3089. **$34.95**



Dungeons of Daggorath.* You're pitted against a succession of awesome beasts. Each victory brings you closer to your ultimate opponent—the evil wizard! #26-3093. **$29.95**

Baseball. Nine innings of fun! You're in full control of this realistic simulation of America's Number One sport, both behind the plate and on the field. #26-3095. **$24.95**

ZAXXON.* The official home version of the great arcade favorite by Sega! Match wits with the deadly ZAXXON Robot! Challenges escalate as you progress. 32K required. #26-3062. **$34.95**

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Fort Worth, Texas 76102

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ADDRESS _____
CITY _____ STATE ____ ZIP _____
TELEPHONE _____

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Feedback

Morse Code Changes

Depending on the configuration of their systems, some readers are having trouble running my "Morse Code Coach" (*HOT CoCo*, February 1984, p. 100).

As published, it's for a 16K, Extended Color Basic cassette system, but those with a 32K disk system should delete line 5, and those with a 16K disk system should delete lines 10–110, remove all the EXEC commands, and delete the FOR X = 1 TO 69:READC:NEXTX: from line 310.

I've also learned that you always get a score of 100 percent on the Morse Code tests. Although that's great for the ego, it doesn't tell you much about your progress. Therefore, insert SC = SC – 1 immediately after NU = NU – 1 in line 820.

Robert Yeater
Moundsville, WV

Free (As in Costs Nothing) Ware

The freeware marketing concept offers programmers an alternative means of marketing Color Computer software. We feel that this gives programmers certain advantages over the traditional choices of commercial marketing or putting their programs into the public domain.

Those interested should send us a request for the author's or user's infopack, plus a self-addressed, stamped envelope.

Donald G. Barber
The CoCo Freeware Clearinghouse
P.O. Box 1084
Morgantown, WV 26507
304-599-4493
CIS# 70305,723

SDOS Info

I was intrigued with a recent demonstration of an expansion interface called Colormate with SDOS. I'm surprised to see little about it in *HOT CoCo*, and would especially appreciate a comparison of it against FLEX and OS-9.

Also, since the 6809E MPU is so sophisticated and flexible, why hasn't someone written a version of OS/VS for it? OS-9, with its multi-user capability, makes it seem possible.

Much of my CoCo knowledge comes from your magazine, and I value your opinions. Thanks for a fine publication.

Randy Stanard
Fountain Valley, CA

We're expecting a copy of SDOS soon. We'll tell you what we think of it in an upcoming issue.—eds.

Business Partner

Congratulations on the January 1984 issue. I've always looked to the Color Computer as a serious business machine and have converted some Model I/III programs for bookkeeping and inventory, but you published the first serious programs I've seen outside of commercial advertisements.

Above all, the screen format in "Stock Transactions Tracker" (*HOT CoCo*, December 1984, p. 58) is first rate. I'd like to see at least one business-oriented program in each issue.

Alan G. Johnson
Colorado Springs, CO

We'll try.—eds.

Kaleidophone Correction

Thanks for publishing my article, "CoCo Lightshow" (*HOT CoCo*, February 1984, p. 70). Unfortunately, you didn't include my proofreading corrections. The most important one is in the schematic. I've heard of "the sound of one hand clapping," but I've never before seen a capacitor with only one plate.

Fred Lenherr
New Salem Research
West Main St.
New Salem, MA 01355

Sorry Fred.—eds.

LLISTing Beyond 64 Characters

In the February 1984 issue of *HOT CoCo*, Doctor ASCII told G. Herbert Gill to save a program in ASCII and load it into a word processor in order to LLIST a program containing lines longer than 64 characters (p. 129). That will work, but there are easier methods, especially for cassette users.

I had a similar problem with my Smith-Corona TP-1 until I found a utility called Line Width Driver on page 18 of the April 1982 issue of *TRS-80 Microcomputer News*, and in a book called *Color Computer Secrets* from a Canadian company called Disk 'n' Data. After running that program, you can POKE your desired line width into 155 and LLIST or PRINT#-2 anything you want with no problem.

An alternative solution to Mr. Gill's problem appeared in the June 1983 issue of *HOT CoCo*, as a valuable utility called "Doculist/C" (p. 58). A modified version appeared in the January 1984 Feedback section (*HOT CoCo*, p. 8).

Both versions of Doculist/C require

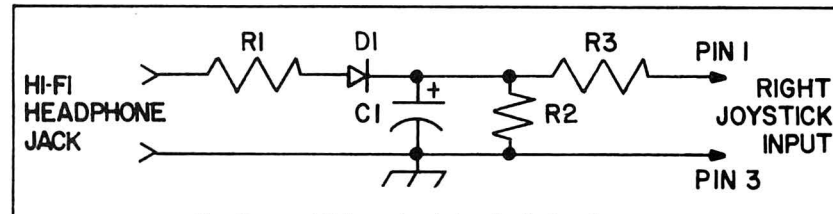

Fig. Corrected Schematic of Amplitude Interface

a printer line width that is longer than Mr. Gill's limit of 64, but you can easily modify that by changing the numbers 69 and 70 in lines 63170 and 63240 to something smaller—55 and 56 should be small enough.

Neil Edward Parks
Beachwood, OH

Challenging "An Interesting Challenge"

As a Color Computer owner and a Radio Shack salesman, I must respond to the quotation from Tano's George Merchant regarding his assessment of Tandy's attitude toward CoCo owners: "Once you buy it, it's your problem" (*HOT CoCo,* December 1983, p. 79).

All the employees at my store have computers, and we try our best to help all computer owners, regardless of what they own. Mr. Merchant might have found an employee or two who weren't concerned about service, but they certainly do not represent Tandy's attitude toward its customers.

We have a line of great computers, and we stand behind what we sell. I'm sorry Mr. Merchant had a bad experience, but the rest of us don't deserve the blame for it.

Jim Clarke
Fairfield, CA

Computer And Electronics Swap

Micro International is sponsoring a computer and electronics swap meet on Sunday, April 15, 1984, from 10 a.m. to 5 p.m. at the American Legion Hall at Butterfield and Spring Roads in Elmhurst, IL.

Admission is $2 in advance and $3 at the door.

Micro International
Dept. M
P.O. Box 774
Highland Park, IL 60035
312-530-1552

Color Basic, Please

Your magazine is terrific, but I have to skip the greater part of the material because I own a 16K Color Basic machine. *Please* put more listings I can use in *HOT CoCo*.

Do more authors submit articles for Extended Color Basic machines or are machines like mine simply not as popular?

Robert LeBar
Hartsdale, NY

Most submitted manuscripts are for Extended Basic machines. Also, our reader surveys show that the vast majority of our readers have Extended Color Basic. But don't despair. We intend to include Color Basic material regularly, as well as articles from which any Color Computer owner can benefit.—eds.

Anyone Out There, Rockville?

My son and I are proud CoCo owners and would like to share ideas and experiences with clubs or other users in the Rockville, MD, area.

Yaron and Gideon Samid
237 Congressional Lane
Rockville, MD 20852

Sorry, Doc

A couple of production gremlins worked their way into the March Doctor ASCII column (p. 136) The corrected lines for Program Listing 3 appear on this page, along with a corrected keyboard rollover table.—eds.

```
10 FOR I=32382TO32407
70 DATA 255,223,167,128,183,255,
222,140
80 DATA 255,0,38,241,183,255,223
,28
170 IF PEEK(49152)=68 THEN S=&HE
000 ELSE S=&HC000
```

Corrected Lines for the March Doctor ASCII, Program Listing 3

					(X)			
		254	253	251	247	239	223	191
	338	@	H	P	X	0	8	ENTER
	339	A	I	Q	Y	1	9	CLEAR
	340	B	J	R	Z	2	:	
	341	C	K	S	up	3	;	
(Y)	342	D	L	T	dwn	4	,	
	343	E	M	U	lft	5	-	
	344	F	N	V	rt	6	.	
	345	G	O	W	spc	7	/	

Corrected Keyboard Rollover Table from Doctor ASCII, March 1984

Sprinks on The CoCo 2

CoCo 2 and 1.2 ROM Color Computer owners might have had trouble getting the Sprinks program in the October Elmer's Arcade (p. 12) to work properly. This is because the keyboard-rollover table does not reset itself on these newer models. The Program Listing gives a new line 500 to correct this problem for the Sprinks listing. This fix is faster than the one on p. 8 of the January Feedback.—eds.

```
500 IF(PEEK(341)AND8)=0ANDPOINT(
A,B-1)<>5THEN POKE341,255:B=B-1E
LSEIF(PEEK(342)AND8)=0ANDPOINT(A
,B+1)<>5THEN POKE342,255:B=B+1EL
SEIF(PEEK(343)AND8)=0ANDPOINT(A-
1,B)<>5THEN POKE343,255:A=A-1ELS
EIF(PEEK(344)AND8)=0ANDPOINT(A+1
,B)<>5THEN POKE344,255:A=A+1
```

Program Listing. Sprinks Line 500 Fix for 1.2 ROM

Expanded Horizon

You guys were right! *HOT CoCo* is the most informative magazine I've ever purchased. My recent subscription has taken me so much farther than I had ever gone in the 10 months of owning my Color Computer. For example, taxes should be a breeze this year thanks to the "Emancipation of the Taxpayer" (*HOT CoCo*, February 1984, p. 62).

Also, James Wood's "Basic Beat" has helped immensely. Mr. Wood's down-to-earth instruction and easy examples have taken much of the frustration out of learning Basic, even though I've read through the Color Basic instruction manual.

Richard Stafford
Hubbard, OH

Wider, Please

Please publish your program listings in the wide, easy-to-read format. I've had to pass up several programs in the narrower format because they're too difficult to enter. I don't think I should have to spend a hundred dollars to use the listings from a magazine.

Darlene B. Abernathy
Chicago, IL

We print the shorter listings in the smaller, one-column format to save space. Longer listings always appear in the larger, two-column format. Perhaps we should be stricter about what we consider "short" listings. We'll pay more attention to this problem in the future.—eds.

Auto-Start Help

You publish such useful information and tips in *HOT CoCo* that I thought you or your readers could help me. I would like to know how to autostart Extended Color Basic or machine-language programs from tape or disk. Does anyone have an answer?

Richard A. Thomas
7215 Valley View Road
Ferndale, WA 98248

Look for an article on auto-starting programs in an upcoming issue.—eds.

Attention Colormaniacs

We are sorry, but if you look for "Colormania—Part III" this month, you won't find it. Author Mark Silverblatt is a serviceman stationed overseas, and because of delays with overseas mail and Mark's duties, we did not receive his latest Colormania in time for this issue.—eds.

Add a REM Statement

Those who copy programs from magazines such as *HOT CoCo* will find it helpful to add a REM statement to identify the publication and issue. It saves trouble when you need to refer to the article from which the program came.

Harold L. Laroff
Monsey, NY

CoCo Blueprints?

I would like to compliment your staff for putting together the best CoCo magazine. *HOT CoCo* gives me the information I need to use my Color Computer to its maximum potential. However, I'm often searching through back issues for the articles I need. Therefore, I suggest that you publish a data base of all articles, reviews, letters, and so on by title, author, and subject.

I'm also building a house and would like to find some software that would let me draw floor plans, lot plans, and 3-D room plans. I'd welcome suggestions from anyone out there.

Jeff Rose
123-2 Deerhurst Lane
Webster, NY 14580

We're working on such a project, and it won't be your usual article index. Can any readers help Jeff build his house?—eds.

We've Moved

Eds. note—Looking for the High Scores section? We've moved it, and whatever other game tips you send in, to the Gameware area of the Review section. We'll see you there.

Send your letters to Feedback, HOT CoCo, *80 Pine St., Peterborough, NH 03458.*

On-Line

Are you running a BBS? Drop a note to Feedback and let our readers know about it.

Parkesburg, PA

I'd like to let your readers know of my new BBS.

Joseph Brach, Sysop
Parkesburg, PA
215-857-3035 (BBS)

Modem Link BBS

Our new BBS operates 24 hours a day, seven days a week. Use the ML I.D. The password is MAGY.

J. and Debra Cylde (Sysops)
Nyack, NY
914-358-6840 (BBS)

Rainbow Connection BBS

Rainbow Connection Bulletin Board Services now contain five new systems. You can access BBS #4 at 212-441-5907. Canadians can access BBSs 5, 6, 7, and 8 at 514-845-5452. Each system consists of a hard disk and multiplexer with telephone ringover for four users.

Access the original three BBSs by dialing 212-441-3755, 212-441-3766, and 212-441-5719.

Bob Rosen
Spectrum Projects

Aviation BBS

The Department of Aviation Technology at Purdue University, West Lafayette, IN, operates an aviation BBS from 5 p.m. Friday until 8 a.m. on Monday and all day on holidays.

The system operates on a 64K Color Computer and covers aviation topics only. Access it by calling 317-743-3897.

Michael S. Nolan
Academic Advisor
Purdue University
School of Technology

CoCo Corner

CoCo Corner operates 24 hours a day at 300 baud out of Hialeah, FL.

Victor Gonzalez
Hialeah, FL
305-681-8490 (BBS)

Clubhouse

Have a Color Computer club? Let prospective members know about it through a letter to Feedback.

Albuquerque

We've reorganized the Albuquerque Color Computer Club, a part of the New Mexico Computer Society. Membership in the club is free, but there are dues for membership in the Computer Society.

The club meets every other Tuesday at 7 p.m. for 2–3 hours. For more information, phone Steve Maggs at 293-8567 or Anthony Segura at 821-5876.

Stephen Schenkel
7401 Rio Grande NW
Albuquerque, NM 87107

Erie, PA

The Erie TRS-80 User's Group is open to all TRS-80 users, although most own Color Computers. We have a software library of public domain programs and a newsletter. Phone or write me for details.

Tom Kuklinski
320 Maryland Ave.
Erie, PA 16505
814-456-4786

Orange, CT

Those interested in participating in a Color Computer user's group in the Orange, CT, area can phone or write me.

James J. Pino
320 Old Silo Road,
Orange, CT 06477
795-6211

Parkesburg, PA

I'm starting a user's group in the Parkesburg, PA, area.

Joseph Brach
P.O. Box 233
Parkesburg, PA 19365

S. Charleston, WV

The Kanawha Valley Personal Computer Club serves all microcomputer users. We meet at 7 p.m. on the second and fourth Tuesdays of each month at the Seventh Day Adventist Church, 622 Kanawha Boulevard West. The first Tuesday features user group activities and the second Tuesday offers tutorial sessions.

We announce club activities on two BBSs: The Twenty-First Century Connection (304-925-3338, 24 hours a day) and the Charleston Network (304-345-8280) daily from 6 p.m. through 7 a.m., or on Friday at 6 p.m. through 7 a.m. on Monday.

Sharon J. Graff
Secretary-Treasurer
Kanawha Valley Personal Computer Club
1223 Ridge Drive
S. Charleston, WV 25309

Mississauga, Ontario

We have formed the Meadowvale Color Computer Club for CoCo users in the Meadowvale/Streetsville area of Mississauga. We meet the first Tuesday of each month at 6:30 p.m. at the new library in the Professional Centre, across from the Meadowvale Town Centre.

Howard Porter, Secretary
Meadowvale Color Computer Club
P.O. Box 186
Streetsville, Ontario L5M 2B8

Peoria, IL

The Peoria Color Computer Club (PC^3) meets on the second and fourth Saturdays of each month at 10:00 a.m. at the Germantown Hills Fire Station in Germantown Hills, IL. Phone or write me for more information.

Harold E. Brazee
102 Twin Oaks, Court
East Peoria, IL 61611
309-694-4703

Colorado Springs, CO

We've formed a CoCo users' group in Colorado Springs, and everything looks promising. Interested parties can contact me at 303-597-7806.

Herbert B. Ridge
6555 Pawnee Circle
Colorado Springs, CO 80915

Evansville, IN

I'm starting the Evansville CoCo Club. Those interested should phone or write.

Brian Broyles
Box 462
Poseyville, IN 47633
812-874-2210

Brisbane, Australia

The Brisbane Color Computer User's Group meets at the following locations:

- Brisbane West—17 Penley St., The Gap, on the third Sunday of each month at 1 p.m. Phone Brian Dougan at 07-302072.
- Brisbane North—Hendra High School on the first Saturday of each month at 1 p.m. Phone Jack Fricker at 07-2628869.
- Brisbane South—Mount Gravatt on the second Saturday of each month at 1 p.m. Phone Geoff Tolputt at 07-3917801.

We publish a free bimonthly newsletter called *CoCo Bug*. For copies, contact the editor: Paul R. Humphreys, 63 White St., Wavell Heights, Qld., 4012.

Joshua Gans
294 Russell Tce
Chapel Hill
Brisbane, Q., Australia, 4069

Two New Jersey Locations

I am starting a CoCo club in both of the areas in which I live. I'm at my address in Ocean County, NJ, from Friday to Sunday, and anyone interested can reach me

then by calling 201-269-2054, or writing to John Knam Jr., 32 Pine Tree Drive, Bayville, NJ 08721.

I go to school in Wayne, so anyone interested in joining a club in north Jersey should write to John Knam Jr., William Patterson College, Heritage 210, Wayne, NJ 07470. I'm at that address during the week.

John Knam Jr.

Maine State Penn

Several months ago the Maine State Prison JayCees and the Long Timer's Group Inc. cosponsored the purchase of three Color Computers. We then formed the C.O.M.B.A.T. (Computer Based Advancement Training) club and have begun a *Getting Started with Color Basic* instruction course.

C.O.M.B.A.T. is open to anyone—but you must be a Maine State Prison inmate. We don't look for many new members from your Feedback readers, but we'll appreciate any suggestions and other input.

Stephen Haberski, Director
C.O.M.B.A.T.
Box A
Thomaston, ME 04861

Hinesville/Savannah, GA

We're starting a CoCo club in the Hinesville/Savannah, GA, area. Contact me for more information.

William H. Mason
417 Timberlane Circle
Hinesville, GA 31313
912-368-3900

Kansas City, KS

Our user's group, K.C. CoCo, serves those in the Kansas City, Kansas and Missouri area and meets on the first Sunday of each month at 2:30 p.m. at the Guaranteed State Bank, 6900 State Ave., Kansas City, KS.

Visitors and new members are welcome. Those interested can phone or write to me.

Mike Allinder
K.C. CoCo
P.O. Box 11192
Kansas City, KS 66111
913-287-1904

Parkersburg, WV and Marrietta, OH

We're now forming a Color Computer user's group in the Parkersburg/Marrietta area. We have no formal meeting time as yet, but we do have a large library and several hardware and programming specialists. Contact me for more information.

Gregory Wentzel
1209 36th St.
Parkersburg, WV 26104
304-428-5547

HOT CoCo's

Consumer Watch

Below is a letter that Softlaw sent to people who ordered their VIP Calc program. We noted in a previous Consumer Watch that Softlaw was not shipping that particular product. We think that this letter accurately portrays Softlaw's experiences and intent in regards to VIP Calc. Please note that this letter was sent December 14, 1983. It reflects the status of VIP Calc at that time, not now.—eds.

Dear Valued Customer:

In the letter of November 16, 1983, I informed you that we expected that VIP Calc would be shipped in the first week of December. Obviously, it hasn't. This letter is to inform you of the progress on the program.

Mr. Murphy has stayed on as a visitor at Softlaw. In fact, he has made his residence in the Calc program. The program is done in that all the features are in, but it remains to be debugged thoroughly. Debugging is fairly unpredictable. The programmer gave me two scenarios. If the debugging is simple, VIP Calc will be ready for shipment at the end of December. However, if debugging becomes difficult, the worst-case scenario is shipment at the end of January.

I tell you this so that you can accurately assess your plans regarding this product. Although it will be the best spreadsheet on the market, many of you want the best, but most of all you need a product now. Please feel free to cancel your order for VIP Calc at any time and purchase some other product. We will immediately process your cancellation and issue any refund. It is far better for you to have a product which satisfies your needs than to be upset with us. We therefore encourage you to reassess your need for VIP Calc in light of the schedule above.

Let me give you a little perspective on the problems encountered in writing the Calc and some things that we have learned. First, VIP Calc is the only software package we have which cannot be shipped. Every other piece in our library and all our games are being shipped. Second, the problems we have run into with VIP Calc were largely unforeseen. We truly have believed that the dates we gave were accurate. Because of this we have not pulled or altered our ads (which are finalized a month before they appear). Of course, in hindsight we should have done so, but hindsight is always perfect, and humans rarely are. Obviously, from now on we do not intend to advertise before we have a product in our hands. Believe me, the pressure has been very uncomfortable.

Sincerely,
Tom Saag
Customer Relations

We have been unable to contact the following companies by mail or phone:

Hollow Earth Software
P.O. Box 148
Still River, MA 01467

Color Computer Weekly
P.O. Box 1355
Boston, MA 02205

If anyone has a new phone number or address where they can be reached, please let us know about it.

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NEW VERSION 2.4

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- ☐ No personality modules required.
- ☐ Will program most EPROM's.
- ☐ High quality zero insertion force EPROM socket.

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SATURN Electronics Company Inc.

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COLOR COMPUTER

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*DRIVE 1 FOR COCO	$229
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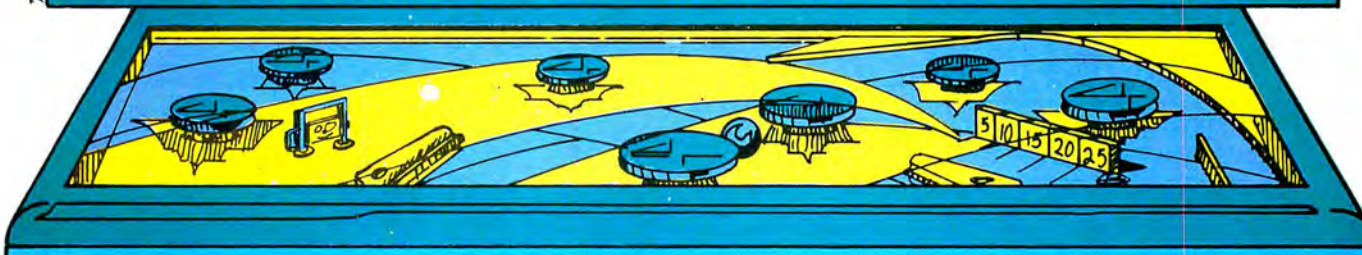
ELMER'S ARCADE

THE PITS OF GANYMEDE



by Richard Ramella

"Shh," said Elmer when I asked for five nickels in change during my most recent visit to his seedy arcade.

"Are you in business or what? Give me nickels," I demanded.

"And I said *Shh!*," he responded, pointing at the small black-and-white TV on the counter.

I understood. It was time for another episode of *Nelson of Neptune*, about which let me tell you:

Nelson of Neptune appears on Elmer's TV at no set schedule. It comes in on UHF channel 147. It's a science-fiction serial in black and white. It is old. The sets are horrible, the acting atrocious, the makeup ridiculous, and the special effects mundane.

Elmer and I love it, especially the string-suspended teapot that represents Thunderbolt, Nelson's spaceship. It is bad.

Murmuring with contentment, Elmer and I settled down for what turned out to be "Chapter 85: The Pits of Ganymede." In this installment, the evil Torn of Tagarald blasts a cruise ship filled with vacationing Twimulkets. The ship screams toward the surface of Ganymede, Jupiter's fourth moon. As two score Twimulkets are cast down into a network of sub-Ganymedean caves, Torn of Tagarald cackles maliciously and heads elsewhere in the Cosmos to do more evil. On the scene comes good old Nelson, and the rest of the chapter involves his flight through the tunnels, rescuing a Twimulket here, a Twimulket there.

There's a problem, however, and it has to do with a miasmic yellow mist that is rising level by level up the pit walls as Nelson rescues everyone in sight. At chapter's end, the mist catches our hero, and he staggers this way and that making *ak-ak-gag* sounds.

"That's the best acting he's done in

System Requirements

16K RAM
Extended Color Basic

a long time," Elmer said, switching off the set.

"The guy who plays Nelson is getting a bit chubby, though."

"Yeah," said Elmer, "but that's my kind of TV show: really, truly bad!" He added, "You going to write a game based on the episode?"

"As always," I told him, already mind-programming game number 85 in my *Nelson of Neptune* series.

"Well, at least you're not stealing from me when you do that." When I made no reply, he looked directly at me. "You're a terrible thief, you know. You've never written an original game in your life."

"I beg your pardon, Elmer. Pits of Ganymede will be a fresh original game."

"Get out of here, scoundrel! But leave a few nickels before you go."

"Gladly," I grinned. I dropped 50 cents into a new acquisition of Elmer's—a very old British pinball machine called, curiously enough, Pits of Ganymede. This synchronicity did not dissuade me from writing the game. Indeed, it spurred me on.

So let's descend into the poisonous atmosphere of the Jovian moon's interior and save all the Twimulkets we can.

First, here's how to play: Type RUN and tap enter. A screen message tells you the adventure takes about 45 seconds to engender itself. Please be patient.

When the game begins, the player piece represents Nelson's ship, Thunderbolt. It doesn't look like a teapot, but it does look like a CHR$(141) graphic, a rectangle with the southwest quarter gone. Thunderbolt is within a red-rimmed tunnel system through which it can be moved by tapping or holding down the appropriate arrow keys. The screen only shows about a tenth of the network of pits. (Later, I'll reveal how this is done.)

Consider that you are simply viewing a portion of the system through a window. To move the window and your view of the field, tap the A, Z, comma, and period keys. I won't tell you how these move the field. Your experimentation will make it clear. Note: The ship's position also moves when the window view is switched.

Your Objective

At the start, Thunderbolt is magen-

```
'100 REM * PITS OF GANYMEDE * TRS
-80 16K EXT. COL. BAS.*ELMER'S/R
AMELLA
110 PCLS1
120 CLS
130 CLEAR 5200
140 PRINT @ 232,"PITS OF GANYMED
E";
150 A=TIMER
160 IF A>1000 THEN A=A-1000: GOT
O 160
170 FOR B=1 TO A
180 X=RND(20)
190 NEXT
200 DIM A$(50)
210 YY$=CHR$(237)
220 U$=CHR$(94)
230 D$=CHR$(10)
240 L$=CHR$(8)
250 R$=CHR$(9)
260 NN=49
270 PRINT @ 289,"ADVENTURE START
S IN 45 SECONDS"
280 A$(1)=STRING$(99,191)
290 A$(50)=A$(1)
300 FOR B=2 TO 49
310 A$(B)=CHR$(191)+STRING$(96,1
75)+STRING$(2,191)
320 NEXT
330 FOR A=1 TO 5
340 B=1+RND(96)
350 FOR C=2 TO 49
360 MID$(A$(C),B,3)=STRING$(4,12
8)
370 E=RND(4)
380 IF E=1 AND B>2 THEN B=B-1 EL
SE IF B<47 THEN B=B+1
390 NEXT C,A
400 FOR A=1 TO 5
410 B=1+RND(46)
420 FOR C=2 TO 96 STEP 2
430 FOR F=0 TO 2
440 MID$(A$(B+F),C,2)=STRING$(2,
128)
450 NEXT F
460 E=RND(4)
470 IF E=1 AND B>1 THEN B=B-1 EL
SE IF B<47 THEN B=B+1
480 NEXT C,A
490 X=1
500 PRINT @ 448,"...OR THEREABOU
TS."
510 G=RND(20)
520 FOR J=2 TO 98
530 IF MID$(A$(3),J,1)=CHR$(128)
 THEN L=L+1
540 IF L=G THEN MID$(A$(3),J,1)=
YY$: GOTO 580
550 NEXT
560 L=0
570 GOTO 510
580 IF J<17 THEN V=1 ELSE V=J-16
590 M=J
600 FOR T=1 TO 50
610 J=RND(99)
620 K=RND(49)
630 IF MID$(A$(K),J,1)=CHR$(128)
 THEN MID$(A$(K),J,1)=CHR$(207)
ELSE 610
640 NEXT
650 FOR L=1 TO 2
660 FOR T=1 TO 20
670 J=RND(100)
680 K=12+RND(38)
690 IF L=1 THEN Q=255 ELSE Q=239
700 IF MID$(A$(K),J,1)=CHR$(128)
 THEN MID$(A$(K),J,1)=CHR$(Q) EL
SE 670
710 NEXT T,L
720 K=3
730 J=M
740 H$=INKEY$
750 IF(PEEK(341)AND8)=0THENH$=U$
ELSEIF(PEEK(342)AND8)=0THENH$=D$
ELSEIF(PEEK(343)AND8)=0THENH$=L$
ELSEIF(PEEK(344)AND8)=0THENH$=R$
760 IF K=49 OR MID$(A$(K+1),J,1)
<>CHR$(128) THEN 770 ELSE IF H$=
D$ THEN MID$(A$(K),J,1)=CHR$(128
): K=K+1: MID$(A$(K),J,1)=YY$
770 IF K=2 OR MID$(A$(K-1),J,1)<
>CHR$(128) THEN 780 ELSE IF H$=U
$ THEN MID$(A$(K),J,1)=CHR$(128)
: K=K-1: MID$(A$(K),J,1)=YY$
780 IF J=98 OR MID$(A$(K),J+1,1)
<>CHR$(128) THEN 790 ELSE IF H$=
R$ THEN MID$(A$(K),J,1)=CHR$(128
): J=J+1: MID$(A$(K),J,1)=YY$
790 IF J=1 OR MID$(A$(K),J-1,1)<
>CHR$(128) THEN 800 ELSE IF H$=L
$ THEN MID$(A$(K),J,1)=CHR$(128)
: J=J-1: MID$(A$(K),J,1)=YY$
800 IF H$="Z" AND X>1 THEN X=X-1
810 IF H$="A" AND X<36 THEN X=X+
1
820 IF H$="," AND V<67 THEN V=V+
1
830 IF H$="." AND V>1 THEN V=V-1
840 GOSUB 900
850 FOR P=1 TO 3
860 IF P=1 THEN Q=207 ELSE IF P=
2 THEN Q=255 ELSE Q=239
870 IF MID$(A$(K+1),J,1)=CHR$(Q)
 OR MID$(A$(K-1),J,1)=CHR$(Q) OR
 MID$(A$(K),J+1,1)=CHR$(Q) OR MI
D$(A$(K),J-1,1)=CHR$(Q) THEN 950
880 NEXT P
890 GOTO 740
900 PRINT @ 0,"";
910 FOR N=X TO X+14
920 PRINT MID$(A$(N),V,32);
930 NEXT
940 RETURN
950 IF Q=207 THEN 1160
960 IF P=2 AND YY$=CHR$(237) OR
P=3 AND YY$=CHR$(253) THEN 740
970 MID$(A$(K+1),J,1)=CHR$(128)
980 MID$(A$(K-1),J,1)=CHR$(128)
990 MID$(A$(K),J+1,1)=CHR$(128)
1000 MID$(A$(K),J-1,1)=CHR$(128)
1010 IF P=2 THEN YY$=CHR$(237) E
LSE YY$=CHR$(253)
1020 SS=SS+1
1030 PRINT @ 498,"SCORE:";SS;: G
OSUB 1080
1040 MID$(A$(K),J,1)=YY$
1050 GOSUB 900
1060 GOSUB 1080
1070 GOTO 740
1080 FOR T=1 TO 5
1090 SOUND 176,1
1100 SOUND 193,1
1110 SOUND 204,1
1120 SOUND 218,1
1130 NEXT T
1140 RETURN
1150 GOTO740
1160 U=RND(3)
1170 IF U>1 THEN 740
1180 PRINT @ 480,"LEVEL";NN;"FLO
ODED";
1190 SOUND 1,10
1200 FOR N1=2 TO 98
1210 IF MID$(A$(NN),N1,1)=CHR$(1
28) THEN MID$(A$(NN),N1,1)=CHR$(
159)
1220 NEXT N1
1230 GOSUB 900
1240 IF NN<K OR NN=2 THEN PRINT
@ 32,"LOST IN THE MIASMIC MIST."
: PRINT "FINAL SCORE";SS: PRINT
"TAP ANY KEY TO TRY AGAIN": SS$=
INKEY$: IF SS$="" THEN 1240 ELSE
 RUN 100
1250 NN=NN-1
1260 PRINT @ 480,STRING$(31,32);
1270 PRINT @ 498,"SCORE:";SS;
1280 GOTO 740
1290 END
```

Program Listing. The Pits of Ganymede

ELMER'S ARCADE

ta. Find a magenta rectangle and contact it. You have rescued a Twimulket and increased your score by one. Thunderbolt turns orange. Now find an orange Twimulket and contact it. You score another point, and the ship reverts to magenta. Score 40 and you've maxed the game.

And so it goes except for a complicating factor. In the pits you will also find up to 50 poison mushrooms, white rectangles. If you contact one, maybe (and I said maybe) it will release fumes, which flood Level 49 with a miasmic yellow gas. Anything on that level is trapped. This could end the game if you have Thunderbolt in the wrong place. You might not see the first releases of gas, but you will know when they occur. There are 48 levels. The pit field is 100 positions wide. You will know when you are at the edge of the field because it is completely rimmed in red.

This is not a frenetic game. It calls for patience and strategy. I hope no one complains about the inability of scoring in the millions. Remember, you're saving Twimulket lives here, not scoring points.

This program comes very close to overflowing the limits of 16K memory, so expand it at great peril to its workability.

Programming Techniques

To me, the most interesting facets of this game are how the pits are assembled and the moving-window feature made to work. Both are done with strings—arrayed strings.

To start, a red-rimmed 99-by-50 field with a cyan interior is created. Most of this work is done in line 310, where the second through 49th lines of the A$(B) array are made equal to a red rectangle plus 49 cyan ones plus another red one. The top and bottom red rims are made separately from this process. Stack the 50 lines of the A$(B) array, and you have the field without the pits.

I'm tired of the constrictions of the grid for computer game playing, so I wracked my brain for something that looked more natural. The answer was to let the pits dig themselves. Five vertical pits are dug by the commands running from lines 330–390, and five horizontal tunnels are generated in lines 400–480.

Let's look at how the vertical shafts

> *"This is not a frenetic game. It calls for patience and strategy."*

are made. Line 330 starts a loop for each of the five shafts. Line 340 gives B a random value somewhere after the leftward red rim and before the rightward one. Line 350 says the path will descend from the second to 49th line of the A$(C) array. Line 360 starts at MID$ position B and turns four positions blank. Line 370 has a one-in-four chance of coming up with a 1, which in line 380 makes the B number increase or decrease by one. This has the effect of making the shaft progress in a sinuous way. The horizontal shafts occur the same way, except the blanks occur in the current A$ array line and two below it.

It is this random completion of 10 interwoven caves that takes most of the waiting time at game's start.

After the pits are created, the starting position of the ship Thunderbolt is established in lines 520–550, the 50 poison mushrooms sown in lines 600–640, and the 40 magenta and orange Twimulkets imperiled in lines 650–710.

At the start of the game, Thunderbolt is near the top of the pits, though its horizontal position varies.

I will skip over other programming methods—I've covered them in the past—and get to the part about the window. It's simple and effective. Lines 900–930 print only a portion of the strings forming the scenario. Starting at screen PRINT@ 0 position, it prints the 32 characters of each of 15 lines of the A$ array strings. The window shifts position according to the key taps, changing the values of X and V in lines 800–830. X represents the first array of the 15 that will be printed in the window, and V represents the first position of 32 within the array.

In lines 750–790, the position of Thunderbolt is changed, assigning it different positions within the array. The arrow keys make these changes, but the window changes hold it in place so it moves up, down, or sideways with the rest of the scene. ■

Address correspondence to Richard Ramella, 1493 Mt. View Ave., Chico, CA 95926.

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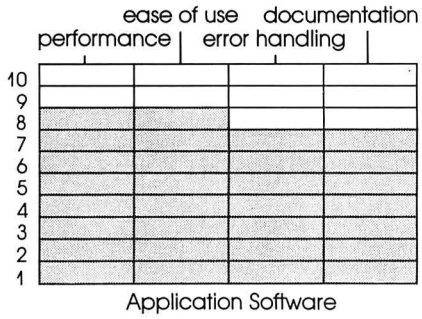


SuperStat
Skyline Marketing Corp.
4510 W. Irving Park Road
Chicago, IL 60641
16K, Extended Color Basic
$29.95, cassette

by Scott L. Norman

SuperStat is another of Skyline Marketing's efforts to produce reasonably priced, business-oriented Color Computer software. In general, it succeeds.

SuperStat incorporates several of the most useful procedures of conventional descriptive statistics into one package. It will find the mean, standard deviation, standard error of the mean, and correlation and covariance matrices for a series of observations on several variables.

It can also carry out simple and multiple linear-regression analyses, generate analysis of variance tables, and carry out F- and t-tests on the regression model. All the usual facilities for editing data and transforming regression variables are present, and you can use a regression model to predict the dependent variable.

Finally, SuperStat has facilities for computing the probability of obtaining a value less than or equal to a given number for a standardized, normally distributed variable. You can also calculate the tail area (P-value) for students' t-distribution.

Although you don't have to be a professional statistician to use SuperStat, it does require a certain degree of familiarity with statistical terms. It's a working program, and not the best choice for learning statistics on your own. It doesn't claim to teach, though, and when used as intended, it's quite satisfactory.

The 30-page manual is divided into general operating instructions and a reference guide. Most commands result in a series of prompts, and these are all described, together with their results. The commands are all four letters long.

SuperStat is written in Basic, and you can copy the tape version to disk with no modifications. One of the utility commands, IOSW (for set I/O switches), lets you specify whether you'll use tape or disk for mass storage. The same command directs reports to the video display or printer, and controls the formats for both.

You can enter data from the keyboard or from tape or disk files that you've prepared in SuperStat's own format, a simple procedure from the manual.

The size of the problem you can tackle is always a concern with CoCo applications programs. A 32K disk system, the instructions say, will handle about 100 observations on 20 variables, or 500 observations on two variables.

These figures assume that you've typed in PCLEAR 1 to leave about 17.6K free after you've loaded SuperStat. For maximum capacity, use cassette operation and the POKEs equivalent to PCLEAR 0.

Unfortunately, this prevents the use of SuperStat's only graphics enhancement: a scatter plot depicting the functional relationship between two variables in a regression setup. I found this a very helpful routine, and would hate to have to do without it. And since none of my test data sets came close to filling the computer, I didn't have to.

SuperStat has a fairly complete set of commands for editing a data set. You can append an observation to the end of the array, change a single element or an entire row, "delete" one observation or a block of observations (that is, ignore (but don't delete) them when doing an analysis), and restore deleted observations to active status.

The SCAT command generates a bivariate scatter plot of one variable against another. To eliminate the need for an involved scaling routine, the variables are standardized: The appropriate mean is subtracted from each, and the result is divided by its own standard deviation. The result is a universal set of axes, ranging between + and −3 standard deviations for each variable.

There is one point for each observation, and this scaling will preserve any relationships between the original variables. Large positive correlations lie near a 45-degree line, for example.

Linear-regression analysis, invoked by the REGR command, produces no outputs of its own. There are progress reports and warning messages in certain pathological situations, but in general you must use two additional commands to obtain the results: ANOV gives the statistics from the analysis-of-variance table, and COEF produces the estimates of the slope and intercept of the analysis' least-squares line. It also includes the standard errors and t-tests of significance

Contents

edited by Mark E. Reynolds

of the slope and intercept.

Yet another command, PRED, uses the regression model to predict values of the dependent variable. You can enter the independent variable(s) from the keyboard, or from the data array.

You can use SuperStat's TRAN command to perform a logarithmic transformation on the dependent variable. Other transformation options are available: adding a constant or multiplying by one, exponentiating a variable, raising to a power, and standardizing (as for the scatter plot). Repeatedly invoking TRAN lets you carry out more complex transformations.

SuperStat is interactive and fairly easy to work with, although I probably would want a high-resolution scatter plot for a real analysis. In any event, the final decision about the form of a variable transformation will often rest on the numerical results.

The linear-regression package is just one side of SuperStat; the descriptive statistics capability can be more useful for certain types of problems. You can preview all the computed quantities on the video display or direct them to the printer, just as for regression analysis.

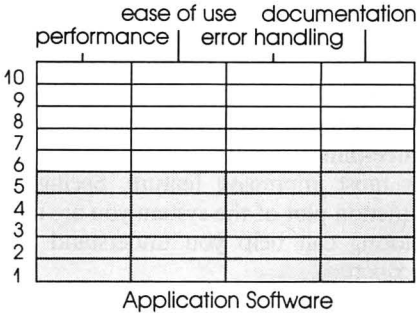
It can be quite a chore to get a feeling for correlation and covariance matrices when you have to look at them in screen-size sections, so the printout is welcome.

You also get the following three descriptive statistics commands:

- MEAN calculates (for each variable in a data set) the mean, standard deviation, standard error of the mean, a t-value (mean divided by standard error) for testing the probability that the observed mean is zero, and the significance level for the t-test.
- CORR computes the matrix of correlation coefficients among any specified subset of the variables. Since this is a symmetric matrix, it only displays one-half (the lower).
- COVA computes the covariance matrix for any subset of the variables. This is related to the correlation matrix: The correlation coefficient between any two variables is the ratio of their covariance coefficient to the geometric mean of their individual variances.

SuperStat seems to do a workmanlike job of the computations, and assuming there's nothing pathological about your data, you can probably rely on the four-figure accuracy claimed.

In general, I found SuperStat to be useful and well documented—at least as far as its own operation is concerned. Program author Michael Peck apparently agrees with the idea that you need an understanding of statistics to get the most from this program; his documentation includes a bibliography of half a dozen applications-oriented entries. ■



Master Writer
Pyramid Distributors
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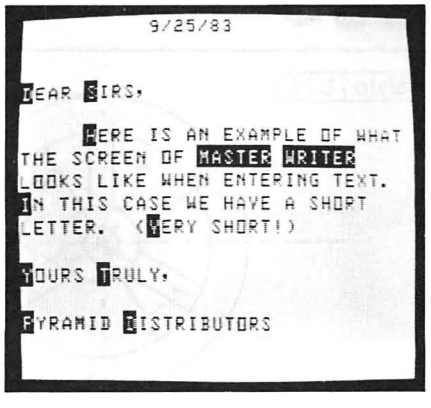
Santa Monica, CA 90405
16K
$14.95, cassette
$19.95, disk

by Robert P. Bussell

Master Writer is a machine-language word processor that features a low price and ease of use. It is an ideal program for the casual user.

The disk and cassette versions are almost identical, except that the available memory limits text files saved on cassette, while disk files can be as large as the available disk storage. Master Writer automatically configures itself to any memory size.



Master Writer

The program is menu driven, and a few of Master Writer's features are especially convenient. For example, although you must keep track of file extensions, you do not have to enter them. Master Writer will assign the extension .DAT to the file name. If you choose to enter an extension yourself, be careful to use a period and not a slash, as a separator, or you will create a file name that you can never retrieve or delete from Basic. A spool function lets you print one file while you are editing another—a time saver.

If you often use a phrase of up to 31 characters, you can define and enter it with a special function key, and a FIND command gives a quick and convenient way to search for a word or phrase in the text.

Editing and Printing

Master Writer's print-formatting options are fairly standard: You can set the baud rate, margins, line length, lines per page, line spacing, and a carriage return only or a carriage return and line feed.

The program's editing functions include full cursor control; copy, delete, or save to disk a marked block of text; search for specified strings; reverse screen display; insert text; or merge two files. You access each function by pressing the clear key and another letter. Pressing the H key brings up a help menu, listing the available commands.

When you are through editing, a return to the main menu automatically saves the text file to disk.

When you execute the FIND command from the editor, an F appears on the prompt line. If you don't delete it prior to entering the search string, the program will include the F in this string. The same problem occurs with the L that appears with the MERGE command.

Although Master Writer should work with the Radio Shack printers, it does have some incompatibility problems with other brands, such as my Okidata 82A. When the program encounters a NEW-PAGE command or an imbedded FORM-FEED command, it substitutes a number of carriage returns to space to the next page, but this doesn't work on my printer.

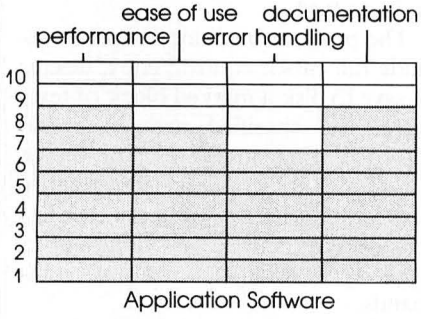
The documentation describes a method of making a customized version of the program with your desired options preset. I changed the baud rate to 1,200 to be compatible with my printer and saved the customized version as described in the documentation.

When I loaded this customized version and invoked the options menu, the baud rate was shown as 1,200. However, when I attempted to execute a print file, I found that the baud rate had not been changed.

Master Writer comes with a 31-page user's manual. The explanations of the functions were clear, but a small sample text file and an example of how to use it would have been helpful.

Master Writer is a valuable program for the price. However, I cannot recommend it for extensive word-processing applications. The screen display is limited to 32 characters per line, and you must use the defined function keys to simulate tab functions. Master Writer does not support right-margin justification.

If you don't intend to do serious word processing, the nice price makes this program worth consideration. ■



Mathmenu: Numerical Analysis Programs
Inter + Action
113 Ward St.
New Haven, CT 06519
16K, Extended Color Basic
$44.95, cassette
$49.95, disk

by Stuart Hawkinson

Mathmenu is a useful cross section of programs to solve a wide range of engineering and scientific math functions that require extensive calculation.

The programs include an RPL (Reverse Polish Logic) calculator, numerical integration and differentiation, matrix and vector operations, quadratic root finding, rectangular/polar conversions, curve fitting, and two- and three-dimensional plotting.

In the cassette version, the computer searches the tape for the program you select. The disk version organizes the calculations via a menu-selection program that allows single-key access to each function. It conveniently returns you to the menu after Mathmenu completes the computation.

The documentation discusses each program and provides some background on the operations performed, but the program displays instructions with each section, so you need the printed documentation only for reference.

I found the descriptions to be clear, and the program operations easy to follow.

Mathmenu's ability to plot two- and three-dimensional function graphs is its most impressive feature. Seeing a function plot of the system you are exploring can help you understand its properties.

2D PLOT plots any function that you can enter as a Basic expression, calculating Y in terms of X. When you select the Enter New Equation option, the program halts with a prompt asking you to enter the equation at line 10.

To plot a polynomial, for example, enter the equation as a line in the program: 10 Y=6+3*X−5*X*X. Type GOTO 45 to start the program again, and you are ready to specify the plot limits.

You can also plot other functions by entering new equations at line 10. You can even superimpose plots of different functions—very useful for making comparisons.

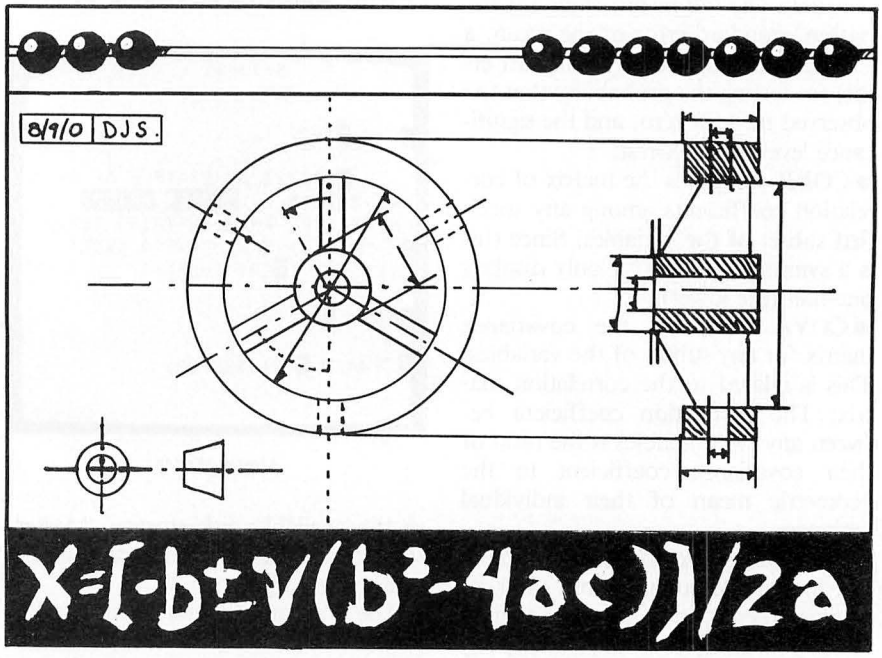
Plot-program options include specifying plot limits, scaling axes to adjust the plotting area, removing or replacing the coordinate axes, saving or reading plots from disk or tape, and printing the plots. For this last option, you must supply a dot-matrix screen-printer program to use with your printer.

The 3D PLOT program lets you plot a function of Y in terms of X and Z. It displays a 45-degree oblique function projection with the familiar cross-hatched grid to help you see the surface. The disk provides two sample plots.

The plot programs have some limitations. I had difficulty getting the scales and limits of the axes just right. But once you set up a plot correctly, you can save it to disk.

Two things would improve the plotting process. First, it would be helpful to have tick marks along the axes, with the values of the points included. This is a must when doing any sort of quantitative work. The program might also label the plot, so you could refer more easily to the function that produced the graph.

The RPL calculator performs elementary calculations, and lets you switch between decimal and hexadecimal number systems. A number-base converter is supplied as a separate pro-



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gram. You can convert numbers between any two bases (from 2–35) and display the result as a combination of digits and letters.

The RPL calculator does addition, subtraction, multiplication, division, and exponentiation. Besides the four stack registers available to most RPL calculators, the program can also store results in any of three memory registers.

You will find a minor flaw in the program when you convert certain decimal numbers to hexadecimal. Due to roundoff error in some calculations, the hexadecimal numbers (only integers allowed) can be off by one. Also, an annoying requirement in the number-conversion program makes you put a space between each digit you enter.

The matrix and vector operations provide a complete range of calculations. You can add, multiply, and invert matrices. Combined with renaming intermediate results, this lets you solve simultaneous linear equations. You can manipulate matrices with up to eight rows and eight columns.

The vector operations include the standard calculations, plus cross product and dot product. You can also calculate normalized vectors and lengths, as well as find the angle between two vectors, and the equation of the plane containing two vectors.

Numerical integration and differentiation are used to solve many engineering problems. Mathmenu uses Simpson's rule for numerical integration. This provides adequate results for many well-behaved functions.

You simply supply the function to be integrated as a Basic function in line 10. Then you can request various approximations to the integral of the function by specifying the limits of integration and the number of steps to be used. A simple two-point formula does numerical differentiation.

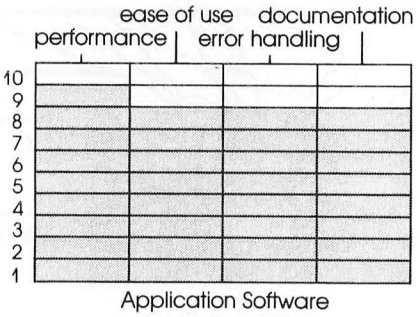
Again, this is adequate for well-behaved functions without any sharply changing regions. However, these formulas cannot accurately evaluate functions near discontinuities or with irregular curvature.

The well-known quadratic formula calculates the roots of quadratic equations. The program finds both real and complex roots. The author should also have included a program to find the zeros of any polynomial. Being limited to quadratic equations leaves many problems unsolved.

Mathmenu also provides a program to fit data to a curve. The possible functions for approximation include linear, quadratic, and cubic equations. It doesn't provide statistics for the curve-fitting process, so the goodness-of-fit is open to question.

At least, the program gives a plot to show the differences between the observed data and the calculated curve.

In general, Mathmenu provides more useful numerical analysis functions than any other program for the Color Computer. A number of extensions to the programs, suggested above, would make the package outstanding. As it is, it does an adequate job of solving fundamental engineering and scientific problems. ■



Color-80 BBS
Logical Computer Products
(East Coast)
P.O. Box 125-5121
Arlington, MA 02174

Silicon Rainbow Products
(West Coast)
1111 W. El Camino Real
Suite 109
Sunnyvale, CA 94087
64K, two disk drives
$150

by C. Warren Andreasen

The Color-80 BBS's manufacturers claim it is "the best bulletin board program ever written for the TRS-80 Color Computer." Since I haven't seen all the rest, I can't argue that point. It is a pretty good system, although it's not without flaw.

The package comes with two disks (for drives 0 and 1), a manual, and a correction sheet. The manual is a nicely bound, 24-page booklet broken into sections for software, technical, and hardware documentation. It also includes a list of the variables used in the Basic portion of the program and their use. This is helpful if you want to modify the program or understand its inner workings.

This BBS was written around the Hayes Smartmodem, but you can use any 300–1,200 baud type. It will match either rate at which callers phone in. This is a nice feature, but I found that my copy sometimes would not lock in at 1,200 baud. An enclosed sheet stated that the bug appeared after a recent update, and the vendor promised to fix it as soon as they found it. I noted no problem at 300 baud.

During my first attempts at operation, I found that I could not receive data from the modem into the program, even though the modem would answer and send out data. Because part of the program is written in machine language, patches are made to the Basic ROM loaded into RAM. But the Color-80 BBS is based on the Extended Color Basic 1.1 ROM, and my computer has the newer 1.2 version, so the program's patches foul the keyboard routine. I ended up borrowing a 1.1 ROM. Program author Jeff Francis told me they were revising the drivers so the critical code would not be ROM dependent, but until then you can't run the Color-80 BBS on the newer ROM.

Before you can put the BBS on the air you must buy or build a special modem cable with the receive-data line and the carrier-detect line reversed, so data from the modem goes into the carrier-detect port and the carrier information goes into the receive-data port. This lets you use interrupts on received data. The received-data line will not generate the interrupt, so without this cable, you could lose characters. Building the cable involves a simple wire swap between two pins—a procedure the manual clearly explains.

You must also build your system disk by making back-ups of the original disk and running a special program that installs your system-operator (sysop) information and passwords. The Color-80 BBS recognizes only one system operator's name and password.

I did find a small problem in building the system disk. The instructions say to begin by formatting two blank disks. At one point you are prompted to insert a blank disk into the drive, but there is already one there, and now it contains the data you've entered up to this point. But don't worry—just continue with the disk you're using.

Running the BBS

The Color-80 BBS contains a wealth of data base, pictures, download programs, and the like. And you can add new files and delete unwanted ones. Users can upload new files, but they won't become part of the base until the sysop reviews and accepts them.

The main menu contains a data base with about 15 different files to start you off (everything from a paper on abortion to a tongue-in-cheek article on building an atomic bomb). You also get a list of bulletin-board numbers nationwide and for the San Francisco Bay area, and an electronic shopping area with advertisements for goods and services.

The BBS has a division for the regular user, containing many menus and functions, and another division for the sysop's administrative area, protected by a reasonably secure system.

The sysop's area includes functions for adding new members to the permanent-user log, changing the bulletin, changing status (i.e., setting the time during which the chat mode is active). An error log informs you of any errors that have occurred since the last boot and warns you of impending problems, like a failing disk drive.

A special command shows you how many applications, hang-ups, downloads, and uploads have occurred since the last BBS boot. Each message has the usual BBS features, including a convenience that sets up the header information (to, from, subject) for any replies the sysop chooses to send.

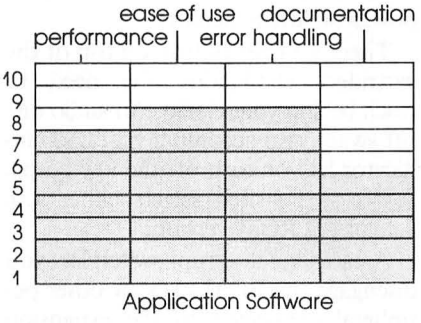
Another nice feature speeds the cycle time during which the program cleans up files and does housekeeping chores after a user logs off. It's ready for the next caller in a matter of seconds.

The Color-80 BBS software contains a clock that keeps track of the date and time, but it suffers from the fact that disk access turns off interrupts. While disk action is in progress, the clock stops, so it might run fast or slow, depending on how much use the BBS gets. The manual explains how to tweak the timing loops to achieve maximum accuracy. It also says the manufacturer is working on a hardware clock to cure this problem; meanwhile you must reset the clock once or twice a day.

I also had a problem with the log utility program, which lets you modify, correct, and review your permanent-user log. The documentation mentions removing a person from the log, but fails to tell you how, and there is no delete command to do so. You could have a user log that grows too large for the allotted disk space, and you can't delete people who no longer check in.

There is also no way to lock out an unwanted user. If you had a caller who left obnoxious messages, you only have the option of deleting the offending message. The person sending, the person to whom the message is sent, or the sysop can delete a message.

The Color-80 BBS is well thought out. Is it a good program? Yes. Is it the best BBS program? Maybe. It can be improved, and probably will be. ■



Speak Up!
Classical Computing Inc.
Box 3318
Chapel Hill, NC 27515
16K
$29.95, cassette

by Richard J. Fisher

David Dubowski's Speak Up! is a software-based speech-synthesis program that produces 37 of the most commonly used English speech phonemes. A little creative spelling can duplicate those phonemes that aren't included with Speak Up!

Phonemes are the smallest units of speech and serve to distinguish one utterance from another. For example, the very slight difference that changes "pin" to "bin" is phonemic.

Speak Up! is a machine-language program that comes on cassette with three copies of a 16K version on one side and three copies of a 32K version on the other. The program requires just over 7K and is accessible interactively or through the PRINT@ statement (Color Basic), and the USR function (Extended Color Basic).

Following Speak Up!'s concise instructions, I soon had my 32K CoCo speaking every phrase I could conjure up. Most were understandable as typed. However, as the documentation suggests, the words were obviously more intelligible if you use phonetic spelling.

For instance, typing "My name is CoCo" produces "Mee namee is CoCo," with a short "a." Using creative spelling, "Mi naim is CoCo" yields the correct pronunciation, and eliminating the spaces between the last three words gives a better phrasing of the sentence.

This illustrates another aspect of this program. Speak Up! uses spaces, commas, and periods to create pauses of different length. Eliminating a space between words can sometimes change the reproduction of the preceding word if it ends in a pronounced vowel sound.

After several hours of experimentation, I discovered several tricks to produce respectable-sounding speech. When you need a hard T sound, as in "hit," using multiple letters (hittt) yields the correct result. To say a long I, as in "like," spell it "li k." This works equally well with most consonants, as in "taxx" (tax) and "noww" (now).

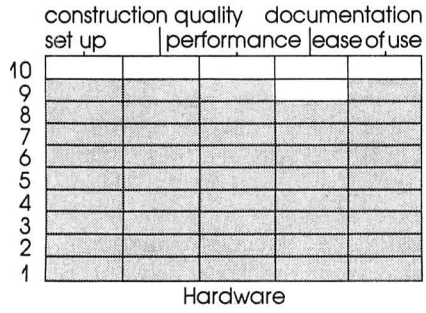
Some words require special spelling techniques. The proper name Juliet is an example. After many trial runs, I decided "Jewlee et" gave the best results.

Although the documentation says you can type "th" to produce the "th" sound, it wasn't phonetically correct. Typing "this thing" yields "zis sing."

Since most of Speak Up!'s phonemes occur in other languages, you can also get your computer to speak them. I coaxed my CoCo to say a few phrases in Spanish and French. In fact, you can get Speak Up! to produce almost any sound you can think of.

Speak Up! produces fairly understandable and phonetically correct speech. You can change the tonal quality by using the POKE command to modify a memory location. The sound output is also routed to the cassette interface to accommodate recording your CoCo's new-found voice.

I found Speak Up! to be entertaining, easy to use, and well worth the minor expense. Ifyouwood li k ai taukingCoCo, thiscood beeyouranser atai reasunuble peri s. ■



Keyboard Beeper Cartridge (Krickit)
Eng Systems Laboratories
8203 Springfield Village Drive
Springfield, VA 22152
$59.95

by Peter Paplaskas
***HOT CoCo* staff**

What's a keyboard beeper cartridge? Just what it sounds like—a peripheral that plugs into the CoCo's ROM port and emits a soft beep each time you press a key.

Think of what a help it would be in word processing or typing in valuable data—especially on the original CoCo keyboards, which often fail to recognize input. With the Keyboard Beeper, also known as the Krickit, you no longer need to constantly watch the monitor to make sure that the computer has accepted each character you've typed.

By POKEing in the proper memory locations, you can also use the Krickit to give an end-of-line alarm, input prompts, and an alarm against improper data entry.

The cartridge requires no hardware or software modifications and is compatible with all ROM versions and keyboard alterations. The unit comes with gold-plated edge fingers and a cable with an expansion port, so you can plug in and use other ROM packs or a disk operating system along with the Krickit.

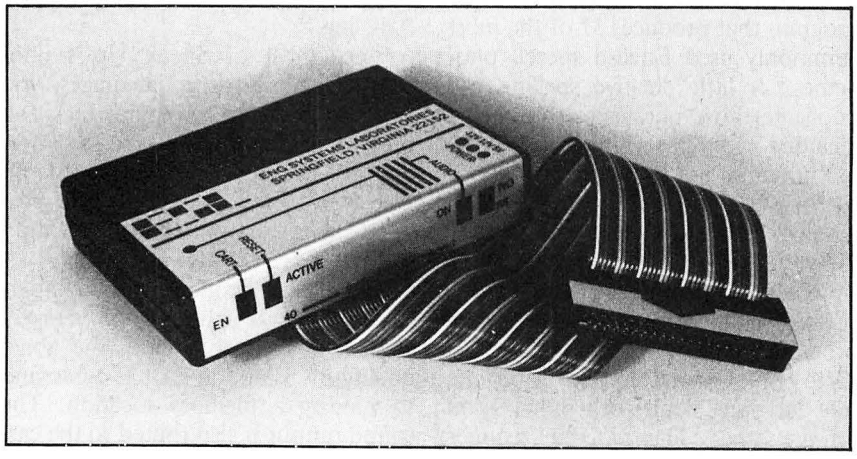
You can also use it with a buffered multipack expansion system, although the manufacturer recommends that you plug the Krickit into the multipack, rather than the other way around.

The Keyboard Beeper Cartridge has three LEDs that monitor the Color Computer's +5-volt, −12-volt, and +12-volt power lines and serve as a power on/off indicator.

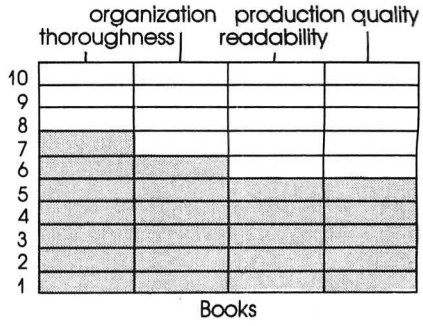
There's a reset button on top of the cartridge, eliminating the need to reach behind your CoCo. An audio on/off switch and accompanying LED indicator let you turn off the key beeps. A recessed switch selects either 1.0, 1.1, or 1.2 ROM version.

A cartridge-interrupt switch lets you disengage the ROM pack or other peripheral connected to the expansion cable and reset to Basic without disconnecting the ROM pack. Therefore, you can easily make back-ups of ROM-pack programs.

Eng Systems offers a 30-day, money-back guarantee if the Krickit doesn't live up to your expectations. It lived up to mine, and has proved a handy addition to my Color Computer. ■



The Keyboard Beeper Cartridge (Krickit)



25 Graphics Programs in Microsoft Basic
Timothy J. O'Malley
TAB Books
Box 40
Blue Ridge Summit, PA 17214
$17.95, hardcover
$10.95, softcover
150 pp.

by Delmar E. Searls

Only a few books on the market deal with computer graphics and their application to mathematics, science, and business. Consequently, the appearance of *25 Graphics Programs in Microsoft Basic* sparked my interest.

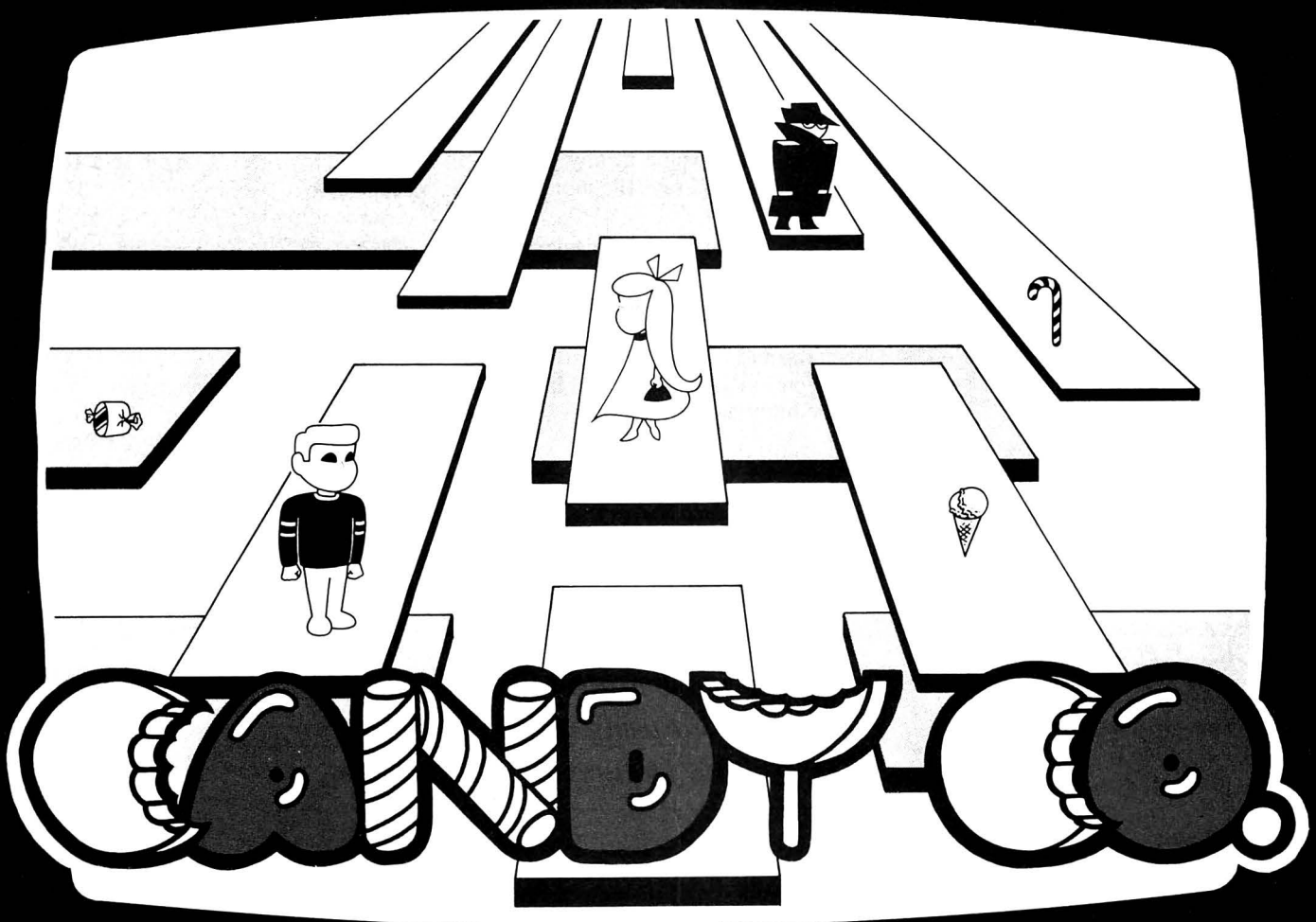
The title, a colorful cover, and a very promising table of contents suggest a worthwhile book. Unfortunately, it isn't.

The programs in the book fall into two main categories: low-resolution screen graphics and high-resolution printer graphics. Although the book states that its programs were written for a Z80 machine, the author doesn't say exactly which machine that is. Many of the programs use memory POKEs and machine-language subroutines, making them practically worthless for anyone not owning the same machine as the author's.

Furthermore, the high-resolution line-printer graphics were written not only for a specific computer but for a specific, and again unnamed, printer. These programs contain a machine-language subroutine that drives one of the pins in the printer's dot matrix head. None of them use video graphics, and even if you could convert them, they would be slow and inefficient.

All of this might be forgivable if Mr. O'Malley had explained the theory behind what he was doing—but he didn't. His explanation consists of line-by-line descriptions of each program. It is difficult to follow and

Setting The Standards



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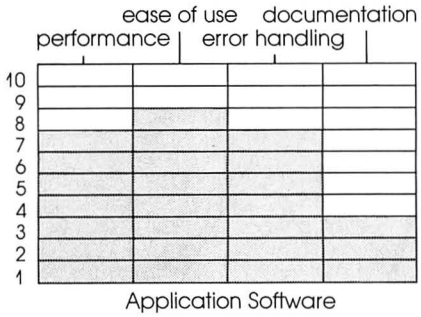
not very enlightening.

It would take quite a bit of effort to learn anything from this book. The author tells you not to worry about understanding the machine-language subroutines, because the book is about Basic—a point I found particularly irksome.

I cannot recommend this book to anyone not owning the same computer and printer as the author, and you won't know if you have them until you buy the book. The programs are machine-specific, and the explanations aren't very clear. ■



DSKMON
Chroma-Systems Group
P.O. Box 366
Dayton, OH 45420
16K
$24.95, disk

by Robert P. Bussell

DSKMON is a machine-language disk utility that offers you an easy method of accessing all data stored on disk and a convenient method of modifying the data and returning it to the disk. You can relocate the utility to any convenient area of memory.

DSKMON includes a series of text files that contain a completely documented source-file listing of all the routines used in this program. This should help a new Assembly-language programmer learn to program functions for the disk.

You access all functions of DSKMON from a main menu. The Read Sector option lets you read any sector on a disk to a buffer area in memory. The Write Sector option writes the contents of the buffer area to the sector you specify.

Once you have read a sector into the buffer area, you can use the Dump Buffer option to review the buffer's contents. You'll get a buffer display in both hexadecimal and ASCII. The up and down arrows let you scroll through the entire 256-byte buffer.

The Modify Buffer option lets you change disk data. It also displays the buffer contents and a pointer window to the current byte in the buffer that you can change. You can enter a new hexadecimal value at any position in the buffer and save the modified buffer to disk.

The Information Display option lets you enter the file name on the disk and receive a display of pertinent data concerning the file, including the name and type of file; start, end, and execution addresses of binary files; the number of disk-storage bytes used in data files; and the granule numbers the file used.

"DSKMON comes with a three-page explanation of the options, but novices could benefit from more information about using the utility's features..."

Use the Granule Conversion option to convert Radio Shack's granule numbers to DSKMON's track and sector information.

The Selective Backup option offers a convenient means to copy programs from one disk to another. It displays a transfer prompt with the name of each file on the source disk. Obviously, you need two disk drives to use this utility.

I accidentally deleted this review during preparation, but I didn't have to type the file over. I loaded DSKMON; read track 17, sector 3 (the beginning of the disk directory) into the buffer; and dumped the buffer to the display.

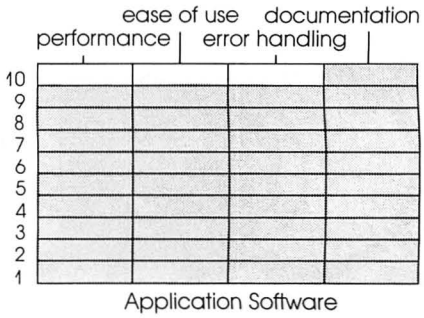
While scrolling through the display, I noticed that the deleted file was still in the directory, but the first character of the name was set to zero. I then used the Modify Buffer option and scrolled to the byte set to zero. I entered the hexadecimal code for the first character of the name and used Write Sector to store the buffer on the disk at track 17, sector 3.

I exited the program and typed DIR. My text file was on the disk after a loss of about two minutes.

DSKMON ran flawlessly with one exception. The program would not let me access track zero. I don't know if this is a program bug or if it is intentional. However, I wanted to access all tracks, so I typed in POKE 13874,43 after loading DSKMON. This changes the test for the track-number entry to let you enter a zero. You can type in SAVEM "DSKMON", &H3000, &H4C00, &H3000 to save this change.

DSKMON comes with a three-page explanation of the options, but novices could benefit from more information about using the utility's features to understand disk operations.

The program is well written and usable. It is an important part of my utility library. ■



Screen Machine
$29.95, cassette
$32.95, disk
Super Screen Machine
$44.95, cassette
$47.95, disk
Rainbow Connection Software
3514 6th Place NW
Rochester, MN 55901
16K, Extended Color Basic

by Steve Brown

Picture, if you will, an elegant countess, swathed in furs and jewels, descending a grand staircase in a timeless European castle. The sparkling candles in the crystal chandelier paint the scene with romance, but as she majestically rounds the last turn of the stairs, you notice galoshes on her feet.

It is in the same, although perhaps less poetic, way that I view the CoCo: powerful, efficient, state-of-the-art, able to stand on its own against most

↙ See List of Advertisers on page 131

micros, but wearing "galoshes," represented by the amateurish 32-by-16 text display and the programmer's inability to combine graphics and text on a single screen.

Happily for the countess, though, a handsome prince bearing a pair of dainty slippers has arrived on his charger. Rainbow Connection Software's Screen Machine and Super Screen Machine make the CoCo screen display equal to its other good qualities.

The Screen Machine and Super Screen Machine are comprehensive software systems that produce high-resolution graphics text displays in selectable densities while offering you many sophisticated commands to enhance the screen environment.

Both programs offer complete screen control, while Super Screen Machine offers extended utility with additional controls and a unique system to use Super Screen Machine's features for machine-language programming with Radio Shack's EDTASM+.

Both packages include three programs plus the screen generator itself.

A machine-language preloader automatically loads the Screen Machine into the upper memory of 16K, 32K, or 64K. The 64K option also transfers all ROM—including ROM packs—into RAM, and it stays that way even after reset.

You'll first notice that the Screen Machine has replaced the familiar text screen with an expanded green screen and up to 64 black characters. The program commands give you total control over the screen environment but do not interfere with any of Extended Color Basic's command set. But the Screen Machine is much more than a program to draw text letters on the graphics screen.

System Features

The Screen Machine offers four standard and four double-width character sets in PMODE 4 and 12 densities from 64 characters by 24 lines to 16 characters by 8 lines. The program is functional on all graphics pages and in all PMODEs, with Basic and artifacted colors for all characters.

You have two-character commands to use program functions either from the immediate command mode or from commands imbedded in Basic programs. You can call up a help screen at any time to refer to available commands.

The Screen Machine lets you use subscript and superscript, automatic underlining, and double-width characters and provides scroll-protection for the top and bottom of the screen.

You also get a full ASCII 224-character set, including true lowercase letters with descenders, an improved cursor, slashed zero, and Greek math symbols, plus characters representing lunar landers, stick figures, tanks, planes, electronic symbols, and so on, for animated games or displays.

The Super Screen Machine adds features such as a variable scroll rate, a variable key click, a break-key disable, 10 definable commands, a patch to use the program's features with Radio Shack's EDTASM+ cartridge, and a dynamic graphics screen dump.

Both programs also include a character-generator program that lets you create your own full character set of either letters or symbols, pixel by pixel, to use in your own programs. If you need a special character set—say Russian Cyrillic letters—you can build them for later use. It took me about an hour to make a new character set. You also get a demonstration program to help you explore the various aspects of the Screen Machines.

Screen Machine Commands

The Screen Machine has an alternate color set command that takes control from Basic's COLOR com-

Screen Machine review continued—p. 35

High Scores

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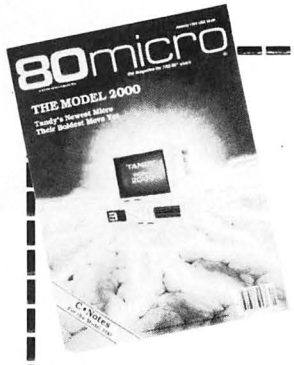

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Screen Machine review continued from—p. 32

mand and lets you use two color sets on the same screen. Basic controls one, and Screen Machine controls the other.

You can also get the so-called "artifacted colors" that Basic doesn't generate. The Screen Machine turns on every other pixel in PMODE4 to create these alternate colors. You can paint in PMODE4 by POKEing location 178 with a one or two and omitting the foreground color in PAINT commands.

You can type the Screen Machine commands right on the screen and enter more than one command at a time—up to 31 characters, separated by commas or spaces. You can change and execute the commands while a Basic program is running, and imbed them in your own Basic programs.

Screen Machine contains its own error messages that identify Screen Machine command errors without crashing the program. This error-trapping ensures that you don't lose your Basic program due to a Screen Machine command error. The messages point to syntax, length, range, switch, or missing command errors.

You can interface Screen Machine and Super Screen Machine to specific commands in Extended Color Basic: specifically, the CLS#, all PMODEs, SCREEN, COLOR, PRINT TAB, and PRINT@ commands. The program interface accommodates comma field width and lowercase letters. For instance, Screen Machine automatically accommodates PRINT TAB commands to the character density you choose.

Documentation

Documentation is, in a word, excellent. The attractive, 20-page book is detailed and easy to understand. Clear instructions show how to use the programs, how to interface the program with Basic, and how the advanced programmer can create his own routines and new uses for the Screen Machine system.

Rainbow Connection Software's documentation could become the definitive example for all software documentation.

Summary

Screen Machine and Super Screen Machine are well worth the price. The systems have no faults worth mentioning and flexibility too great to detail. I am excited about the vistas these programs open up on the CoCo's screen. Screen Machine is a real bargin; but in my opinion, Super Screen Machine is your best buy, even if you never use it with EDTASM+. Throw away those flopping galoshes and put your CoCo in silver slippers. ■

Sample Super Screen Machine and Screen Machine Monitor Displays

Gameware

This month's games offer some of the best arcade action your CoCo has ever known.

Programmer's Guild

I first looked askance at **Ninja Warrior** (The Programmer's Guild, P.O. Box 66, Peterborough, NH 03458, $29.95, 16K cassette) as a program that just took too much liberty with the Ninja legend. It seemed like a silly rehash of the Moon Hopper idea, with the moon buggy replaced by a neophyte martial artist who must jump and kick his way through the hazards along a mountain road as he tries for the title of Ninja Grandmaster.

Well, I'll never believe that the mountains of feudal Japan ever saw such goings on, but a few rounds of play showed me that this game was a true challenge to my reflexes and judgement.

Your Ninja begins as a white belt and works his way up through 16 levels. The first two or three levels are rather easy—even boring—but when you get near the black-belt stage, things really get interesting.

The hazards as you progress are more numerous and varied and come more quickly. Not only must you have uncanny reflexes to meet each new threat, but the way you meet it will determine the choices you have against the next one. You might find yourself jumping over flames, kicking a sword-wielding attacker, and somehow trying to fend off a speeding arrow, all at the same time.

Ninja Warrior presents a real challenge to your physical and mental reactions, and deserves a high score among CoCo games.

Aardvark Action Software

Bag It Man (Aardvark Action Software, 2352 S. Commerce, Walled Lake, MI 48088, $24.95, 32K cassette/$29.95, 32K disk) is a fine example of the CoCo's arcade-graphics capabilities, and it's a great game. This one doesn't demand too much of your reflexes (except when you try to hop on the moving mine cars), but it will certainly tax your planning skills.

You control a somewhat misguided individual who tries to steal sacks of gold from a mine. Two guards chase the thief around, but he can enjoy dropping the sacks on their heads, tricking them into falling down a mine shaft, or whacking them with a pickaxe.

But try as he might to do them in, these resilient and purposeful watchdogs are down (with cute little stars orbiting their poor bashed-in heads) for only a few seconds. Then they're up again in hot pursuit for one of the most amusing predicaments your CoCo will ever get you into.

Computer Shack

Cashman (Computer Shack, 1691 Eason, Pontiac, MI 48054, $27.95, 32K cassette/$29.95, 32K disk) is almost an aerial version of Bag It Man, and another example of excellent CoCo graphics.

This game offers joystick control of the Sheik or the Sailor—or both in the two-player mode—who must climb and jump up and across girders, ladders, conveyor belts, and chains to grab stores of cash located around the screen.

Although it would be difficult to find better graphics, I don't find Cashman much of a challenge in the single-player mode. Not that it's easy, it just lacks the motivational factor to keep me playing. Falling, or touching one of the bizarre "kats" that roam the screen, causes no immediate damage—it just costs you a power point. But when you run out of these points, your game is over.

With the added incentive of competing against a second player, however, the game becomes much more interesting. And Cashman is a true two-player game, because both players are on the screen at the same time.

Cashman

Chopper Strike

Chopper Strike ($27.95, cassette/$29.95, disk—both tape and disk contain 16K and 32K versions) is another Computer Shack program. In it you maneuver a helicopter through enemy territory, destroy as many of their defenses as possible, and rescue your own men who happen to be standing around down there.

The graphics in this one are not nearly as detailed as those in Cashman, but I find the game much more engaging, especially for those who excel in using the joystick. Chopper Strike gives you very accurate control, and you need it—especially when you must slip past heat-seeking missiles or navigate through narrow, protected tunnels.

If you appreciate precise movement, dodging, and planning as you wend your way through more difficult obstacles, take a look at Chopper Strike.

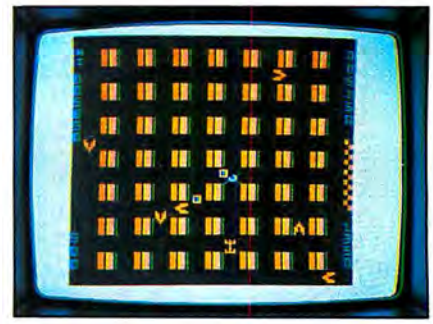
Spectral Associates

Storm Arrows (Spectral Associates, 3418 S. 90th St., Tacoma, WA 98409, $24.95, 16K cassette/$28.95, 16K disk—Color Basic) is the odd man out in this month's Gameware selection. Its graphics and concept are much simpler than any of the others, but it's by no means an easy game.

The screen displays a grid representing the streets of an extraterrestrial city. V-shaped Storm Arrows and an Imperial Pursuit Cruiser patrol these streets, and you must fight them off with an I-shaped representation of a land skimmer.

At first, Storm Arrows appears less interesting than any of the other four games, but then so would a chess board when compared to the one from "Candyland." But to keep your land skimmer on the streets very long requires lightning reflexes.

Storm Arrows uses simple elements to provide good arcade action, especially for those with Color Basic machines. Unfortunately, the joystick control is a hindrance here. It's difficult to position the stick correctly to make all the necessary quick turns. An arrow-key-control option in this game would be an important improvement.—*M.E.R.* ■



Storm Arrows

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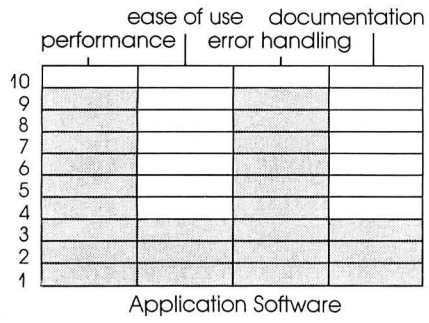
BY GUIER S. WRIGHT
HOT CoCo STAFF

OS-9—POWER FOR THE FEW



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OS-9 is the powerful tool the Shack claimed. But not everyone needs or can use this new CoCo DOS.

Microware and Motorola modeled OS-9 upon Bell Telephone Laboratories' Unix system for mini- and microcomputers. The technical manual says that those familiar with Unix-based systems should "feel quite comfortable" with OS-9. However, those familiar only with Radio Shack's RSDOS or FLEX might be in for a long and possibly frustrating experience.

OS-9 is more than just a method of getting information to and from a disk drive. It is a complete operating environment in which the system itself controls all input/output, memory management, command interpretation, and even the computer. It is almost as if OS-9 were a software computer without a CPU, ROM, or RAM. It uses the Color Computer's hardware, ROM, and RAM to do the manual labor the way that a CPU might use a character-generator chip.

This concept might be a little hard to visualize, but it means that OS-9 can work with almost any hardware configuration if you properly tailor it, and that is one of OS-9's main advantages. You can modify it to work with any number of systems, languages, computers, or peripherals. For the Color Computer owner, this means flexibility, software interchangeability, and access to numerous languages not normally available under RSDOS.

First Things First: The Manuals

When you first open the OS-9 package, it seems that OS-9 consists entirely of instruction manuals. The box contains a software-registration card, a six-month subscription card for Radio Shack's *TRS-80 Microcomputer News* magazine, a 31-page *Getting Started with OS-9* instruction manual, a 172-page *OS-9 Program Development* manual, a 139-page *OS-9 Commands* manual, a 178-page *OS-9 Technical Information* manual, and OS-9 boot and System Master disks.

It might seem that 520 pages of instruction would be more than enough information about the new operating system. Maybe, maybe not.

The first manual, *Getting Started with OS-9*, begins at a good pace. It is well written, clear, and sometimes overly simplified, but not condescending. There are no cartoons or childlike explanations, which is refreshing.

Perhaps Tandy has decided that all Color Computer owners are not 9 years old, and that quite a few of us are more serious about programming. And OS-9 is an operating system for the serious programmer.

Unfortunately, *Getting Started with OS-9*, and the registration and subscription cards are the only things clearly written. A few cartoons would improve the program development, commands, and technical manuals. I'd rather see things the old way and be treated like a child than to be forced to interpret what the manuals are trying to say.

They bounce around between self adoration (it seems as though at the beginning of each section you must be told what a wonderful and powerful system OS-9 is), references to other sections of the manuals (there doesn't seem to be any order in which to read the three main manuals, and each of them refers to the other manuals as if you have—or sometimes haven't—already read

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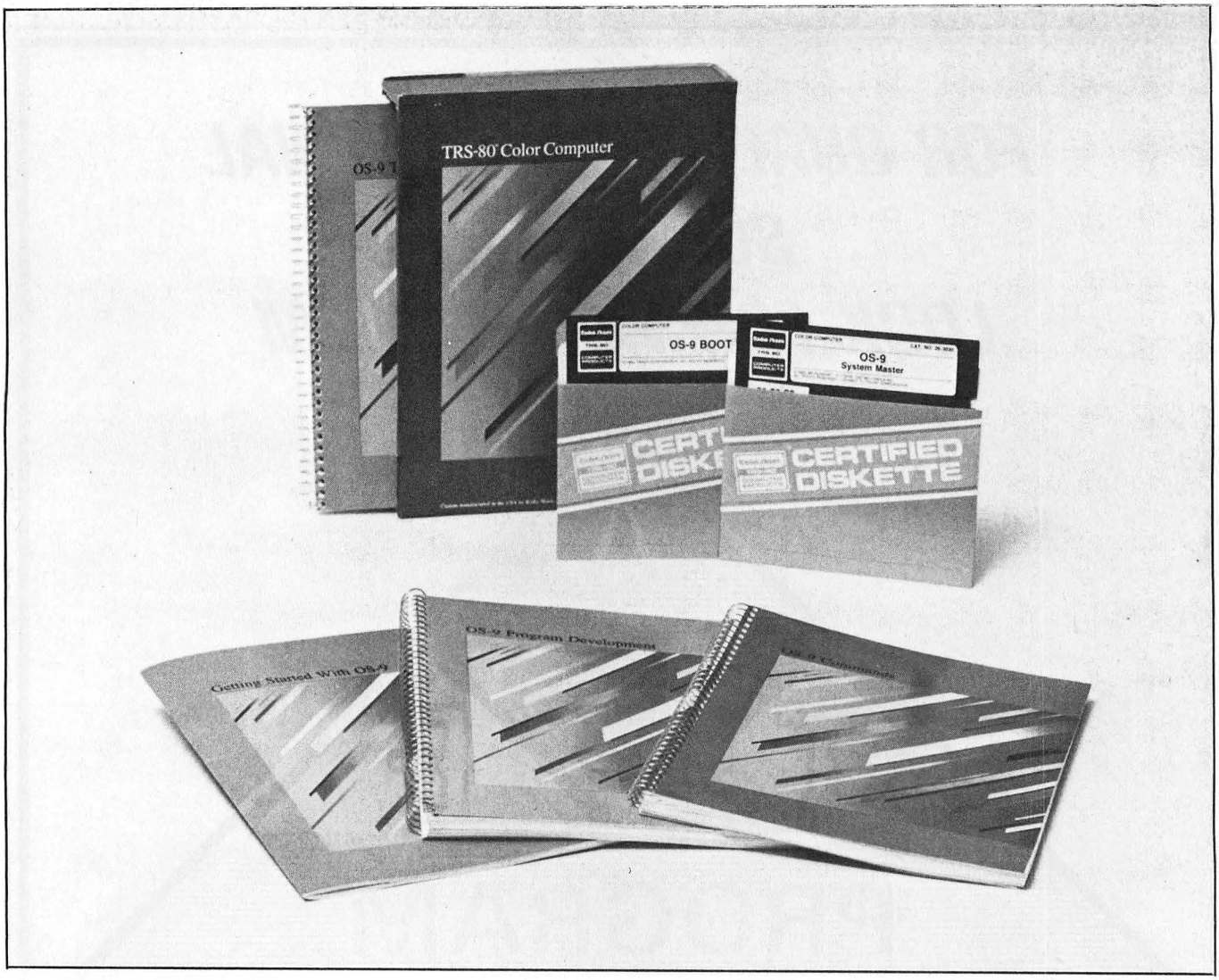

Photo—Frank Cordelle

them), and explanations so filled with technicalese that I doubted whether even the writer of the manual knew what he was talking about.

The author assumes far too much of the reader. To even begin to understand some of the concepts, you must read all three manuals at once and then reread them again and again as you try to piece together various ideas and definitions.

The OS-9 manuals are a serious problem. They are close to being incomprehensible. Granted, OS-9 is a very different and complicated system that is difficult to explain, but I'm sure the manuals will confuse many people.

However, they are not without bright spots. For example, the definition of Sleep (a command that suspends operation of a program for a set amount of time) offers the following passage (punctuation is just as it appears in the manual):

> The, List command starts running as a child process invoked from shell, and is run as background task. The Sleep command then puts shell to sleep indefinitely. When List eventually encounters the file nothing, which doesn't exist, it terminates, and sends a signal (the error status), which wakes up shell.
>
> It's important to note, that if the error hadn't occurred, shell would have slept forever. (The keyboard is not read while the shell sleeps.) The only way out, would be to re-boot.

The section on creation of new processes offers this:

> If a parent process creates more than one child process, the children are called "siblings" with respect to each other. If the parent/child relationship of all processes in the system is examined, a hierarchical lineage becomes evident.

Granted, these passages are taken out of context, but you get the feeling that most of the manuals were written out of context. I kept feeling as though I should have read a 300-page explanation of OS-9 before starting any of the three manuals.

However, there is a lot of information in this documentation, if you can decipher it, and even a minimal understanding will reveal OS-9 as a very powerful tool.

But What Can It Do?

OS-9 is an outstanding file manager with the ability to create directories, subdirectories, and sub-subdirectories, each with its own files (files that can contain any sort of information including text, data, or programs). The many ways in which you can access these files as program modules or macros show OS-9's potential for organized program development.

You can access each file either from the immediate mode or from other running programs for input or output. You can use them in combination with other programs, either sequentially or concurrently using another OS-9 feature: multitasking.

Multitasking gives priority to certain tasks. For example, a program that requires only occasional processing, such as one that spends much time waiting for you to enter data, gets a lower priority than one that can run without waiting for a keyboard response, such as printing something already in memory. The higher-priority program

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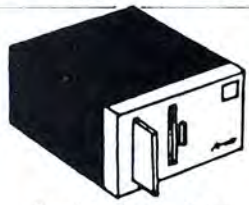

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gets more CPU time.

OS-9 can run any number of tasks concurrently, but the law of diminishing returns says that sooner or later you'll overtax the 6809's capabilities and slow execution. Multitasking also means multiuser, so more than one terminal can access the Color Computer, although I suspect that even two will occasionally demand more than the computer can handle, depending on what you are doing.

OS-9 also comes with an assembler and debugger for developing machine-language programs. You can use the assembler to generate OS-9-based programs, or you can switch to standard 6809 to write programs for systems without OS-9.

With the debugger and the ability to create macros for program development, OS-9 is an Assembly-language programmer's dream. If you choose to write machine-language programs that will run under OS-9, there are some tricky but powerful new commands and techniques to master.

Since OS-9 manages all I/O, selects load addresses based on memory available at run time, and uses the interrupts extensively, there are a number of things to keep in mind when writing Assembly-language programs. Among other things, you must make all I/O operations through system calls (a blessing or a curse?), and all code must be position-independent (meaning a lot of PC-relative addressing). You must use interrupts carefully, and you cannot use extended addressing.

If the last paragraph was gibberish to you, think carefully before rushing out to buy OS-9 as a way to learn Assembly-language programming. On the other hand, if you started ticking off ways to modify that program you wrote last week so that it will use only indexed and direct-page addressing and leave the FIRQ and IRQ masks alone, then OS-9 is probably the right system for you.

The debugger is useful and even adds a few features like a calculator mode that displays hexadecimal-decimal-binary conversions and a method of PEEKing memory using indirect addressing.

Of course, there are a few commands that are specific to OS-9. For example, L finds the beginning address of a program. (Since the beginning address of a program changes depending upon the location at which OS-9 loads the program, the debugger uses an image of the program and its register values.)

OS-9 also has a text editor that you can use to change files, programs, and so on. It is by no means a word-processing-type text editor (although you could use it as one if you absolutely had to). The commands and techniques for it are complicated and difficult to use. Many of the functions seem useful, but just as many seem useless.

I wasn't impressed with the text editor. It is serviceable and will make developing programs a little easier, but until you know it well, expect to be searching the manual over and over again.

To Buy, or Not to Buy?

So, should you rush out to buy OS-9? It depends upon what you plan to do with it. OS-9 is only a framework on which you can build, but not everyone is a master carpenter. OS-9 is a handful of powertools (not including Basic) with all the instruction manuals written in Swahili. You get no blueprints or diagrams or charts to help you construct your mansions.

If you are a competent Assembly-language programmer, then OS-9 is probably the best development tool you can buy for your Color Computer. You could consider it an assembler/debugger package that lets you do things other assemblers won't. There will be frustrations with the manuals and some of the procedures required in writing programs, but the advantages should outweigh these problems.

OS-9 is a sophisticated operating system that definitely expands the Color Computer's potential. You can use Pascal, C, and other high- and mid-level languages with OS-9, and it is perhaps the most economical way for Color Computer owners to gain access to new programming languages.

For a student majoring in computer science, this system is ideal for home study. For the engineer, scientist, or programmer, OS-9 provides the elements needed to work on program development at a reasonable cost. For the software developer, there is still a question about how many people will purchase OS-9. For the dedicated hacker who just can't get enough hard-core Color Computer beeping, OS-9 will provide a monumental challenge.

But for the Basic programmer, part-time player, or prepackaged software user, I don't think that OS-9 is worth the money. I have not seen Basic-09 yet, and it could turn out that with both OS-9 and Basic-09 more people can use the power and flexibility of this system, but $170 seems like a lot of money to spend if you are just going to play around. ■

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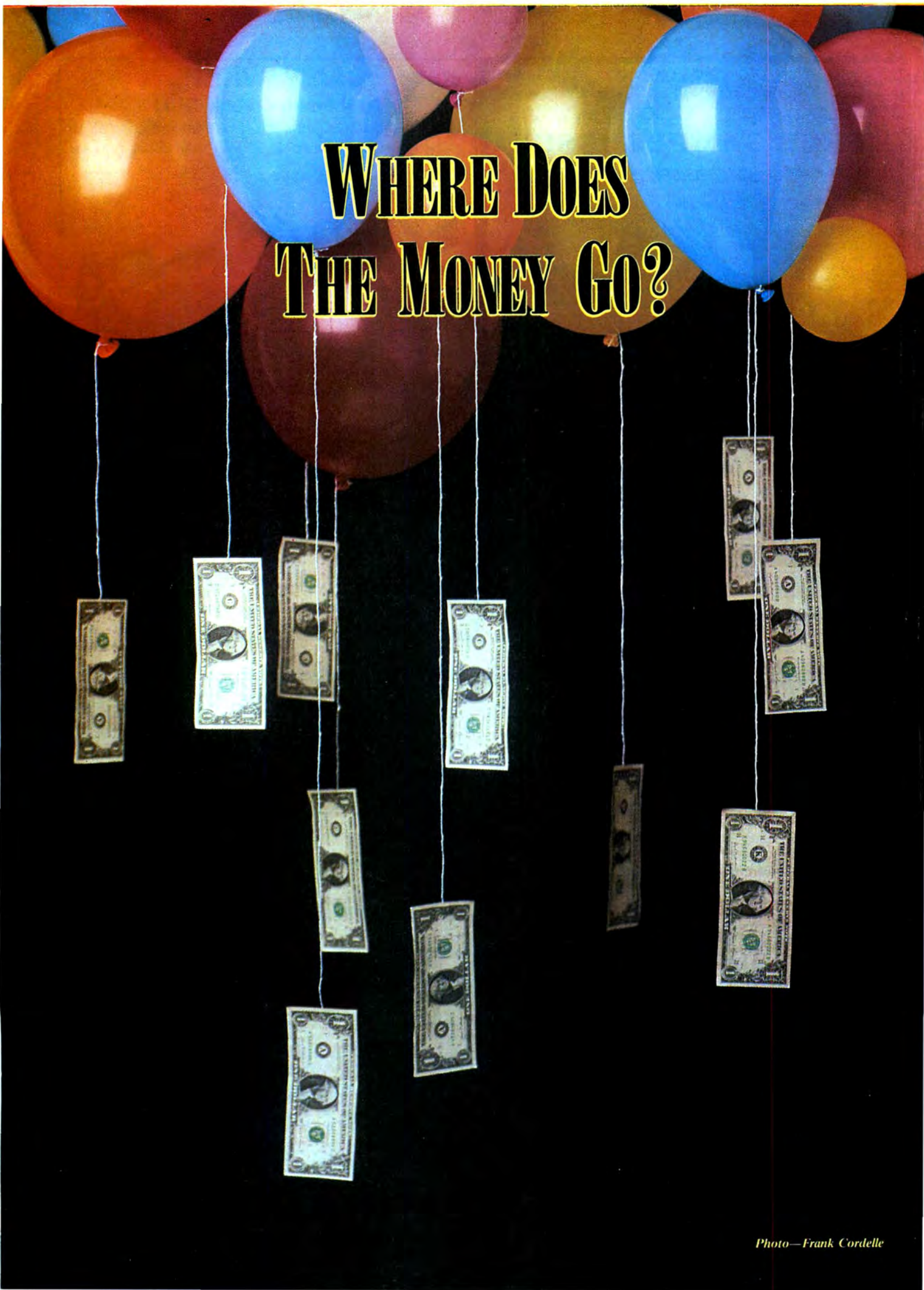

WHERE DOES THE MONEY GO?

Photo—Frank Cordelle

BY JAMES J. BARBARELLO

Gain control over where those dollars go with this home/office financial management program.

Here's a challenging idea. Take a sophisticated Model II data-management program and implement it on the CoCo. Remember, the Model II has over 30K available in Basic, about 400K storage on a single disk, and a number of advanced commands. Do it all on a minimal system; a 16K Extended Color Basic CoCo with only cassette storage.

I converted my Model II Financial Transaction Recorder program (FTR) for use on the CoCo. FTR (Program Listing 1) records any type of financial transactions. It allows you to define 10 separate transaction categories and assign each transaction to one category. It also allows you to obtain detailed reports on your transactions. FTR can be used as a checking-account tracker, a household budget manager, and a small-business bookkeeping system, among other things.

Each entry in FTR is called a record. A group of records is called a file. A single file can contain as few as one or as many as 100 records. FTR uses a companion program, Tally, to produce detailed reports. For any given report, Tally (Program Listing 2) can process an unlimited number of files.

A record is made up of five different types of information or fields. The five fields are payee (21 characters), date (eight characters), amount (11 characters), category (one character), and check number (10 characters). Each field is a string literal; that is, the field accepts whatever characters you enter, even if they don't make any sense. The value of the amount field is used in the reports, as is the value of the category field (to determine the assigned transaction category).

FTR is menu driven. When you begin, you are asked if you want to start any new file with record 1. You can answer N (no) and identify any starting record number. For example, suppose you use FTR as a checking-account tracker. You enter the maximum 100 records and your first file is full. You then start a new file with record 101. This lets you create an unlimited-length data base. After entering the starting record number, you are presented with a menu containing five tasks.

Task 4 is "read a file from tape." Assume you have an existing file containing records 101–114. Regardless of how you answered the starting record question, when you read this file using task 4, it tells FTR that your file begins with record 101 and has 14 records. Task 4 also reads in the 10 category definitions (0–9) that were previously saved with the file. When the file has been read in, you are returned to the menu.

If you now select task 2, modify data, you can change any of the 14 records you just read in. Selecting task 1, add data, lets you add records to the current file (the next record added is automatically assigned the number 115). You might also wish to change categories. Selecting task 3, define categories, provides you with that capability. When you are done with all additions and modifications, select task 5, end.

Task 5 allows you to store the new or modified file to tape. But tape systems can be much less reliable than a disk. After you finish recording the file, FTR advises you to rewind the tape to verify. FTR then reads back the file and compares it to what should have been recorded. If there is any difference, you are informed that a read error has occurred. FTR then returns you to the menu so you can rerecord the file.

FTR is an in-memory system in that all the information being processed is placed in the memory at the same time. Most data systems use a random-access method where only the record being processed need be in the memory. In-memory systems are faster than random-access systems, but they require more memory.

A simple calculation for FTR shows that you need 5,100 bytes alone to hold the 100 possible records. Because of this, you must be innovative in creating your program and having everything fit in a 16K CoCo. You need to go through Listing 1 for FTR and Listing 2 for Tally to see how they work. An understanding of the programs also allows you to use them more effectively.

System Requirements

16K RAM
Extended Color Basic
Printer (optional)

FTR

In Listing 1, line 10 (PCLEAR) allows you to use memory normally reserved for graphics. In addition, 8,000 bytes are reserved for string storage. Line 20 initializes the A$ array that holds your records, and the C$ array that holds the category definitions. The first C$(0) is defined as general.

Line 30 defines the L (length and location) array. Elements 1–5 indicate the length of each field, while elements 6–10 indicate its starting position in the A$ record. For instance, the date (field 2) for a record (A$(i)) is eight characters long (L(2) = 8) and starts at position 22 (L(7) = 22, where 7 is 2 + 5). Knowing this, you can extract the date from record 4 by citing MID$(A$(4),L(2),L(7)).

Line 40 checks for an initial run of the program (T = 0) and branches to a subroutine at line 1000. This subroutine allows you to define the start record number for a new file. Line 50 prints the menu and line 60 obtains your choice by way of the subroutine at line 1050. The 1050 subroutine is used extensively throughout the program. It simulates the Model II function INPUT$(1) that retrieves a single keystroke. This subroutine also creates a cursor (blinking question mark) to let you know it is requesting a response.

Line 70 initializes A$(0), used as temporary storage when adding or modifying a record. Instead of modifying the record's array element directly, it is

temporarily placed in A$(0) and worked on. Then, if you wish to cancel modifications, the actual record remains intact. Line 70 also routes execution to the subroutines you selected and, upon return, sends you back to the menu at line 40.

Subroutines 1–5 begin at lines 100–500. Task 1 begins at line 100, which prints the task title and sets M (modify record) to LR (last record) plus one. If 100 records have been identified (LR – SR + 1 = 100), line 105 prints an "alert" message and returns you to the menu where you can select task 5 to save the file. Otherwise line 110 passes execution to the data-modification subroutine at line 1100. Since the A$ array was previously initialized to all periods, all records exist (although LR points to the last valid record). Adding a record is merely an act of modifying the null record and adjusting LR to indicate it is now valid.

The subroutine starting at line 1100 begins by creating the screen as shown in Fig. 1. Line 1110 calls the INPUT$(1) subroutine (line 1050) that causes a blinking cursor to appear directly to the left of the first field. Line 1120 checks for an up arrow (ASC(94)) or a down arrow (ASC(10)) and moves the cursor up or down within preset limits. If neither is sensed, line 1130 checks to see if shift and clear were pressed (ASC(92)). If so, execution returns to line 110.

If all of these tests fail, it indicates that data is to be entered. Therefore line 1140 retrieves a string of characters from the keyboard. If you press the enter key only (LEN(A$) = 0), line 1140 causes execution to return to line 110, which sends you right back to line 1100. In this manner, if you inadvertently select a field for change, simply press enter, and the field is left unaffected.

When a valid input is received, line 1040 determines the field number (1–5) from the cursor's current position (X). Line 1150 then places this input into the proper position of A$(0) by way of the MID$ function. If the input is shorter than the field length, the field is padded with periods. Then execution returns to line 110, which again goes to line 1100. This process continues until the shift and clear keys are pressed. Since A then equals 92, execution continues with line 120. The current cursor position (X) is stored in a temporary variable (P, for position). Then execution passes to the Save Prompt subroutine at line 1200.

Here you are given three choices. By pressing the key shown in reverse video, you can elect to either save the new/modified data, restore the unmodified record, or continue where you left off before you pressed shift and clear. Line 1220 causes the question to be asked until one of the three options is chosen. Line 1230 blanks out the previous prompt. If you wish to restore, line 1240 retrieves the valid record, places it back into A$(0) and then passes execution through line 1280 to subroutine 1300. Here you make your choice to either continue, or return to the menu.

If you elect to continue (A$<>"S" in line 1250), X is retrieved, A$ is set to a null string, and you are returned to line 120. Here the test for a null A$ (A$ = "") is found valid, so you are returned to line 110. The last choice (save) is processed beginning in line 1260. Here T (task) is checked. If this is a record addition (task 1, or T = 1), then the LR pointer and M are incremented. Line 1270 stores the new/modified data in the proper array element, lets you know the record has been saved, and then asks you whether you want to continue or return (via the 1300 subroutine).

"Having all your financial transactions on file is of little use unless you can get detailed reports. This is where Tally comes in."

Task 2 begins at line 200 where the task title is displayed. Line 210 allows you to select a valid record number for modification. If you input an invalid record number, line 220 informs you so. Then you are allowed to continue (try again) or return via the subroutine at line 1300. When a valid record number has been input, line 230 transfers the record contents into A$(0), and then goes to the Add/Modify subroutine at line 1100. The subroutine works identically, except that when modifying, the LR pointer is not incremented.

Task 3 begins at line 300, where the categories (C$ array) are passed to a temporary holding area (CT$ array). Lines 310–330 display the present category definitions. Line 340 calls the continue or return subroutine and, if you elect to continue, gets your selection for the category to change.

Line 350 retrieves your new definition and stores it in the C$ array. If you press enter, however, the current definition is left unchanged. Line 360 asks if the definitions are okay. If not, the original ones (in the CT$ array) are restored in line 370. When you indicate Y (yes) to the "Categories O.K." prompt, you are returned to the menu with the revised categories in the C$ array.

Task 4 begins at line 400. In line 410, the tape-file subroutine at line 1400 is called after S$ is equated to READ. This routine is used for both saving and reading a file, so the variable action is stated by S$. The subroutine prints appropriate information and then waits for you to press the enter key. When you do, execution returns to line 410 where "Searching..." is printed. (The three extra PRINT statements clear the previous prompts.)

Line 420 opens communications for input and retrieves SR (start record) and LR (last, or ending record). These are displayed in line 430 and used in the FOR...NEXT loop in line 440 to read all data on file. Line 440 also retrieves the 10 category definitions into the C$ array. Line 450 closes communications and informs you the read action has been completed. After you press any key, line 450 returns you to the menu.

Task 5 begins at line 500. Line 510 calls the tape file subroutine with S$ equated to store. The first and last record numbers are printed for information, as well as the current saving status. Line 540 opens communications for output and saves SR and LR. Line 550 saves all valid records and the 10 category definitions to tape. Line 560 closes communications and advises you to rewind the tape to verify.

When you press enter, execution advances from line 570 to line 580 where communications are reopened for input and the start and ending record numbers are retrieved and compared. Line 600 compares each of the valid records in turn to those currently stored. If all data that is read is correct, line 610 verifies the accuracy of the stored category definitions. Line 620 then closes communication and informs you that the file has been verified and the program is ended. Line 999 ends the program.

If any data is found to be in error (as can occur with a worn tape), execution branches to line 1500. Here, the screen is changed to orange and a read error

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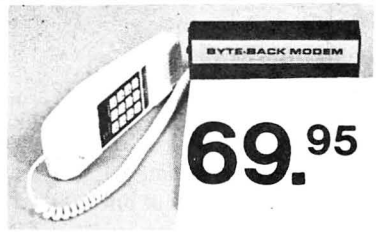

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message appears. When you press any key, the normal green screen is restored and you are returned to the menu. In this instance, you can select task 5 again and rerecord the file.

Tally

Referring to Listing 2, the Tally program structure is similar to FTR. Line 30 calls the subroutine at line 600, which formats the screen. The printing of X$ in line 600 simply causes a carriage return (since X$ is a null string). Before returning, this subroutine positions the cursor at screen position 160.

Line 30 requests a date for use in the printout heading and truncates it to eight characters. Lines 40, 50, and 60 get your inputs for number of files to review (NF), first record number to be included in the report (SR) and last record number to be included in the report (LR).

Line 70 ensures that LR is greater than or equal to SR. Line 80 jumps to the portion of the 600 subroutine that clears the center portion of the screen and then prints your inputs. Line 80 calls the subroutine at line 910, which allows you to elect to continue (C) or redo (R) previous inputs. Line 100 reformats the screen (600 subroutine) and then prints the report specifications you entered (subroutine at line 700).

Line 100 also asks for your intended range of categories, and retrieves the first category number. The report allows two selection criteria, namely range of records and range of categories. As an example, you might want the report to include records 100–190 and categories 5–8. Any records below 100

```
1 REM** FINANCIAL TRANS RECORDER
2 REM** NAME: FTR
3 REM** REV 1, 5 SEPT 1983
4 REM**
10 PCLEAR1:PMODE0:CLEAR8000:CLS0
:LR=0
20 PRINT@237," WAIT ";:DIM A$(10
0):RN=0:FORI=0TO100:A$(I)=STRING
$(51,46):NEXT:FORI=1TO9:C$(I)=ST
RING$(10,46):NEXT:C$(0)="GENERAL
   "
30 L(1)=21:L(2)=8:L(3)=11:L(4)=1
:L(5)=10:L(6)=1:L(7)=22:L(8)=30:
L(9)=41:L(10)=42
40 CLS0:PRINT" FINANCIAL TRANSAC
TION RECORDER":IFT=0THENGOSUB100
0
50 PRINT@77," MENU ";:PRINT@128,
Z$:PRINT"  1. ADD DATA":PRINT"
2. MODIFY DATA":PRINT"  3. DEFIN
E CATEGORIES":PRINT"  4. READ FI
LE FROM TAPE":PRINT"  5. END":PR
INT:PRINT:PRINTTAB(9);"CHOICE ?"
:PRINT
60 X=400:GOSUB 1050:A=VAL(A$):IF
A<1ORA>6THEN60
70 MID$(A$(0),1,52)=STRING$(52,4
6):T=A:ON A GOSUB100,200,300,400
,500:GOTO40
100 CLS:PRINTTAB(7);"TASK # 1: A
DD DATA":PRINTSTRING$(32,128):X=
233:M=LR+1
105 IF LR-SR+1=100 THEN PRINT@19
3,"file full. PRESS ANY KEY, THE
N SELECT TASK #5 TO STORE DATA..
":X=254:GOSUB 1050:RETURN
110 GOSUB1100:IFA<>92 THEN 110
120 P=X:GOSUB 1200:IF A$="R" THE
N RETURN ELSE IFA$=""THEN110 ELS
EMID$(A$(0),1,52)=STRING$(52,46)
:GOTO100
200 CLS:PRINTTAB(5);"TASK # 2: M
ODIFY DATA":PRINTSTRING$(32,128)
:X=233
210 PRINT@96,"ENTER RECORD # TO
BE MODIFIED":PRINT"(";SR;"TO";LR
;")...";:INPUT M
220 IF M<SR OR M>LR THEN PRINT@2
57,"*** INVALID RECORD NUMBER **
*":GOSUB 1300:IFA$="C"THEN200ELS
ERETURN
230 MID$(A$(0),1,52)=A$(M-SR+1)
240 GOSUB 1100:IF A<>92THEN240
250 P=X:GOSUB1200:IFA$="R"THENRE
TURNELSEIFA$=""THEN240ELSEMID$(A
$(0),1,52)=STRING$(52,46):GOTO20
0
300 FORI=1TO9:CT$(I)=C$(I):NEXT
310 CLS:PRINTTAB(3);"TASK # 3: D
EFINE CATEGORIES":PRINTSTRING$(3
2,128)
320 PRINT" #  DEFINITION   # DE
FINITION":PRINT" -  ----------
 -  ----------"
330 FORI=0TO4:PRINTI;" ";C$(I);"
  ";I+5;C$(I+5):NEXT
340 GOSUB1300:IFA$="R"THEN 360 E
LSEPRINT@352,;:INPUT"WHICH CATEG
ORY TO CHANGE...";CC:IFCC<1ORCC>
9THEN310
350 PRINT@352,"CHANGE #";CC;"TO:
 .........":PRINT@367,;:LINE IN
PUT A$:IF LEN(A$)=0 THEN 310 ELS
E MID$(C$(CC),1,10)=LEFT$(A$,10)
+STRING$(9,32):GOTO 310
360 PRINT@356,"CATEGORIES O.K. (
Y/N)...":X=380:GOSUB 1050
370 IF A$="Y" THEN RETURN ELSE I
F A$="N"THENFORI=1TO9:C$(I)=CT$(
I):NEXT:GOTO310 ELSE 360
400 CLS:PRINT" TASK # 4: READ FI
LE FROM TAPE":PRINTSTRING$(32,12
8)
410 S$=" READ":GOSUB 1400:IFA$="
R"THENRETURNELSEPRINT@194,"SEARC
HING...":PRINT:PRINT:PRINT
420 OPEN"I",#-1,"FTR":INPUT#-1,S
R,LR
430 PRINT@194,"FIRST RECORD:";SR
:PRINT"   LAST RECORD:";LR:PRINT
:PRINT"   READING RECORD NUMBER:
"
440 FORI=1TOLR-SR+1:INPUT#-1,A$(
I):PRINT@313,I+SR-1;:NEXT:FORI=0
TO9:INPUT#-1,C$(I):NEXT
450 CLOSE#-1:PRINT@291,"DONE. PR
ESS ANY KEY...":X=314:GOSUB1050:
RETURN
500 CLS:PRINTTAB(9);"TASK # 5: E
ND":PRINTSTRING$(32,128)
510 S$="STORE":GOSUB1400:IF A$="
R" THEN RETURN
530 PRINT@194,"FIRST RECORD:";SR
:PRINT"   LAST RECORD:";LR:PRINT
:PRINT"   SAVING RECORD NUMBER:
1"
540 OPEN"O",#-1,"FTR":PRINT#-1,S
R,LR
550 FORI=1 TO LR-SR+1:PRINT#-1,A
$(I):PRINT@312,I+SR-1;:NEXT:PRIN
T@291,"SAVING CATEGORIES...":FOR
I=0TO9:PRINT#-1,C$(I):NEXT
560 CLOSE#-1:PRINT@290,"DONE. RE
WIND TAPE TO VERIFY":PRINT"  PRE
SS enter WHEN READY...":X=347
570 GOSUB 1050:IF ASC(A$)<>13THE
N570
580 PRINT@290,"SEARCHING...":PRI
NT:OPEN"I",#-1,"FTR":INPUT#-1,S,
L:IF S<>SR AND L<>LR THEN 1500
590 PRINT@290,"VERIFYING RECORD
#:"
600 FORI=1 TO LR-SR+1:INPUT#-1,A
$:PRINT@308,I+SR-1;:IF A$<>A$(I)
 THEN 1500 ELSE NEXT
610 PRINT@290,"VERIFYING CATEGOR
IES...":FOR I=0 TO 9:INPUT#-1,C$
:IF C$<>C$(I) THEN 1500 ELSE NEX
T
620 CLOSE#-1:PRINT@290,"FILE VER
IFIED. PROGRAM ENDED"
999 END:REM* SUBROUTINES BEGIN *
1000 FORI=4TO11:PRINT@32*I,Z$:NE
XT:PRINT@194,"START NEW FILE AT
RECORD";LR+1:PRINT@264,"O.K. (Y/
N)...";:X=278:GOSUB 1050
1010 IF A$="Y" THEN SR=LR+1:RETU
RN ELSE IF A$<>"N"THEN 1000
1020 PRINT@257,"ENTER NEW START
RECORD...";:INPUT LR:LR=(LR>0)*(
1-LR):GOTO 1000
1050 A$=INKEY$:IF A$=""THENPRINT
@X,"?";:POKE1024+X,63:GOTO1050EL
SERETURN
1100 PRINT@64," ARROW KEYS MOVE
CURSOR UP/DOWN.TO MODIFY, PRESS
c AND ENTER NEWDATA. TO END SESS
ION PRESS shiftAND clear TOGETHE
R.":PRINT@224,"   PAYEE: ";LEFT$
(A$(0),21):PRINT"    DATE: ";MID
$(A$(0),22,8):PRINT"  AMOUNT: ";
MID$(A$(0),30,11)
1110 PRINT"CATEGORY: ";MID$(A$(0
),41,1);"  - ";C$(VAL(MID$(A$(0)
,41,1))):PRINT" CHECK #: ";MID$(
A$(0),42,10):IFA$="R"THENRETURNE
LSEGOSUB1050
1120 A=ASC(A$):PRINT@X," ";:IFA=
10THENX=(X<330)*-32+X:GOTO1100EL
SEIFA=94THENX=(X>233)*32+X:GOTO1
100
1130 IF A=92 THEN RETURN
1140 LINE INPUT A$:IFLEN(A$)=0TH
ENRETURN ELSEL=(X-201)/32
1150 MID$(A$(0),L(L+5),L(L))=LEF
T$(A$,L(L))+STRING$(20,46):RETUR
N
1200 REM** SAVE PROMPT
1210 PRINT@450,"sAVE, rESTORE OR
 cONTINUE...";:X=478
1220 GOSUB 1050:IF A$<>"S" AND A
$<>"R" AND A$<>"C" THEN 1220
1230 PRINT@450,STRING$(29,32);
1240 IF A$="R" THEN MID$(A$(0),1
,52)=A$(M-SR+1):GOSUB1100:GOTO12
80
1250 IF A$<>"S"THEN X=P:A$="":RE
TURN
1260 IF T=1 THEN LR=LR+1:M=LR
1270 MID$(A$(M-SR+1),1,52)=A$(0)
:PRINT@422,"RECORD #";M;"SAVED."
1280 GOSUB1300:RETURN
1300 REM* CONTINUE/RETURN
1310 PRINT@452,"cONTINUE, OR rET
URN...";:X=474
1320 GOSUB 1050:IF A$<>"C"AND A$
<>"R" THEN 1320
1330 IF A$="C"THEN PRINT@452," "
 ELSE PRINT@X,A$;
1340 RETURN
1400 REM* TAPE UTILITY
1410 PRINT@194,"PREPARE CASSETTE
 RECORDER TO":PRINT@234,S$;" FIL
E.":GOSUB 1300:IF A$="R" THEN RE
TURN ELSE PRINT@290,"PRESS enter
 WHEN READY...";
1420 X=315:GOSUB 1050:IF ASC(A$)
<>13 THEN 1420 ELSE RETURN
1500 POKE359,57:SCREEN0,1:PRINT@
289,"** read error **. FILE MUST
 BE  RE-SAVED. PRESS ANY KEY..."
:X=347:GOSUB 1050:POKE359,126:CL
OSE#-1:RETURN
```

Program Listing 1. Financial Transactions Recorder

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or above 190 are not printed (but contribute to the grand total figures of the report—more on that later).

In addition, only those records between 100 and 190 that are coded with categories 5, 6, 7, and 8 are included in the report. By planning your categories wisely, your report can address related items of expense.

Line 110 retrieves the last category. Line 120 reprints the category range you just specified. Line 130 asks if they are okay and, if not, allows you to reenter them by returning to line 100. Line 140 reformats the screen and includes an indication of the report category range specified. It also initializes report variables to zero.

A loop begins at line 150, where the current file number (initially zero) is incremented by one. Line 160 calls the Tape Utility subroutine at line 950 that prints instructions and returns after you press enter. Line 160 then prints "Searching..." and removes previous prompts. Line 170 opens communications for input and reads the file's start and finish record numbers (S and L). These values are printed on the screen by line 180. Line 190 reads the records into the A$ array and the category definitions into the C$ array.

Line 200 closes communications and advises you to ready your printer. It then calls the subroutine at line 810 (an INPUT$ routine as used in FTR) that returns when you press a key. Line 210 clears a portion of the screen and identifies which file number printing is being accomplished from. If this is the first file being processed, execution jumps to the subroutine at line 500, which prints the report heading.

The report generation begins in line 220, which retrieves the category (C) and record number (R) of each record. Line 220 also retrieves the information in the amount field of the record and adds it to the GT array (which stores the grand total amount for each category). Line 230 checks if this record is to be included in the report and, if not, jumps to the NEXT command in line 340.

Line 240 prints the record number after tabbing over 10 spaces. The report is printed starting at column 10, which allows the paper to be punched for a three-ring binder. Lines 250–270 check the payee and date fields, stripping off any excess periods. Line 260 prints the payee and line 280 prints the date (right-justified). Line 290 formats and prints the amount. Lines 300 and 310 strip excess periods and print the check number (right-justified).

Line 320 increments the line counter (NL) by one. It then checks to see if 50 lines have been printed; if so it skips to the next page, prints the heading, and resets NL to zero. Line 330 adds the record's amount to the report total. Line 340 completes the FOR...NEXT loop. It also checks to see if all files have been read. If not (F less than NF), it returns to line 150 for the next file. Otherwise, it proceeds to print the totals (lines 330–400). Execution ends with line 490.

Using FTR

It is best to do a little planning before using FTR. Let's start with the category definitions. As I previously noted, you can obtain Tally reports for groups of contiguous categories. Suppose you are using FTR as a checking-account record and you have identified house, car, charity, insurance, food, utilities, clothes, entertainment, medical, and computer as your categories.

This order of categories would not be best for your Tally printout. A better arrangement would be house, utilities, insurance, food, clothes, charity, car, computer, and entertnmt (categories are limited to 10 characters). Selecting the first four categories would then provide a printout of all essential expenses. Similarly, the last two categories would indicate those luxury expenses that could be reduced to assist your budget. By modifying line 20 of the FTR program, you could also change the general category to anything you wish.

With your categories well planned, you can use FTR. Presuming you have previously typed in and saved the program, you would now CLOAD and run it. If you have just turned on you CoCo, the screen clears and the message, "Wait" appears. If the program stops with a syntax Error message, nothing is wrong. FTR is a memory hog. Run again and the program operates properly. The first screen asks if you wish to start your file with record 1. Since you are just starting, press Y. You now see the menu screen.

Adding Categories

Select task 3, define categories, by pressing 3 (you do not have to press enter). The screen now shows the 10 category definitions; zero is general and all others are blank (10 periods). Near the bottom of the screen you see "Which

category to change." Press one and enter.

The message is replaced with "Change # 1 to: ?....." If you press enter, no change is made and the previous question appears. For our example, type the word "house" and press enter. Note that the list has been modified and category 1 is now house. Continue adding your category definitions. When done, press enter in response to the "Which category?" question. The question is replaced with "Categories O.K. (Y/N)." If you press N, all changes are erased. To exit from this task, you must respond Y. When you do, you return to the menu.

Adding Records

Press one at the menu. The screen that appears is the same for both the add and modify tasks. Note that instructions are provided at the top of the screen. A blinking question mark (cursor) is to the right of the word payee. Press the down-arrow key. Note the cursor moves down one line. Press the up-arrow key. The cursor returns to the payee line. Now, as stated in the instructions, press C to begin changing the data.

The FTR cursor is replaced with the normal Basic cursor (box of changing colors). Type in your data and press enter. If the data extends past the periods, FTR truncates it. Move the FTR cursor to the next field to be added or modified (you can return at any time to a field to change the data). When all data has been entered, hold down the shift key and press clear. The message [S]ave, [R]estore or [C]ontinue appears near the bottom of the screen. Note that the first letter of each word is in reverse color. Pressing that key produces the function the word indicates.

Press C. The message disappears and the FTR cursor reappears at its position just prior to pressing shift and clear. This allows you to return to adding data if you pressed shift and clear by mistake. Now press R. All data entered is erased (restoring the record to its previous state). You see a new message, [C]ontinue or [R]eturn. Pressing R returns you to the menu. Pressing C allows you to continue adding. The restore option is most useful in the modify task where you have second thoughts about changes you've made to an existing record and wish to cancel those changes. For our example, press C and reenter your data.

Press S. You see "Record # 1 saved" with the continue/return prompt under it. If you press C, you can continue adding records. For our example, add two more records. When you are finished adding, you can press R to return to the menu.

Modifying Records

Press two at the menu. A message tells you to enter the record number to be modified. The range of records on file is indicated below the message (for our example, (1 to 3) is displayed). If you enter a number outside of that range (such as 42), you are informed that you selected an Invalid Record and see the continue/return question at the bottom of the screen. When you enter a valid record number, the add/modify screen appears. Note that when this screen appears in task 1 (add), all fields are initially blank. Here, the previously stored data is initially displayed.

"It is very important that all three plugs be attached to the cassette."

Select record 1 for modification. Make some modifications and then call the restore option. Note the record is restored to its original state. Make some further changes and save. When you return to the menu, again select task 2 and record 1. Note the changes you made have been saved.

Saving Your File

Press five (task 5: end) at the menu. The message "Prepare cassette recorder to save file" appears, along with the familiar continue/return question. If you select this task by mistake, you can always press R to return to the menu. Press C.

The continue/return question disappears and you are asked to press enter when ready. Place a tape in your cassette deck, and set it to record. It is very important that all three plugs be attached to the cassette. The CoCo must have full control of the deck. Because of FTR's large memory requirements, there are one or two pauses during saving of a 100-record file. The CoCo must be able to stop the recorder while it is garbage collecting (reallocating string storage space).

When your deck is ready, press enter. The screen clears and the first and last record numbers are displayed, along with the message "Saving record number: 1." The cassette engages and as records are saved, the record number changes. When all records are saved, the message "Saving categories" appears.

After a short time the deck stops and the message "Done. Rewind tape to verify. Press enter when ready" appears. Remove the small grey plug from the deck, rewind to the beginning of the file, reinsert the small grey plug, and press play on the deck. When you press enter, the message "Verifying record #: " appears. As each record is verified, its number appears. If at any time a read error occurs, the screen turns bright orange and the message "[read error]. File must be resaved. Press any key" appears. In this instance, press any key and when returned to the menu, select task 5 to try again. If no errors occur, you eventually see "Verifying categories" and "File verified. Program ended." You are now sure that your file has been successfully saved to tape and is error free.

Modifying an Existing File

This discussion skipped over task 4 by design, since you didn't have an existing file. Now that you do, rerun FTR. At the initial screen, press N in response to the "Start new file at record 1" prompt. You are then asked to enter a new start record. Enter the number 123. The screen now asks "Start new file at record 123." Press Y.

At the menu, select task 4 by pressing 4. The screen clears and the message "Prepare cassette recorder to read file" appears, with the continue/return prompt at the screen bottom. Press C and the message "Press enter when ready" appears. Place your file cassette in the deck, rewind the cassette, and place the deck in the play mode (make sure all three plugs are connected). Now press enter.

The deck engages and "Searching" appears. After some time, the first and last record numbers of the recorded file appear along with the message "Reading record number." As each record is read in, its number is displayed. When all records and category definitions have been read, the message "Done. Press any key" appears. Press any key to return to the menu.

Note that task 4 overrides the initial identification of start record; the first record number was obtained from the recorded file. So when modifying an existing (recorded) file, you can respond Y

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to the start record question without having to remember what the first record number is.

Using Tally

Having all your financial transactions on file is of little use unless you can get detailed reports. This is where Tally comes in. Staying with our previous example (checking transactions), say you write an average of 25 checks a month and you have 250 checks on file. You want monthly transaction reports and, at the end of the year, grand totals of all checks by category (but not a listing of all checks—you already have that from the monthly reports). You also want to know how much you spent on luxury items from June through September.

At the end of the first month, you run Tally. Initially, you are asked for the date. Enter it in free form, limited to eight characters (such as 9/5/84). Then you are asked how many files you want to review. Since you only have one file, you respond by entering one. You are now asked for the start-report record. Since you want your report to include all records in the file, you enter one. Now you are asked to finish the report record. If you know the last record number, enter it. Otherwise, enter a large number (like 999). Then you are asked for the number of files to review. The data you entered is displayed again for review, along with the prompt "[C]ontinue or [R]edo." Like the continue/return prompt in FTR, pressing C lets you continue. Pressing R lets you redo the entries.

"You can use FTR and Tally to create an effective, low-cost financial management system."

A new screen presentation now appears, in which the start and finish record numbers you specified, as well as the number of files to be reviewed, are displayed. Now, from within this group you further define selection criteria. You now see "Report range of categories" and "Enter first category." For this first report, you want all categories to be included, so you enter zero. Then you are asked to enter the last category. Enter nine. The display now shows "Categories 0 through 9 inclusive." If you had entered six and eight, only records with categories 6, 7, or 8 would have been included in the report.

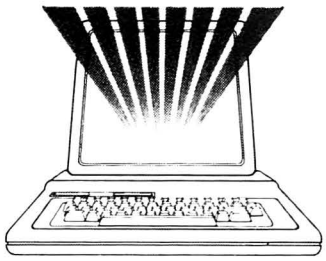
With all selections made, "File # 1 to be loaded. Prepare cassette recorder to read data" appears. You also see the continue/redo question. You can now change your selections by pressing R. Otherwise, pressing C brings the message "Press enter when ready." Prepare your cassette recorder.

When ready, press enter. A series of messages similar to that in task 4 of FTR appears as the records are read in. When done reading, you see "[Ready printer]. Press any key." Prepare your

```
1 REM** TALLY PRINTOUT OF FTR
2 REM** NAME: TALLY
3 REM** REV 1, 30 JULY 1983
4 REM**
10 PCLEAR1:PMODE0:CLEAR8300:CLS0
20 PRINT@237," WAIT ";:DIM A$(10
0):FORI=1TO100:A$(I)=STRING$(51,
46):NEXT
30 GOSUB 600:PRINT@128,;:LINEINP
UT"DATE (8 CHAR MAX) ? ";RD$:RD$
=LEFT$(RD$,8)
40 INPUT"HOW MANY FILES TO REVIE
W ";NF
50 INPUT"START REPORT RECORD ";S
R
60 INPUT"FINISH REPORT RECORD ";
LR
70 IF LR<=SR GOSUB 800:GOTO 30
80 GOSUB 610:PRINT@160,"REPORT D
ATE: ";RD$:PRINT"START REPORT RE
CORD =";SR:PRINT"FINISH REPORT R
ECORD =";LR:PRINT:PRINT"NUMBER O
F FILES TO REVIEW =";NF
90 GOSUB 910
100 GOSUB600:GOSUB700:PRINT@131,
"REPORT RANGE OF CATEGORIES":PRI
NT:INPUT"ENTER FIRST CATEGORY...
";FC:IFFC>9THENGOSUB800:GOTO100
110 INPUT"ENTER LAST CATEGORY...
";LC:IF LC<FC OR LC>9 THEN GOSUB
 800:GOTO100 ELSE PRINT@160,;
120 PRINT@290,"REPORT CATEGORIES
:";FC;"THRU";LC
130 PRINT@458,"O.K. (Y/N)...";:X
=471:GOSUB 810:IFA$="N"THEN100EL
SE IF A$<>"Y"THEN130
140 GOSUB610:GOSUB700:PRINT@97,"
CATEGORIES";FC;"THRU";LC;"INCLUS
IVE.";STRING$(33,128):F=0:PG=0:F
ORI=0TO9:RT(I)=0:GT(I)=0:NEXT
150 F=F+1:GOSUB 610:PRINT@166,"F
ILE #";F;"TO BE LOADED.":PRINT
160 GOSUB 950:PRINT@194,"SEARCHI
NG...":PRINT:PRINT:PRINT
170 OPEN"I",#-1,"FTR":INPUT#-1,S
,L
180 PRINT@194,"FIRST RECORD:";S:
PRINT"   LAST RECORD:";L:PRINT:P
RINT"   READING RECORD NUMBER:"
190 FORI=1TOL-S+1:INPUT#-1,A$(I)
:PRINT@313,I+S-1;:NEXT:FORI=0TO9
:INPUT#-1,C$(I):NEXT
200 CLOSE#-1:PRINT@289,"ready pr
inter. PRESS ANY KEY.":X=318:GOS
UB810
210 GOSUB 610:PRINT@289,"PRINTIN
G FROM FILE";F;"...":IF F=1 THEN
 GOSUB 500
220 FOR I=1TO L-S+1:C=VAL(MID$(A
$(I),41,1)):R=I+S-1:GT(C)=GT(C)+
VAL(MID$(A$(I),30,11))
230 IF R>LR OR R<SR OR C>LC OR C
<FC THEN 340
240 PRINT#-2,TAB(10);:PRINT#-2,U
SING"#####.  ";R;
250 IA=INSTR(MID$(A$(I),1,21),".
.");SP=22-IA:IFSP=22THENSP=0
260 PRINT#-2,LEFT$(A$(I),21-SP);
TAB(41);
270 IA=INSTR(MID$(A$(I),22,8),".
.");SP=9-IA:IFSP=9THENSP=0
280 PRINT#-2,STRING$(SP,32);MID$
(A$(I),22,8-SP);
290 PRINT#-2,USING"$$####,###.##
 ";VAL(MID$(A$(I),30,11));
300 IA=INSTR(MID$(A$(I),42,10),"
..");SP=11-IA:IFSP=11THENSP=0
310 PRINT#-2,STRING$(SP,32);MID$
(A$(I),42,10-SP);"  ";C
320 NL=NL+1:IF NL=50 THEN FORJ=1
TO10:PRINT#-2,X$:NEXTJ:GOSUB 500
:NL=0
330 RT(C)=RT(C)+VAL(MID$(A$(I),3
0,11))
340 NEXT:CLOSE#-1:IF F<NF THEN 1
50
350 IF NL>30 THEN FOR I=NL TO 66
:PRINT#-2,X$:NEXT ELSE PRINT#-2,
X$:PRINT#-2,TAB(10);STRING$(69,6
1):PRINT#-2,X$
360 PRINT#-2,TAB(31);"TALLY SHEE
T TOTALS":PRINT#-2,TAB(31);STRIN
G$(18,45):PRINT#-2,X$
370 PRINT#-2,TAB(10);"CATEGORY.
DESCRIPTION";TAB(45);"REPORT TOT
AL";TAB(61);"GRAND TOTAL":PRINT#
-2,TAB(10);STRING$(30,45);TAB(45
);"------ -----";TAB(61);"-----
-----":A$="$$#####,###.##  $$####
,###.##"
380 FORI=FC TO LC:PRINT#-2,TAB(1
7);:PRINT#-2,USING"#. ";I;:PRINT
#-2,C$(I);TAB(44);
390 PRINT#-2,USING A$;RT(I);GT(I
):RT=RT+RT(I):GT=GT+GT(I):NEXT
400 PRINT#-2,TAB(45);"----------
--   ----------":PRINT#-2,X$:P
RINT#-2,TAB(35);"TOTALS:";TAB(44
);
410 PRINT#-2,USING A$;RT;GT
420 GOSUB 610:PRINT@297,"PROGRAM
 ENDED."
490 END:REM* SUBROUTINES BEGIN *
500 PG=PG+1:PRINT#-2,TAB(16);"TA
LLY SHEET FOR RECORDS";SR;"TO";L
R;"AS OF ";RD$;TAB(70);"PAGE";PG
:PRINT#-2,TAB(29);"( CATEGORIES"
;FC;"TO";LC;")":PRINT#-2,X$
510 PRINT#-2,TAB(10);"REC #. DES
CRIPTION";TAB(41);"  DATE";TAB(5
1);"    AMOUNT";TAB(64);" CHECK
NO.  CAT"
520 PRINT#-2,TAB(10);STRING$(29,
45);"  --------  ----------  --
--------  ---":PRINT#-2,X$:RETUR
N
600 CLS0:PRINT"  TALLY PRINTOUT
OF FTR FILES":PRINT@96,X$:PRINT
610 PRINT@160,;:FORI=1TO10:PRINT
:NEXT:PRINT@160,;:RETURN
700 PRINT@64,;:PRINTUSING"start*
*##  finish**###  files**#";SR;L
R;NF;:PRINTSTRING$(32,128):RETUR
N
800 PRINT@262,"** INVALID INPUT
**":PRINT:PRINT"PRESS ANY KEY TO
 TRY AGAIN...";:X=350
810 A$=INKEY$:IF A$=""THENPRINT@
X,"?";:POKE1024+X,63:GOTO810ELSE
RETURN
900 REM* CONTINUE/RETURN
910 PRINT@454,"cONTINUE, OR rEDO
...";:X=473
920 GOSUB 810:IF A$<>"C"AND A$<>
"R" THEN 920
930 IF A$="C"THEN PRINT@452," ":
RETURN ELSE PRINT@X,A$;
940 IF T=3THENRETURN ELSE 30
950 REM* TAPE UTILITY
960 PRINT@194,"PREPARE CASSETTE
RECORDER TO":PRINT@234,"READ DAT
A.":IF F=1 THEN GOSUB 900
970 PRINT@290,"PRESS enter WHEN
READY...";
980 X=315:GOSUB 810:IF ASC(A$)<>
13 THEN 980 ELSE RETURN
```

Program Listing 2. Tally

SUPER SCREEN



- **A big 51 character by 24 line screen.**
- **Full upper and lower case characters.**
- **Easily combine text with hi-res graphics.**
- **PRINT @ is completely functional on the big screen.**
- **The powerful ON ERROR GOTO is fully implemented.**
- **Auto-key repeat for greater keyboard convenience.**
- **Control codes for additional functions.**
- **Works with 16K, 32K or 64K computers.**
- **Available on disc or cassette.**
- **Works with extended and/or disc BASIC.**

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Super Screen is a powerful, machine language program that significantly upgrades the performance and usefulness of 16K or greater, Extended and Disc Basic Color Computers. The standard Color Computer display screen is totally inadequate for serious, personal or business applications so Super Screen replaces it with a brand new, 51 character wide by 24 line screen including full upper and lower case characters. Instead of a confusing checkerboard appearance, you now have true lower case letters along with a screen that is capable of displaying 1224 characters. The difference is startling! Your computer takes on new dimensions and can easily handle lines of text that were simply too long and complex to display on the old screen.

COMBINE TEXT WITH HI-RES GRAPHICS

You can now write truly professional looking programs that combine text with hi-res graphics. Super Screen allows you to create graphics displays with the Basic LINE, DRAW and CIRCLE statements and then notate the graphics with descriptive text. You can even use PRINT @ if you wish for greater programming convenience. Super Screen's versatility will amaze you.

PRINT @ IS FULLY IMPLEMENTED

The PRINT @ statement is a valuable asset to the programmer when formatting text on the screen. The standard Color Computer will report an error if you specify a location higher than 511 but Super Screen allows locations all the way to 1223! You get a big screen and a powerful formatting tool as well. Of course, Super Screen also supports the CLS command allowing you to clear the big screen using standard Basic syntax.

ON ERROR GOTO

That's right! Super Screen gives you a full implementation of ON ERROR GOTO including the ERR and ERL functions. Now you can trap errors and take corrective action to prevent crashed programs and lost data using the same standard syntax as other computers. The ON ERROR GOTO capability overcomes a serious deficiency of Color Computer Basic and greatly improves your capability to handle sophisticated tasks. All well written, 'user friendly' programs use error trapping techniques and yours can too! Now that's power!

AUTO KEY REPEAT

No more frustration as you edit a long line in your Basic program: just hold the space bar down and automatically step to the desired position in the line. Need a line of asterisks? Hold the key down and auto repeat will give them to you. Those of you who spend many hours at your keyboard will appreciate this outstanding addition to Super Screen's long list of impressive capabilities.

CONTROL CODES FOR ADDITIONAL FUNCTIONS

Super Screen recognizes several special control code characters that allow selection of block or underline, solid or blinking cursor and other functions. You can 'Home Up' the cursor or you may erase from the cursor to the end of a line or to the end of the screen just like many other computers. These special codes give you an extra dimension of versatility and convenience that put Super Screen in a class by itself.

AND MORE GOOD NEWS...

Super Screen comes with complete, well detailed instructions and is available on cassette or disc. It adjusts automatically to any 16K or greater, Extended or Disc Basic Color Computer or TDP-100 and uses only 2K of memory in addition to the screen memory reserved during power up. Guaranteed to be the most frequently used program in your software library...once you use it, you won't be without it! Super Screen's low price will really please you; only $29.95 on cassette or $32.95 on disc!

ACCOUNTING SYSTEM

The Mark Data Products accounting system is ideal for the small businessman needing a fast, efficient means to process income and expenses, prepare detailed reports and maintain most of the information required at tax time. The system is a family of programs which operate by means of a "menu" selection scheme. When the operator selects a task to perform, the computer loads a program designed to handle that task from the system disc. The system disc contains all of the programs required to create, update and maintain data files and prepare the necessary accounting reports including a transaction journal, a P&L or income report, an interim or trial balance and a balance sheet.

Up to 255 separate accounts may be defined and a single disc system can hold over 1,400 transactions. This system automatically enhances the monitor screen to a 51 character by 24 line display. 32K of memory is required along with an 80-column printer and one or more disc drives.

The MDP system:

- Is accurate, user friendly and simple to use.
- Is easy to customize for specific user requirements.
- Immediately updates the chart of accounts.
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This accounting software equals or exceeds higher priced packages for other computers and includes a detailed operating manual.

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ORDER ENTRY SYSTEM

The Mark Data Products sales order processing system provides a fast, efficient means to enter orders, print shipping papers and invoices, prepare sales reports, and monitor receivables. The system automatically enhances the monitor screen to a 51 character by 24 line display. 32K of memory is required along with an 80-column printer, and one or more disc drives.

The MDP order entry system is a family or programs which operate interactively by means of a "menu" selection scheme. Up to 900 products may be defined and a single disc system can hold over 600 transactions. When the operator selects a task to be performed, the computer loads a program designed to handle that task from the system disc. The system disc contains all of the programs required to create, update and maintain data files and prepare the necessary paperwork including shipping and invoice forms, daily sales reports, a monthly (or other period) sales report and a receivables report.

The MDP system:

- Is accurate, user friendly and simple to use.
- Is easy to customize for specific user requirements.
- Produces a traceable invoice.
- Handles receivables as well as closed orders.
- Is capable of future expandability.

This order entry software equals or exceeds higher priced packages for other computers and includes a detailed operating manual.

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printer (continuous-form paper is required for multiple-page reports) and press enter. The message "Printing from file # 1" appears and the report is printed.

If more than one file is to be read, the records are printed but not the totals. Instead, you are told "File # 2 to be loaded," and so on until the number of files you specified has been read. Then totals are printed. They include the report total and the grand total. The report total is a sum for each category you selected of amounts of all records included in the report. The grand total is a sum for each category you selected of *all* records in the files that were read. For instance, if you identify start record 5 and last record 41 for a file with 50 records, the report total includes records 5–41, and the grand total includes records 1–50. When the report is completed, the program ends.

At the end of the second month, you again run Tally. For start record, refer to last month's printout. Say the last record in that printout was 25. Your start record for this month is the next record (26). With all other entries as for the first month, you obtain a printout that lists records and provides a report total for the second month. In addition, the grand total summarizes transactions from the beginning (first and second months).

At the end of the fifth month, you run Tally. Assume the fourth month ended with record 100. So your fifth month data is on a second file, starting with record 101. You then specify the start record as 101. If you want your grand total to include all five months, you must specify two files to read, even though all report data is in the second file only.

When the first file is read in, no records are printed to the report, but the grand total is updated. At the end of the year, you can use this same procedure to get end-of-year totals. You might have three files (25 records per month times 12 months), and record printing does not start until the third file is read. Your grand totals, however, include all transactions for the whole year.

TALLY SHEET FOR RECORDS 1 TO 999 AS OF 09/05/83 PAGE 1
(CATEGORIES 0 TO 9)

REC #.	DESCRIPTION	DATE	AMOUNT	CHECK NO.	CAT
1.	BALANCE BROUGHT FWRD.	1/1/84	-$1.000.00	NEW ACCNT.	0
2.	GREED BANK (MORTGAGE)	1/1/84	$402.89	1001	1
3.	RED CROSS (DONATION).	1/4/84	$25.00	1002	6
4.	JCP & L (ELECTRIC)	1/6/84	$64.37	1003	2
5.	ARAB OIL CO	1/7/84	$224.18	1004	2
6.	GREASY'S GARAGE	1/7/84	$75.29	1005	7
7.	HOT COCO (SUBSCR)	1/12/84.	$39.95	1006	8
8.	MAMA JO'S MASSAGES	1/14/84.	$25.00	1007	9
9.	NBO (SUIT)	1/15/84.	$69.95	1008	5
10.	MONMOUTH GAS CO	1/17/84.	$24.18	1009	2
11.	INSTANT SOFTWARE	1/18/84.	$25.00	1010	8
12.	DEPOSIT	1/21/84.	-$749.17		0
13.	FOOD COOP	1/22/84.	$357.80	1011	4
14.	GOUGER INSURANCE(CAR)	1/24/84.	$254.18	1012	7
15.	TEXAS COMP SYS (PRT).	1/25/84.	$279.87	1013	8
16.	DEPOSIT	1/25/84.	-$400.00		0
17.	NJ BELL	1/26/84.	$39.76	1014	2
18.	SALVATORE'S CUSINE	1/27/84.	$34.50	1015	4
19.	MAMA JO'S MASSAGES	1/27/84.	$25.00	1016	9
20.	UNDERWARE CITY	1/24/84.	$14.37	1017	5
21.	NJ STATE OF MOT VEH	1/29/84.	$27.50	1018	7
22.	UNITED FUND	1/29/84.	$50.00	1019	6
23.	RADIO SHACK	1/30/84.	$79.95	1020	8
24.	DEPOSIT	1/30/84.	-$250.00		0
25.	RESORTS INT'NL	1/31/84.	$245.00	1021	9

TALLY SHEET TOTALS

CATEGORY.	DESCRIPTION	REPORT TOTAL	GRAND TOTAL
0.	GENERAL	-$2.399.17	-$2.399.17
1.	HOUSE	$402.89	$402.89
2.	UTILITIES	$352.49	$352.49
3.	INSURANCE	$0.00	$0.00
4.	FOOD	$392.30	$392.30
5.	CLOTHES	$84.32	$84.32
6.	CHARITY	$75.00	$75.00
7.	CAR	$356.97	$356.97
8.	COMPUTER	$424.77	$424.77
9.	ENTERTNMT	$295.00	$295.00
	TOTALS:	-$15.43	-$15.43

Fig. 1. The FTR Screen Setup

Luxury Totals

It should now be clear how you get a report of luxury expenses (categories 8 and 9 in our example) for June through September. You would look at your June printout and identify the first record printed as the start record. The last record would be the last record included in the September report.

Based on 25 records per month, the start record might be 126 and the last record 225. You would then have to specify two files (the one with records 101–200, and the one starting with 201). When you were asked for range of categories, you would identify eight as the first and nine as the last category (inclusive). In this report, the grand totals would not reflect the full year's category totals, since you did not read data for January through April (the file with records 1–100). However, your report would give you the totals information you wanted and also list all included transactions.

Some Closing Thoughts

You can use FTR and Tally to create an effective, low-cost financial management system. Keep in mind that debits (payments) and credits (income) must be of opposite numeric signs. For instance, in a checking-account system, you can enter checks as positive (like 123.45) and deposits as negative (like −500). This is convenient, since there are usually many more checks to enter than deposits. (Of course, the report totals then show a normal balance as negative.) An FTR ledger system might use credits as positive and debits as negative; the choice is up to you. Just keep the signs consistent.

Don't bother to enter dollar signs or trailing zeros (enter 500 instead of $500.00). They'd just be unnecessary keystrokes since Tally formats the amounts for you. Also, although I've identified 100 records as a file's maximum limit, there is no minimum file size. You can start a new file after 50 records, or 25 or whatever you wish.

I'd like to hear how you use FTR. Please send me a short note. ■

Address correspondence to James Barbarello, R.D. #1, Box 241 H, Tennent Road, Englishtown, NJ 07726.

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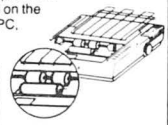

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GAME

BY JOE KRUEGER

Make your way through crevasses and craters to land your craft in this great graphics game.

You are about to land on the moon. Your fuel is low but you think you can make it without refueling. You land on an easy landing pad.

The next time around, your fuel is very low and you must land on a 4X or a 5X landing pad to refuel. You approach the pad: It's a tight squeeze but you are confident.

You descend into the crater and suddenly you are out of fuel. You are drifting out of control and headed straight for the mountainside!

This is the scenario for Ten Seconds to Touchdown. The right and left arrows move your ship right or left, and the space bar provides thrust. Use the controls carefully, however, because as you hold the button down your ship gains momentum, and if you get too close to the crater walls, you cannot thrust away.

Table 1 gives a program line description, and Table 2 the variables used. ■

Address correspondence to Joe Krueger, 4626 East Lafayette, Phoenix, AZ 85018.

50–80	Title page
900–940	Directions
90–110	Set graphics page, set variables
760–890	Draw mountains, numbers, fuel
120	Set variables
130–140	Start of main loop, erase, draw ship
160	Take fuel
170	If space bar pressed then thrust
180–200	Figure variables
210–330	Check points around ship to check for mountain
340–360	If ship hits the side then bounce
370–380	Ship can't go faster than specified
390	Add Y$ for DRAW statement
400–410	If right or left arrow pressed then add to momentum
420–430	Don't move right or left faster than specified
440	Figure X$
450	GOTO beginning of main loop
460	If ship was dropping too fast then blow up
470–560	Check to see if ship made a good landing
570	If after a landing on a 4X or 5X the fuel gets used up faster, it can't go faster than specified
580–620	Explosion, subtract a ship
630–680	Display players' ships and scores
690–740	Successful landing routine
750	Check to see whether to end or not

Table 1. Listing Explanation

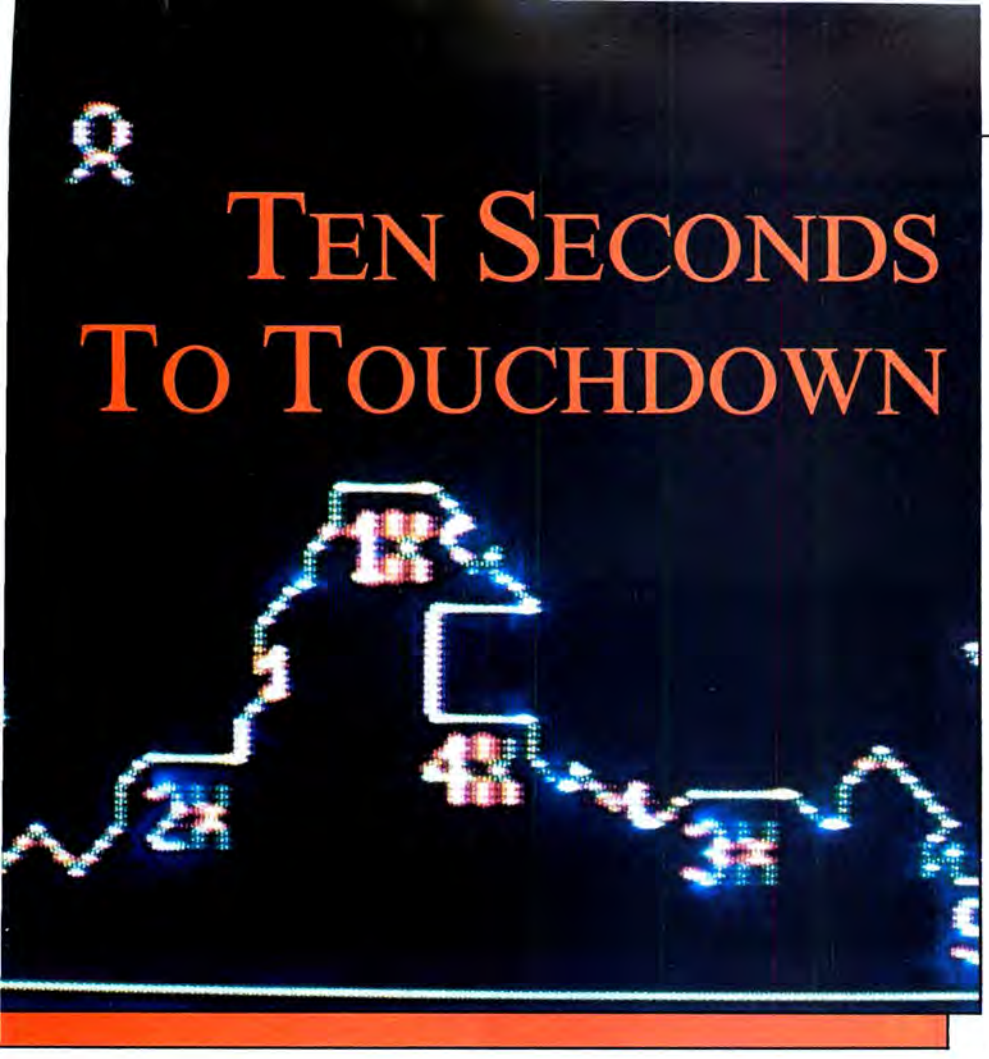
W	How much fuel is used up
SH	Number of ships
Z	Amount of fuel
X$,Y$	Where to draw ship
A$,B$	Where to erase ship
R, S	Value of X$,Y$
C	Speed of ship up and down
D	Speed of ship side to side
ZZ	Used in For...Next loops
A$	Used for Inputs at beginning of program

Table 2. Variables

Program Listing. Lunar Lander

```
50 CLS0:SCREEN0,1
60 PRINT@105,"lunar";:PRINT@111,
"lander";
70 PRINT@388,"";:INPUT"DO YOU NE
ED DIRECTIONS";A$
80 IFLEFT$(A$,1)="Y"THEN900
90 POKE65495,0:PMODE4,1:PCLS:SCR
EEN1,1
100 W=2:SH=3:Z=256
110 GOTO 760
120 X$="125":Y$="17":A$=X$:B$=Y$
:T$="BR6;G2;H2;"
130 DRAW"C0;BM"+A$+","+B$+"E3;H2
;U2;E2;BR2;F2;D2;G2;F3;":DRAW"C0
;BM"+A$+","+B$+T$
140 DRAW"C1;BM"+X$+","+Y$+"E3;H2
;U2;E2;BR2;F2;D2;G2;F3;"
150 IFZ<0THENC=5:Z=0:GOTO180
160 LINE(Z,185)-(Z+W,185),PRESET
170 IFPEEK(345)=247THEN POKE345,
255:C=C-.5:Z=Z-W:DRAW"C1;BM"+X$+
","+Y$+T$ ELSE C=C+.5
180 A$=X$:B$=Y$
190 R=VAL(X$)
200 S=VAL(Y$)
210 IFPPOINT(R,S-5)>0THEN460
220 IFPPOINT(R,S-4)>0THEN460
230 IFPPOINT(R,S-3)>0THEN460
240 IFPPOINT(R+9,S-5)>0THEN460
250 IFPPOINT(R+9,S-4)>0THEN460
260 IFPPOINT(R+9,S-3)>0THEN460
270 IFPPOINT(R,S-2)>0THEN460
280 IFPPOINT(R,S-1)>0THEN460
290 IFPPOINT(R+9,S-2)>0THEN460
300 IFPPOINT(R+9,S-1)>0THEN460
310 IFPPOINT(R,S+1)>0THEN460
320 IFPPOINT(R+9,S+1)>0THEN460
330 IFPPOINT(R+4,S-10)>0THEN460
340 IFVAL(X$)<3THENX$="5":D=-D
350 IFVAL(X$)>240THENX$="240":D=
```

Ten Seconds To Touchdown



Photo—Suzanne Torsheya

System Requirements

16K RAM
Extended Color Basic

```
-D
360 IFVAL(Y$)<17THENY$="17"
370 IF C<-3THENC=-3
380 IFC>5 THENC=5
390 Y$=STR$(VAL(Y$)+INT(C))
400 IFPEEK(343)=247THEN POKE343,
255:D=D-.5
410 IFPEEK(344)=247THEN POKE344,
255:D=D+.5
420 IFD<-5THEND=-5
430 IFD>5THEND=5
440 X$=STR$(VAL(X$)+INT(D))
450 GOTO 130
460 IFC>3THEN580
470 IFZ<0THENZ=256
480 IFR>0ANDR<5ANDS<152ANDS>148T
HENF=3:GOTO690
490 IF R<47AND R>37AND S<118AND
S>114THENF=2:GOTO690
500 IFR<105ANDR>99ANDS<155ANDS>1
50THENF=2:GOTO690
510 IFR<135ANDR>129ANDS<118ANDS>
114THENF=1:GOTO690
520 IFR<150ANDR>145ANDS<149ANDS>
144THENF=4:W=W+1:GOTO690
530 IFR<189ANDR>181ANDS<159ANDS>
155THENF=3:GOTO690
540 IFR<222ANDR>220ANDS<139ANDS>
135THENF=3:GOTO690
550 IFR<224ANDR>219ANDS<171ANDS>
167THENF=5:W=W+1:GOTO690
560 IFR<61ANDR>58ANDS<169ANDS>16
5THENF=5:W=W+1:GOTO690
570 IFW>5THENW=5
580 DRAW"C0;BM"+A$+","+B$+"E3;H2
;U2;E2;BR2;F2;D2;G2;F3;":DRAW"C0
;BM"+A$+","+B$+T$
590 FORZZ=1TO9:CIRCLE(R+4,S-4),Z
Z,1:PLAY"L1O1T255V"+STR$(ZZ*3+4)
+"ABDGEFAD":NEXTZZ
600 FORZZ=9TO1STEP-1:CIRCLE(R+4,
S-4),ZZ,0:PLAY"O1L1T255V"+STR$(Z
Z*3+4)+"DEBFADEA":NEXTZZ
610 FORA=0TO1000:NEXTA
620 SH=SH-1
630 CLS:SCREEN0,1
640 PRINT@37,USING"SHIPS REMAINI
NG      ##";SH
650 PRINT@197,USING"POINTS
     #####";P
660 PRINT:PRINT
670 IFSH<1THENINPUT"DO YOU WANT
TO PLAY AGAIN";A$:GOTO750 ELSE I
NPUT"PRESS ENTER TO CONTINUE";A$
680 PCLS:SCREEN1,1:GOTO760
690 PLAY"L1O3V30T32CDET16GT32ET8
G"
700 CLS:SCREEN0,1
710 Q=Z*F:P=P+Q
720 PRINT@130,USING"### X # = ##
##";Z,F,Q
730 IFF=4ORF=5THENZ=256
740 GOTO 640
750 IFLEFT$(A$,1)="N"THENPOKE654
94,0:END ELSERUN
760 DRAW"C1;BM0,150;R15;D2;F3;U5
;E5;L1;E6;H3;R5;E10;U7;H3;R20;F8
;D5;F6;R3;G3;F6;D5;H3;L2;H3;G4;L
3;G5;D9;G6;R20;D5;E3;R2;E6;F6;E7
;U5;E4;R15;U5;E4;R2;U6;G3;U6;E6;
R2;U4;E4;U5;R15;F5;L3;D2;F4;E3;D
4;R2;F4;L15;D15;R15;D5;F4;R2;U3;
F6;E3;D5;R3;E4;R15;F4;R3;
770 DRAW"U5;E5;F10;G3;D4;E4;D5;R
15;E5;U3;H2;R3;U2;H20;R12;F5;U5;
E6;F4;D2;G2;R5;E6;F5;R5;E3
780 LINE(0,185)-(Z,185),PSET
790 DRAW"BM4,181;U4;R2;L2;U3;R4;
BR2;D6;F1;R2;E1;U6;BR3;BD7;R4;L4
;U4;R2;L2;U3;R4;BR2;D7;R4;"
800 DRAW"C1;BM44,123;E1;R2;F1;D2
;G4;D1;R5;BR2;U2;E4;U2;BL4;D2;F4
;D2;"
810 DRAW"BM2,155;E1;R2;F1;D2;G1;
L1;R1;F1;D2;G1;L2;H1;BD1;BR7;U2;
E4;U2;BL4;D2;F4;D2;"
820 DRAW"BM58,171;L5;D4;R3;F1;D2
;G1;L2;H1;BD1;BR7;U2;E4;U2;BL4;D
2;F4;D2;"
830 DRAW"BM100,158;E1;R2;F1;D2;G
4;D1;R5;BR2;U2;E4;U2;BL4;D2;F4;D
2;"
840 DRAW"BM132,122;E2;D8;L2;R4;B
R2;U2;E4;U2;BL4;D2;F4;D2;"
850 DRAW"BM150,155;L7;E5;D8;BR4;
U2;E4;U2;BL4;D2;F4;D2;"
860 DRAW"BM182,162;E1;R2;F1;D2;G
1;L1;R1;F1;D2;G1;L2;H1;BD1;BR7;U
2;E4;U2;BL4;D2;F4;D2;"
870 DRAW"BM225,172;L5;D4;R3;F1;D
2;G1;L2;H1;BD1;BR7;U2;E4;U2;BL4;
D2;F4;D2;"
880 DRAW"BM239,144;E1;R2;F1;D2;G
1;L1;R1;F1;D2;G1;L2;H1;BD1;BR7;U
2;E4;U2;BL4;D2;F4;D2;BD3;BL10;H1
0;U4;G2;E2;F2;H2;"
890 GOTO 120
900 CLS:PRINT"OBJECT:     TO LAND
 ON A PAD AND             SCORE A
S MANY POINTS             AS POSI
BLE."
910 PRINT:PRINT"CONTROLS:   ->
  MOVE RIGHT                <-
  MOVE LEFT                 SPACE
  THRUST"
920 PRINT:PRINT"HINTS:      AS YO
U THRUST, THE               SHIP
GAINS MOMENTUM              SO WA
TCH OUT!  YOU               ALSO
GET A NEW LOAD              OF FU
EL IF YOU LAND              ON A
4X OR 5X."
930 PRINT:INPUT"PRESS ENTER TO P
LAY";A$
940 GOTO90
END
```

BY ALAIN DUSSAULT

OTHO 3,6

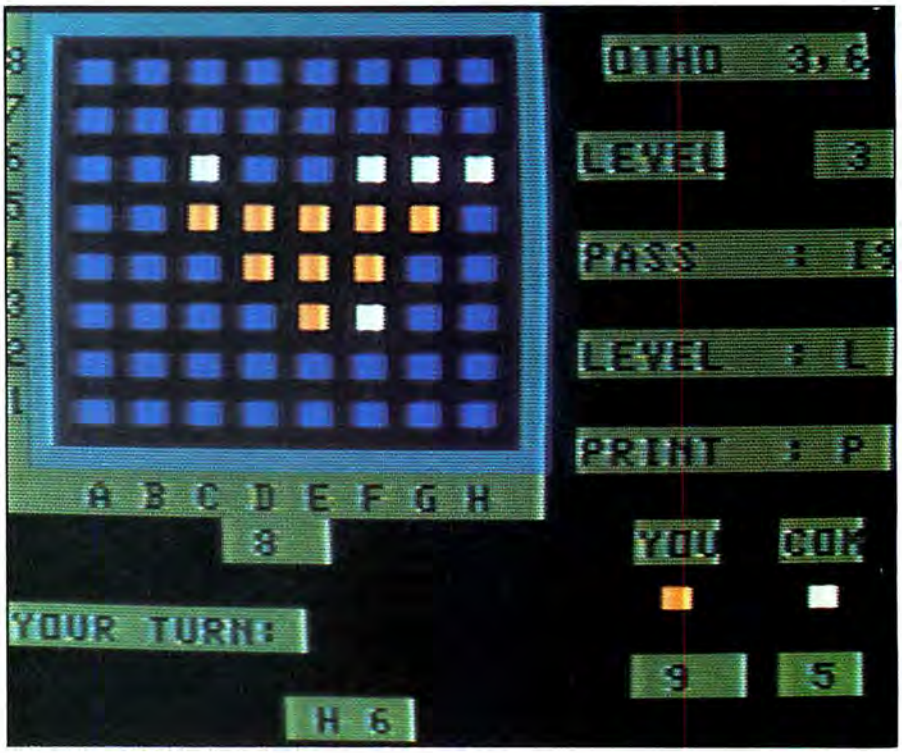


Photo. An Otho 3,6 Game in Progress

Since I acquired a 16K Color Computer with Extended Basic in August 1981, my main concern was to develop a program to play a challenging game of Othello/Reversi. After two unsuccessful attempts, I adapted Flip-A-Piece, a program published in *80 Micro* (March 1982, p. 252). This third attempt was successful because it met my criteria for memory size and flexibility.

I called the program Otho 3,6. The 3 stands for the third algorithm and the 6 for the number of major modifications I made before getting it just right.

Otho 3,6 challenges the Reversi player with four levels of difficulty (see Table 1) and is flexible enough to allow you to play against another player as well as the computer.

Experts and novices alike will enjoy this flexible version of Reversi for Color Computer owners.

How to Play

If you use 16K Extended Basic, you have to enter POKE 25,6:NEW before saving, loading, or running the program. You must also remove all remarks from the listing to clear enough memory and avoid the ?OM error message.

After you type RUN, answer the prompts according to what you want to do. If you choose to play against another player, the screen displays P#1 and P#2 instead of YOU and COM.

As with Flip-A-Piece, the board is divided into 64 squares, eight rows by eight columns. I used low-resolution graphics to display the board and text, which reserves the maximum memory for Basic programming. Because the Color Computer limits the choice of colors, the small square playing pieces are orange on one side and white on the other. The player who begins the game always has the orange pieces. Empty squares are dark blue.

To start, two white pieces and two orange pieces are placed in the four center squares adjacent to each other. The object is to get more pieces on the board than your opponent. Each player tries to flip the other's pieces. A legal move flips at least one of the other player's pieces.

To enter a move, you use a letter (A to H), followed by a number (1 to 8). You do not have to press enter because INKEY$ executes the command. The computer displays its move before it updates the board.

System Requirements

16K RAM
Extended Color Basic
LP VII Printer (optional)

If you decide to let the computer begin, its first move is randomly played. The first four legal moves are considered equivalent to an expert level of play. After that, the computer looks at all the legal moves available to it, then chooses one from a certain imposed order according to the designated level of difficulty.

Even though it is programmed in Basic, the computer makes its move in less than 15 seconds with the rapid POKE. Without the rapid POKE, the computer moves within 20 seconds.

The Print (P) routine in lines 2410–2480 is for those of you who have a Line Printer VII. The printout contains the following information:

- who began to play,
- at what level you are playing,
- all the moves that have been made, and
- who won and by what score.

If you do not have a Line Printer VII, you could replace all PRINT#-2 commands with PRINT to have this information displayed on the screen. Do not forget to place a CLS somewhere in the program.

At the end of a game you must pass (press I,9) to start a new game.

Strategies

For at least the first two-thirds of the game, you should try to flip the least number of your opponent's pieces. During this time, it is more important to have greater "mobility" than to have more pieces than your opponent. In this case, mobility refers to your having the greatest number of possible moves from which to choose. The more moves you have, the less your opponent has.

This strategy requires that you control as many sides of the board as possible. Doing so may require that you abandon the above strategy at some points.

Because winning requires having more pieces than your opponent, you must flip as many pieces as possible during the last few moves of the game.

The computer is programmed to play this way. As mentioned above, it looks for all legal moves in an imposed order (lines 780–890). The legal moves are stored in the G(N1) array (line 880) and the rank of the move in CC(N1).

If you play at a level higher than level 1, the computer goes to the routine to update the square ponderation value (line 880) before going to the evaluation routine.

The updating routine starts at line 1280. To begin with, each string variable from A$ to D$ equals zero. The computer then reads each side of the board to determine which player occupies each space (0 = empty square, 1 = computer piece, 2 = player piece), and the string variables A$ to D$ retain that bit map.

Level 1—Except for the first move, if the computer begins, it plays the first legal move it finds in its search of the legal move routine.

Level 2—The computer chooses the legal move that receives the greatest evaluation value. But before evaluating its legal moves, the computer goes to a special routine that modifies the ponderation value of the squares depending on the way the game progresses.

Level 3—The computer plays as in level 2, but also determines if it can play the gambit. The gambit is a play in which you give up a corner to gain control of one side.

Level 4—The computer plays according to level 3 until only seven empty squares remain on the board. From there on, it chooses its move according to the Flip-A-Piece method. Note that because of the way the computer has to look for legal moves, it always plays the first seven moves as in level 1. You can figure that out by looking at the number printed below the board. It varies from 1 to less than 60 during the first seven moves and from 1 to 60 after that. The reason that 60 is the maximum is that there are 60 empty squares at the start of the game.

Table 1. Levels of Difficulty

"Because winning requires having more pieces than your opponent, you must flip as many pieces as possible during the last few moves of the game."

The rest of the routine checks to see if the contents of the string variables match a certain configuration of pieces positioned on each side of the board. If it finds a match, the routine updates specific square ponderation values.

Let's look at line 1460 as an example:

```
IFA$="00111100"ORA$="01111100"
ORA$="00112200"ORA$="00122200"
ORA$="00111200"THENE(17)=24.
```

This means that if the bottom of the board is occupied by pieces matching any of the above configurations, the computer will have better control of that side by moving to a square beside a corner, even though that play is normally dangerous. The ponderation value of square 17 (square G1) is, therefore, increased from −32 to +24.

The computer then goes to the evaluation routine (lines 670–710):

EV(Z) = E(G(Z)) + 60 − CC(Z)
E(G(Z)) = update ponderation value of the square.
CC(Z) = rank of the square in the imposed order.

When the evaluation has been computed for each legal move, the computer makes the one that has the greatest value. If two moves have the same value, the computer makes the first one.

If you play at level 3 or 4, when the computer goes to the updating routine, it checks to see if it can play the "gambit" or if it has to protect itself against the gambit. The gambit is a play in which you give up a corner to gain control of one side. The gambit routine runs from lines 2150–2380.

The Flip-A-Piece algorithm that chooses the move that would flip the greatest number of pieces is the one to use toward the end of the game. Because the computer does not have to analyze more than six moves at this point, its response is fast.

Improvements

You can upgrade this program for a 32K system. One improvement is to add a routine that, after the computer has gone through the legal-move routine, will select randomly among moves that have the same top evaluation value. In this way, the computer will never play two games the same way.

The second major improvement is to reinforce the Flip-A-Piece algorithm by looking at all possible moves with an Alpha-Beta tree. (See *80 Micro*'s Notes from Beneath the Keyboard, August and September, 1982.) This routine must be in machine language to maintain the speed of the computer response. ■

Address correspondence to Alain Dussault, 2165 Manon St., Laval, Quebec, Canada H7S 1V5.

```
10 CLS6:PRINT@236,"OTHO 3,6";:PR
INT@303,"BY";:PRINT@329,"ALAIN D
USSAULT";:PRINT@363,"OCT. 1982";
:FORK=1TO1500:NEXT
20 POKE65495,0
30 DIME(88),B(99),BB(66),C(8),D(
60),G(25),H(25),W(88),B1(25),B2(
25),EV(25),B3(25),CC(25)
35 REM PRINT@ LOCATION TO DISPLA
Y SQUARE OF THE BOARD
40 FORR=1TO8:W(10+R)=257+2*R:W(2
0+R)=225+2*R:W(30+R)=193+2*R:W(4
0+R)=161+2*R:W(50+R)=129+2*R:W(6
0+R)=97+2*R:W(70+R)=65+2*R:W(80+
R)=33+2*R:NEXT
45 REM START OF GAME SQUARE OCCU
PATION
50 DATA3,3,3,3,3,3,3,3,3,3,0,0
,0,0,0,0,0,0,3,3,0,0,0,0,0,0,0,0
,3,3,0,0,0,0,0,0,0,0,0,3,3,0,0,0,2
,1,0,0,0,3,3,0,0,0,1,2,0,0,0,3,3
,0,0,0,0,0,0,0,0,3,3,0,0,0,0,0,0
,0,0,3,3,0,0,0,0,0,0,0,0,3,3,3,3
,3,3,3,3,3,3,3,-11,-10,-9,-1,1,9
,10,11
55 REM IMPOSE ORDER OF SQUARE FO
R SEARCH ROUTINE
60 DATA81,88,11,18,83,86,61,68,3
1,38,13,16,63,66,33,36,84,85,51,
58,41,48,14,15,64,65,53,56,43,46
,34,35,74,75,52,57,42,47,24,25,7
3,76,62,67,32,37,23,26,82,87,71,
78,21,28,12,17,72,77,22,27
65 REM INITIAL PONDERATION VALUE
S OF SQUARE
70 DATA64,-32,32,16,16,32,-32,64
,0,0,-32,-64,2,2,2,2,-64,-32,0,0
,32,2,8,4,4,8,2,32,0,0,16,2,4,0,
0,4,2,16,0,0,16,2,4,0,0,4,2,16,0
,0,32,2,8,4,4,8,2,32,0,0,-32,-64
,2,2,2,2,-64,-32,0,0,64,-32,32,1
6,16,32,-32,64
80 FORK=0TO99:READB(K):NEXT
90 FORK=1TO8:READC(K):NEXT
100 FORK=1TO60:READD(K):NEXT
110 FORK=11TO88:READE(K):NEXT
120 X=0:X1=0
125 REM DRAW BORDER OF BOARD
130 CLS0:PRINT@1,STRING$(19,211)
;:FORK=33TO320STEP32:PRINT@K,CHR
$(223);:PRINT@K+18,CHR$(223);:NE
XT:PRINT@290,STRING$(17,211);
140 PRINT@0,CHR$(131);:PRINT@32,
"8";:PRINT@64,"7";:PRINT@96,"6";
:PRINT@128,"5";:PRINT@160,"4";:P
RINT@192,"3";:PRINT@224,"2";:PRI
NT@256,"1";:PRINT@288," ";
150 PRINT@320,"   A B C D E F G
H  ";
160 PRINT@54,"OTHO  3,6";:PRINT@
117,"LEVEL";:PRINT@181,"PASS   :
 I9";:PRINT@245,"LEVEL  : L ";:P
RINT@309,"PRINT  : P ";
170 PRINT@448,"PLAY AGAINST COMP
UTER";:INPUTZ$:PRINT@448,STRING$
(32,128);:IFZ$="N"THENU=-4:B(54)
=-4:B(45)=-4:B(55)=4:B(44)=4:GOS
UB920:PRINT@375,"P#1";:PRINT@380
,"P#2";:GOTO220
180 PRINT@375,"YOU";:PRINT@380,"
COM";:GOSUB2400:IFZ$="Y"THENU=3
190 UU=0:VV=0:FF=0:POKE279,PEEK(
275):PRINT@448,"YOU PLAY FIRST (
Y/N)";:INPUTX$:PRINT@448,STRING$
(32,128);:IFX$="Y"THEN200ELSEIFX
$="N"THEN210ELSE190
200 GOSUB920:GOTO220
210 B(54)=2:B(55)=1:B(44)=1:B(45
)=2:GOSUB920:GOTO580
215 REM YOUR MOVE OR P#1 OR P#2
MOVE
220 FF=FF+1:IFZ$="N"THENU=-U
230 SOUND100,1:SOUND150,1:PRINT@
416,STRING$(20,128);:PRINT@480,S
TRING$(10,128);
240 IFZ$="N"ANDU=4THENPRINT@416,
"PLAYER #1: ";:GOTO270
250 IFZ$="N"ANDU=-4THENPRINT@416
,"PLAYER #2: ";:GOTO270
260 PRINT@416,"YOUR TURN: ";
270 Y$=INKEY$:IFY$=""THEN270ELSE
IFY$>="A"ANDY$<="I"ORY$="L"ORY$=
"P"THENPRINTY$;ELSE270
280 IFY$="L"THENGOSUB2400:GOTO23
0
290 IFY$="M"THEN2470
300 IFY$="P"THENGOSUB2410:GOTO23
0
310 O=VAL(INKEY$):IFO<1ORO>9THEN
310ELSEPRINTO;:A=10*O+(ASC(Y$)-6
4)
320 IFA=99ANDZ$="Y"THENBB(FF)=A:
X1=1:GOTO580
330 IFA=99ANDZ$="N"ANDU=4THENBB(
FF)=A:X=1:GOTO220
340 IFA=99ANDZ$="N"ANDU=-4THENBB
(FF)=A:X1=1:GOTO220
350 IFB(A)<>0THENPRINT@480,"SQUA
RE OCCUPIED ";:FORR=1TO1000:NEXT
:PRINT@480,STRING$(20,128);:FF=F
F-1:GOTO230
360 BB(FF)=A:X1=0
370 IFZ$="N"THEN2490
380 R5=1:GOSUB440:R5=0:GOTO540
390 R5=0:B1=0:FORR1=1TO60:A=D(R1
)
400 IFB(A)<>0THEN420
410 GOSUB440
420 NEXTR1
430 B1(Z)=B1:GOTO730
440 N=0:FORJ=1TO8:K=A+C(J)
```

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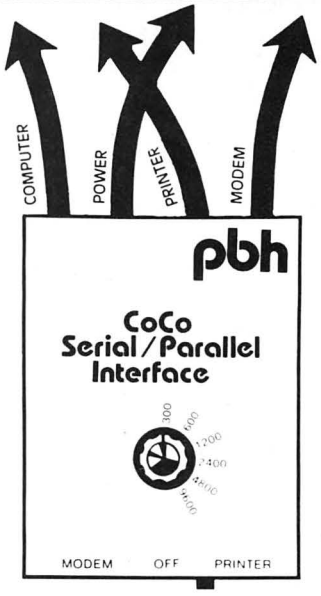

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```
450 IFB(K)<>1THEN500
460 K=K+C(J):IFB(K)=1THEN460
470 IFB(K)<>2THEN500
480 K=K-C(J):IFK=A THEN500
490 N=N+1:IFR5=1THENB(K)=2:GOTO4
80ELSE480
500 NEXTJ
510 IFN>0ORN<B1 THEN530
520 B1=N
530 RETURN
540 IFN>0THEN550ELSESOUND100,2:P
RINT@480,STRING$(10,128);:PRINT@
490,"ILLEGAL MOVE";:FORR=1TO1200
:NEXT:PRINT@490,STRING$(15,128);
:GOTO230
550 IFZ$="Y"THENB(A)=2:GOSUB920
560 IFZ$="N"THENB(A)=U:GOSUB920
570 IFZ$="N"GOTO220
575 REMCOMPUTER MOVE
580 FF=FF+1:IFFF=1THEN1240
590 IFLL=1ORFF<=14THEN610
600 GOTO1280
610 N1=0:G(1)=0:R4=0:FORR=1TO60:
A=D(R):PRINT@360,R;:IFB(A)<>0THE
N640
620 GOSUB780
630 IFG(1)<>0AND(FF<=14ORLL=1)TH
ENR4=1:GOSUB780:GOTO900
640 NEXTR
650 IFG(1)=0THEN770
660 IFLL=4ANDFF>=53THEN720
665 REM EVALUATION ROUTINE
670 FORZ=1TON1
680 EV(Z)=E(G(Z))+60-CC(Z):NEXTZ
:RR=EV(1):GG=CC(1)
685 REM EVALUATION SORT ROUTINE
690 FORZ=1TON1:IFEV(Z)<=RR THEN7
10
700 GG=CC(Z)
710 NEXTZ:A=D(GG):R4=1:GOSUB780:
GOTO900
720 FORZ=1TON1:R4=2:A=G(Z):B(A)=
1:S1=A:GOSUB780:GOTO390
730 GOSUB1150:V=0:NEXTZ
735 REM FLIP-A-PIECE ROUTINE
740 FORZ=1TON1:IFB1(Z)=0THENB1(Z
)=.1
750 B3(Z)=B2(Z)/B1(Z):NEXTZ
760 GOSUB1160:R4=1:GOSUB780:GOTO
900
770 PRINT@480,"COMPUTER HAS NO M
OVE";:X=1:BB(FF)=A:IFX=1ANDX1=1T
HEN1060ELSE220
780 PRINT@416,STRING$(10,128);:N
=0:FORJ=1TO8:K=A+C(J):PRINT@480,
STRING$(20,128);:PRINT@480,"THIN
KING";
785 REM SEARCH FOR LEGAL MOVE RO
UTINE
790 IFB(K)<>2THEN860
800 K=K+C(J):IFB(K)=2THEN800
810 IFB(K)<>1THEN860
820 K=K-C(J):IFK=A THEN860
830 N=N+1:IFR4=1THENB(K)=1
840 IFR4=2THENB(K)=1:V=V+1:H(V)=
K
850 GOTO820
860 NEXTJ
870 IFR4=2THEN890
880 IFN>0THENN1=N1+1:G(N1)=A:B2(
N1)=N:CC(N1)=R
890 RETURN
895 REM COMPUTER PLAY
900 S=INT(A/10):T=A-10*S+64:W$=C
HR$(T):V=0:B(A)=1
910 X=0:BB(FF)=A:SOUND200,1:PRIN
T@480,"I PLAY AT: ";W$;S;:FORJ=1
TON1:H(J)=0:G(J)=0:B2(J)=0:B3(J)
=0:B1(J)=0:EV(J)=0:CC(J)=0:NEXTJ
:GG=0:GOSUB920:GOTO220
915 REM DISPLAY OF THE BOARD PRI
NTING ROUTINE
920 Z=0:FORI=1TO8:FORJ=81TO88:IF
B(J+Z)=1ANDX$="Y"THENP=195:VV=VV
+1
930 IFB(J+Z)=1ANDX$="N"THENP=243
:VV=VV+1
940 IFB(J+Z)=2ANDX$="Y"THENP=243
:UU=UU+1
950 IFB(J+Z)=2ANDX$="N"THENP=195
:UU=UU+1
960 IFB(J+Z)=4ANDZ$="N"THENP=243
:UU=UU+1
970 IFB(J+Z)=-4ANDZ$="N"THENP=19
5:VV=VV+1
980 IFB(J+Z)=0THENP=163
990 PRINT@W(J+Z),CHR$(P);:NEXTJ:
Z=Z-10:NEXTI
1000 IFX$="Y"ORZ$="N"THENPRINT@4
08,CHR$(243);:PRINT@413,CHR$(195
);
1010 IFX$="N"THENPRINT@408,CHR$(
195);:PRINT@413,CHR$(243);
1020 PRINT@471,UU;:PRINT@476,VV;
1030 UU=0:VV=0
1040 IFX=1ANDX1=1THEN1060
1050 RETURN
1055 REM END OF GAME ROUTINE
1060 M=0:N=0:FORK=11TO88:IFB(K)=
1THENM=M+1
1070 IFB(K)=2THENN=N+1
1080 NEXT:IFM>N THENA$="COMPUTER
 WIN":PRINT@448,A$;
1090 IFM=N THENA$="IT IS A TIE":
PRINT@448,A$;
1100 IFM<N THENA$="YOU WIN":PRIN
T@448,A$;
1110 FORK=1TO3000:NEXT
1120 PRINT@448,CHR$(128);:INPUT"
PRINT ALL MOVES (Y/N)";E$:IFLEFT
$(E$,1)="Y"THENGOSUB2410
1130 PRINT@480,CHR$(128);:INPUT"
PLAY AGAIN (Y/N)";A$:IFLEFT$(A$,
1)="Y"THENRUN30ELSEIFLEFT$(A$,1)
="N"THEN1140ELSE1130
```

Listing continued

```
1140 END
1150 FORR=1TOV:B(H(R))=2:NEXTR:B
(S1)=0:RETURN
1160 N=N1:D=1
1170 D=D*2:IFD<N THEN1170
1180 D=INT((D-1)/2)
1190 IFD=0THENA=G(1):RETURN
1200 IT=N-D:FORI=1TOIT:J=I
1210 L=J+D
1220 IFB3(L)>B3(J)THENT=B3(J):T1
=G(J):B3(J)=B3(L):G(J)=G(L):B3(L
)=T:G(L)=T1:J=J-D:IFJ>0THEN1210
1230 NEXTI:GOTO1180
1235 REM COMPUTER PLAY RANDOMLY
FIRST MOVE IF HE START
1240 SS=RND(4):IFSS=1THENA=35:B(
45)=1:GOTO900
1250 IFSS=2THENA=46:B(45)=1:GOTO
900
1260 IFSS=3THENA=53:B(54)=1:GOTO
900
1270 IFSS=4THENA=64:B(54)=1:GOTO
900
1275 REM BIT MAP OF WHO OCCUPIED
 WHAT ON EACH SIDE OF THE BOARD
1280 A$="":B$="":C$="":D$="":FOR
K=11TO18:IFB(K)=0THENA$=A$+"0"
1290 IFB(K)=1THENA$=A$+"1"
1300 IFB(K)=2THENA$=A$+"2"
1310 IFB(K+70)=0THENB$=B$+"0"
1320 IFB(K+70)=1THENB$=B$+"1"
1330 IFB(K+70)=2THENB$=B$+"2"
1340 NEXT
1350 FORK=11TO81STEP10:IFB(K)=0T
HENC$=C$+"0"
1360 IFB(K)=1THENC$=C$+"1"
1370 IFB(K)=2THENC$=C$+"2"
1380 IFB(K+7)=0THEND$=D$+"0"
1390 IFB(K+7)=1THEND$=D$+"1"
1400 IFB(K+7)=2THEND$=D$+"2"
1405 REM UPDATING PONDERATION VA
LUE ROUTINE
1410 NEXT
1420 IFB(11)=1THENE(12)=20:E(21)
=20:E(22)=20
1430 IFB(18)=1THENE(17)=20:E(27)
=20:E(28)=20
1440 IFB(81)=1THENE(71)=20:E(72)
=20:E(82)=20
1450 IFB(88)=1THENE(77)=20:E(78)
=20:E(87)=20
1460 IFA$="00111100"ORA$="011111
00"ORA$="00112200"ORA$="00122200
"ORA$="00111200"THENE(17)=24
1470 IFA$="00111100"ORA$="001111
10"ORA$="00221100"ORA$="00222100
"ORA$="00211100"THENE(12)=24
1480 IFB$="00111100"ORB$="011111
00"ORB$="00112200"ORB$="00122200
"ORA$="00111200"THENE(87)=24
1490 IFB$="00111100"ORB$="001111
10"ORB$="00221100"ORB$="00222100
"ORB$="00211100"THENE(82)=24
1500 IFC$="00111100"ORC$="011111
00"ORC$="00112200"ORC$="00122200
"ORC$="00111200"THENE(71)=24
1510 IFC$="00111100"ORC$="001111
10"ORC$="00221100"ORC$="00222100
"ORC$="00211100"THENE(21)=24
1520 IFD$="00111100"ORD$="011111
00"ORD$="00112200"ORD$="00122200
"ORD$="00111200"THENE(78)=24
1530 IFD$="00111100"ORD$="001111
10"ORD$="00221100"ORD$="00222100
"ORD$="00211100"THENE(28)=24
1540 IFA$="20111110"THENE(12)=-6
4
1550 IFA$="01111102"THENE(17)=-6
4
1560 IFB$="20111110"THENE(82)=-6
4
1570 IFB$="01111102"THENE(87)=-6
4
1580 IFC$="20111110"THENE(21)=-6
4
1590 IFC$="01111102"THENE(71)=-6
4
1600 IFD$="20111110"THENE(28)=-6
4
1610 IFD$="01111102"THENE(78)=-6
4
1620 IFA$="02220100"THENE(15)=-3
2
1630 IFA$="00102220"THENE(14)=-3
2
1640 IFB$="02220100"THENE(85)=-3
2
1650 IFB$="00102220"THENE(84)=-3
2
1660 IFC$="02220100"THENE(51)=-3
2
1670 IFC$="00102220"THENE(41)=-3
2
1680 IFD$="02220100"THENE(58)=-3
2
1690 IFD$="00102220"THENE(48)=-3
2

1700 IFLEFT$(A$,4)="0102"THENE(1
3)=-32ELSEIFRIGHT$(A$,4)="2010"T
HENE(16)=-32
1710 IFLEFT$(B$,4)="0102"THENE(8
3)=-32ELSEIFRIGHT$(B$,4)="2010"T
HENE(86)=-32
1720 IFLEFT$(C$,4)="0102"THENE(3
1)=-32ELSEIFRIGHT$(C$,4)="2010"T
HENE(61)=-32
1730 IFLEFT$(D$,4)="0102"THENE(3
8)=-32ELSEIFRIGHT$(D$,4)="2010"T
HENE(68)=-32
1740 IFA$="00002100"THENE(14)=24
ELSEIFA$="00120000"THENE(15)=24
```

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```
1750 IFB$="00002100"THENE(84)=24
ELSEIFB$="00120000"THENE(85)=24
1760 IFC$="00002100"THENE(41)=24
ELSEIFC$="00120000"THENE(51)=24
1770 IFD$="00002100"THENE(48)=24
ELSEIFD$="00120000"THENE(58)=24
1780 IFA$="00001110"THENE(14)=24
ELSEIFA$="01110000"THENE(15)=24
1790 IFB$="00001110"THENE(84)=24
ELSEIFB$="01110000"THENE(85)=24
1800 IFC$="00001110"THENE(41)=24
ELSEIFC$="01110000"THENE(51)=24
1810 IFD$="00001110"THENE(48)=24
ELSEIFD$="01110000"THENE(58)=24
1820 IFA$="00210000"ORA$="002210
00"ORA$="00211000"ORA$="00211110
"THENE(12)=24
1830 IFA$="00001200"ORA$="000122
00"ORA$="00011200"ORA$="01111200
"THENE(17)=24
1840 IFB$="00210000"ORB$="002210
00"ORB$="00211000"ORB$="00211110
"THENE(82)=24
1850 IFB$="00001200"ORB$="000122
00"ORB$="00011200"ORB$="01111200
"THENE(87)=24
1860 IFC$="00210000"ORC$="002210
00"ORC$="00211000"ORC$="00211110
"THENE(21)=24
1870 IFC$="00001200"ORC$="000122
00"ORC$="00011200"ORC$="01111200
"THENE(71)=24
1880 IFD$="00210000"ORD$="002210
00"ORD$="00211000"ORD$="02111100
"THENE(28)=24
1890 IFD$="00001200"ORD$="000122
00"ORD$="00011200"ORD$="01111200
"THENE(78)=24
1900 IFA$="00022200"ORA$="002222
00"THENE(17)=-32ELSEIFA$="002220
00"ORA$="00222200"THENE(12)=-32
1910 IFB$="00022200"ORB$="002222
00"THENE(87)=-32ELSEIFB$="002220
00"ORB$="00222200"THENE(82)=-32
1920 IFC$="00022200"ORC$="002222
00"THENE(71)=-32ELSEIFC$="002220
00"ORC$="00222200"THENE(21)=-32
1930 IFD$="00022200"ORD$="002222
00"THENE(78)=-32ELSEIFD$="002220
00"ORD$="00222200"THENE(28)=-32
1940 IFA$="00200200"THENE(14)=-2
:E(15)=-2
1950 IFB$="00200200"THENE(84)=-2
:E(85)=-2
1960 IFC$="00200200"THENE(41)=-2
:E(51)=-2
1970 IFD$="00200200"THENE(48)=-2
:E(58)=-2
1980 IFA$="01110000"THENE(16)=-3
2ELSEIFA$="00001110"THENE(13)=-3
2
1990 IFB$="01110000"THENE(86)=-3
2ELSEIFB$="00001110"THENE(83)=-3
2
2000 IFC$="01110000"THENE(61)=-3
2ELSEIFC$="00001110"THENE(31)=-3
2
2010 IFD$="01110000"THENE(68)=-3
2ELSEIFD$="00001110"THENE(38)=-3
2
2020 IFA$="01110200"THENE(15)=-3
2ELSEIFA$="01111020"ORA$="001110
20"THENE(16)=-32ELSEIFA$="002011
10"THENE(14)=-32ELSEIFA$="020111
10"ORA$="02011100"THENE(13)=-32
2030 IFB$="01110200"THENE(85)=-3
2ELSEIFB$="01111020"ORB$="001110
20"THENE(86)=-32ELSEIFB$="002011
10"THENE(84)=-32ELSEIFB$="020111
10"ORB$="02011100"THENE(83)=-32
2040 IFC$="01110200"THENE(51)=-3
2ELSEIFC$="01111020"ORC$="001110
20"THENE(61)=-32ELSEIFC$="002011
10"THENE(41)=-32ELSEIFC$="020111
10"ORC$="02011100"THENE(31)=-32
2050 IFD$="01110200"THENE(58)=-3
2ELSEIFD$="01111020"ORD$="001110
20"THENE(68)=-32ELSEIFD$="002011
10"THENE(48)=-32ELSEIFD$="020111
10"ORD$="02011100"THENE(38)=-32
2060 IFA$="02222200"THENE(17)=-9
6
2070 IFA$="00222220"THENE(12)=-9
6
2080 IFB$="02222200"THENE(87)=-9
6
2090 IFB$="00222220"THENE(82)=-9
6
2100 IFC$="02222200"THENE(71)=-9
6
2110 IFC$="00222220"THENE(21)=-9
6
2120 IFD$="02222200"THENE(78)=-9
6
2130 IFD$="00222220"THENE(28)=-9
6
2140 IFLL<3THEN2390
2145 REM COMPUTER PLAY THE GAMBI
T
2150 IFA$="00222220"ANDB(31)<>0T
HENE(22)=24
2160 IFA$="20222220"THENE(12)=34
2170 IFA$="02222200"ANDB(38)<>0T
HENE(27)=24
2180 IFA$="02222202"THENE(17)=34
2190 IFB$="00222220"ANDB(61)<>0T
HENE(72)=24
2200 IFB$="20222220"THENE(82)=34
2210 IFB$="02222200"ANDB(68)<>0T
HENE(77)=24
2220 IFB$="02222202"THENE(87)=34
```

Listing continued

Listing continued

```
2230 IFC$="00222220"ANDB(13)<>0T
HENE(22)=24
2240 IFC$="20222220"THENE(21)=34
2250 IFC$="02222200"ANDB(83)<>0T
HENE(72)=24
2260 IFC$="02222202"THENE(71)=34
2270 IFD$="00222220"ANDB(16)<>0T
HENE(27)=24
2280 IFD$="20222220"THENE(28)=34
2290 IFD$="02222200"ANDB(86)<>0T
HENE(77)=24
2300 IFD$="02222202"THENE(78)=34
2305 REM COMPUTER PROTECT ITSELF
 AGAINST THE GAMBIT
2310 IFA$="00111110"ORC$="001111
10"THENE(11)=-96
2320 IFA$="01111100"ORD$="001111
10"THENE(18)=-96
2330 IFB$="00111110"ORC$="011111
00"THENE(81)=-96
2340 IFB$="01111100"ORD$="011111
00"THENE(88)=-96
2350 IFA$="01111110"THENE(11)=64
:E(18)=64
2360 IFB$="01111110"THENE(81)=64
:E(88)=64
2370 IFC$="01111110"THENE(11)=64
:E(81)=64
2380 IFD$="01111110"THENE(18)=64
:E(88)=64
2390 GOTO610
2395 REM CHANGE OF LEVEL ROUTINE
2400 PRINT@448,"LEVEL (1/4)";:IN
PUTLL:PRINT@125,LL;:PRINT@448,ST
RING$(32,128);:RETURN
2405 REM PRINTING OF SATUS OF GA
ME PLUS ALL MOVES COORDINATES RO
UTINE
2410 POKE65494,0:IFX$="Y"THENPRI
NT#-2,"YOU BEGAN"ELSEPRINT#-2,"C
OMPUTER BEGAN"
2420 PRINT#-2,"LEVEL:";LL
2440 FORK=1TOFF-1
2450 S=INT(BB(K)/10):T=BB(K)-10*
S+64:W$=CHR$(T):PRINT#-2,W$;S;"
";:NEXTK:PRINT#-2,CHR$(26)
2460 IFFF=60OR(X=1ANDX1=1)THEN24
70ELSE2480
2470 PRINT#-2,A$;" BY ";M;" TO "
;N:PRINT#-2,CHR$(26):POKE65495,0
2480 RETURN
2485 REM ROUTINE IF TWO PLAYERS
2490 N=0:FORJ=1TO8:K=A+C(J)
2500 IFB(K)<>-U THEN2550
2510 K=K+C(J):IFB(K)=-U THEN2510
2520 IFB(K)<>U THEN2550
2530 K=K-C(J):IFK=A THEN2550
2540 N=N+1:B(K)=U:GOTO2530ELSE25
40
2550 NEXTJ:X=0:GOTO540
```

END

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BY DAVID MEREDITH

SNARK

The snark is a small, devious, vicious animal that lives on a rock-strewn plain. Your job is to catch him by turning over the rock that hides him. Be careful though. If you turn over a rock next to the snark, it will jump out and bite you.

In the program Snark, the rocks on the plain are represented by points on a 9-by-9 grid. To turn over a rock, you enter its coordinates. After each entry you are told how far it is to the snark. You can even play blindfolded. Each guess results in a beep that gets higher as you approach the snark.

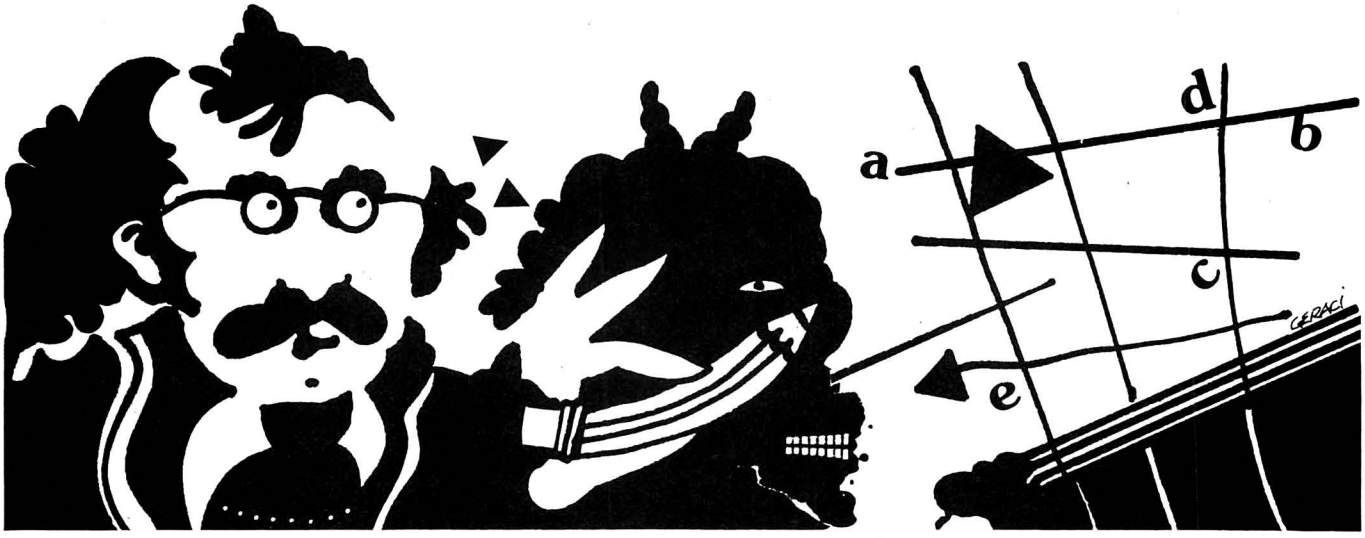
I wrote Snark to introduce children to coordinate geometry. Coordinates are an important concept for anyone who must read a graph or even a map, and that includes just about everyone. Yet coordinates are virtually unmentioned in elementary schools. As a result of this program, even first-graders are able to learn about coordinates.

Snark teaches coordinate geometry in a way that is simple enough for first-graders to understand.

The most interesting programming idea in Snark is the user-input routine. I used LINEINPUT in place of INPUT in line 150 to permit the program to accept any string of characters including commas from the user. LINEINPUT also suppresses the question mark generated by INPUT. The user input is parsed by lines 200–250 that search the input string for two digits. These digits become the coordinates of the user's next guess. Entering 8,7, or 8 7, or 87, or even X8ABC7Q causes the program to look for the snark at the intersection of column 8 and row 7. In this way the user is not limited by any fussy input format. It is important, especially when writing

System Requirements

16K RAM
Extended Color Basic



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And you'll get me on tape doing what I do best: talking, explaining 6809 assembly language and showing you how to tame it. You'll also get dozens of example programs right on the tapes, ready to load, examine and run. Even the accompanying book of documentation could teach you assembly language, but "Learning the 6809" doesn't stop there. Micro Language Lab gives you what you can't get anywhere else: programming information for every one of your Color Computer's "smart" circuits.

"Learning the 6809" isn't that same old isn't-it-wonderful-you-can-put-the-dot-on-the-screen approach. My Micro Language Lab will teach you numbers, graphics, and sound, but it won't run away from you after the first lesson. I want you to learn to program. To learn to use those numbers, graphics, and sound. To find ways of using every electronic nook and cranny in your machine. And I want you to stop wasting memory and make your program run in seconds, not minutes. I won't lose you, because each lesson is carefully paced, and the book contains exercises and self-tests.

I put jargon in its place, too. If you've ever been intimidated by genius programmers, you'll know what I mean. You'll be able to drop a few accumulators, registers, and zero-indexed offsets into your conversation, too.

So contact me or RB2-3 at Green Mountain Micro. "Micro Language Lab" comes in a notebook containing twelve cassettes, documentation, workbook, and data booklets. It costs $99, plus $3.50 shipping and handling. Z80 and 6502 Labs will be available shortly.

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programs for children, to use input routines that can understand any reasonable response. ■

Address correspondence to David Meredith, Department of Mathematics, San Francisco State University, 1600 Holloway Ave., San Francisco, CA 94132.

```
10 'HUNT THE SNARK BY DAVID MERE
DITH JANUARY 1983
20 CLS:PRINT@73,"HUNT THE SNARK"
:PRINT:PRINT:PRINT"DO YOU WANT I
NSTRUCTIONS (Y/N)"
30 PLAY"T4O3L4EP8L16.DP32L8.CP16
O2GP16EP16GP16O3L4CP8L16.DP32L8.
EP16EP16EP16EP16L2E"
40 I$=INKEY$:IFI$="N"THEN90ELSEI
FI$<>"Y"THEN40
50 CLS:PRINT:PRINT"THE SNARK IS
HIDING UNDER A ROCKYOU TYPE IN W
HICH ROCK YOU WANT TO LOOK UNDER
 (ENTER HORIZONTAL THEN VERTICAL
 COORDINATE).  THE COMPUTER WILL
 TELL YOU HOW MANY STEPS TO THE
SNARK."
60 PRINT:PRINT"              warni
ng":PRINT:PRINT"SNARKS ARE DANGE
ROUS.  IF YOU   TURN OVER A ROCK
 ONE STEP AWAY  FROM THE SNARK,
HE WILL JUMP UP AND EAT YOU."
70 PRINT:PRINT"PUSH ANY GREY KEY
 TO PLAY"
80 IF INKEY$="" THEN 80
90 W=RND(-TIMER):WX=RND(9):WY=RN
D(9):REM RANDOMIZE THE RANDOM FU
NCTION THEN SELECT POSITION FOR
THE SNARK
100 Y=0
110 CLS:PRINT"         HUNT THE S
NARK"
120 FOR I=9 TO 1 STEP -1:PRINTI;
" . . . . . .":NEX
TI
130 PRINT"    1  2  3  4  5  6
7  8  9"
140 PRINT@13*32," ":PRINT@13*32,
" ";:REM THIS ERASES PREVIOUS IN
PUT
150 LINE INPUT"WHICH ROCK TO TUR
N OVER? ";F$
160 IF Y=0 THEN 200:REM ELSE REP
LACE # MARKING LAST GUESS WITH N
UMBER OF STEPS FROM LAST GUESS T
O SNARK
170 LO=&H401+3*X+32*(10-Y)
180 D=ABS(X-WX)+ABS(Y-WY):P=10*(
D/10-INT(D/10)):R=INT((D-P)/10+.
5)
190 POKELO,P+112:IFR>0THENPOKELO
-1,R+112
195 REM PICK UP FIRST TWO DIGITS
 FROM INPUT F$ AND USE THEM AS N
EXT GUESS
200 L=LEN(F$):I=0:Y=0:REM MAKING
 Y<>0 INDICATES THAT NEW X,Y PAI
R FOUND
210 IF I=L THEN 140 ELSEI=I+1: C
$=MID$(F$,I,1):IF C$<"1"ORC$>"9"
THEN210
220 X=ASC(C$)-48:I=I+1
230 IFI>L THEN140ELSEC$=MID$(F$,
I,1):IFC$<"1"ORC$>"9"THENI=I+1:G
OTO230
240 Y=ASC(C$)-48
250 LO=&H401+3*X+32*(10-Y):REM T
HE SCREEN LOCATION CORRESPONDING
 TO THE LAST GUESS F$
260 POKE LO,99:POKELO-1,96
270 D=ABS(X-WX)+ABS(Y-WY):REM DI
STANCE FROM LAST ROCK TURNED OVE
R (F$) TO SNARK
280 IF D<>1 THEN 360
285 REM COME THROUGH HERE IF EAT
EN BY SNARK
290 PRINT@12*32,"OH OH":PRINT"TH
E SNARK ATE YOU"
300 PLAY"T5L4.O4DP8O3BP8GP8L2.DP
4L4.DP8L2.G"ELSE360
310 L=&H401+3*WX+32*(10-WY):POKE
L,19:REM PRINT s IN THE SNARK'S
POSITION
320 PRINT@12*32,"OH OH":PRINT"TH
E SNARK ATE YOU"
325 REM PLAY AGAIN ??
330 PRINT"DO YOU WANT TO PLAY AG
AIN (Y/N)"
340 I$=INKEY$:IF I$="Y"THEN90ELS
EIFI$="N"THENSTOPELSE340
350 REM SEE IF YOU FOUND THE SNA
RK
360 IF D=0 THEN PRINT@12*32,"YOU
 GOT HIM!!!":PRINT"GOOD HUNTING"
:PLAY"T7O4L4FP4L4.CP8O3L8.AP16B-
P16O4L4.CP8O3L8.AP16B-P16O4L4.CP
8L4FP4L4.CP8L4FP4L4.G":GOTO330
370 REM KEEP HUNTING
380 SOUND 200-7*D,1
390 PRINT@12*32,"MISSED BY";D;"
STEPS"
400 GOTO140
```

Program Listing. Snark

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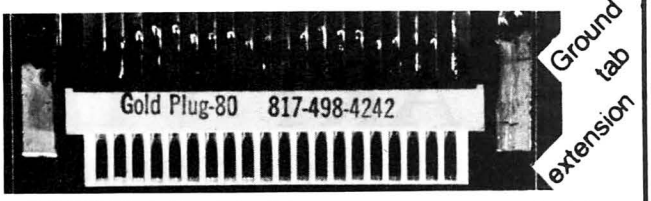

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BY KARL ANDREASSEN

COLORFUL CRYPTOLOGY—PART VIII

The serious analyst invests many hours in developing special tools. Having cracked a difficult cipher, he begins to create aids that not only make similar ciphers easier to enter, but also lead him to attempt more difficult cryptograms.

A handy, if time-consuming, tool is a word list. Because probable words are a good means of entering a cipher message, such lists are almost indispensable.

One of the most practical word lists contains words relative to the known subject of the message. For instance, a message is sent in cipher from a Navy ship, and is intercepted by the enemy during maneuvers. The intercepting cryptanalyst knows that the ship is participating in the maneuvers, and knows the tactical situation. He can easily come up with a list of words that the enemy ship might be sending.

Another good word list comes from matching the repetition of letters with known words—a pattern-word list. Suppose a message contains the letter sequence QHVQ, featuring identical first and final letters. You might try the word DEAD as a possible plaintext equivalent from your word list. Then

So, your enemies think they've got you baffled, eh? Your handy word list will be their demise.

exchange E, A, and D for each H, V, and Q, respectively, in the cryptogram to see if they might produce clues to other words. (Note that Part II of this series (*HOT CoCo*, October 1983, p. 60) carried a program for letter substitution to help you experiment with probable words.)

Your first list might start with two-letter words, progress to three-letter words, and include four-letter words, without concern for letter repetitions.

Then you are ready to begin the job that will prove your mettle. Use the largest dictionary you can comfortably work with, and compile a list of four-letter words containing letter repetitions (ABBA, BILL, COCO, DEEP, and so on).

The list is far more useful in some sort of numerical order (alphabetical order is of little value), so think in terms of the first letter of the word as 1, the second letter as 2, and so on. ABBA, a cloak worn in the Middle East, would be coded 1221. BILL would be 1233, COCO 1212, and DEEP 1224.

Each numeral series heads a column:

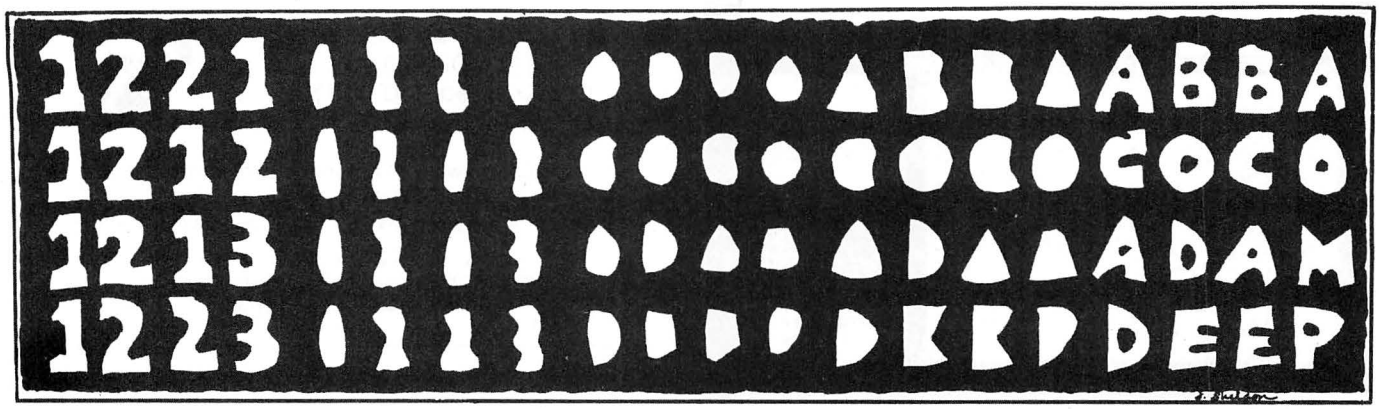
1221	1212	1214	1224	1233
ABBA	COCO	ADAM	DEEP	BILL
NOON	DODO	AHAB	BAAL	AGEE
		AJAR	FOOL	HUFF
		BABE	HOOP	KILL

Try placing MOON, OOZE, PEEP, PEPE, SAGA, SASH, TATE, TEST, and VEER. You might have to create a new column or two for some of these. Don't use any words that don't contain letter repetitions. These are cue words, or perhaps clue words.

A serious student of cryptanalysis will file the lists on disk or tape as he compiles them. A printer is better than a typewriter since you can write a pro-

System Requirements

4K RAM
Color Basic



gram that arranges and prints the words in columns according to letter repetitions. Put the CoCo to work and relax!

The Program Listing prepares the numbers if you supply the words for a four-letter word list, which in the DATA line is a sample of 16 words containing letter repetitions, chosen at random from the dictionary.

To enter words directly into an array instead of using DATA lines, write an INKEY routine to load the W$(X) array and delete line 40. You then change line 30 to include all arrays, perhaps by substituting your incrementing variable for the numeral 16.

You will have to change several lines if you increase the number of words or the number of letters per word (to five-letter words, for instance). Rather than include comments in the program lines, I have prepared these separately as Table 1. Each line subject to change contains an asterisk as a flag.

You might want to add a sort routine before the printout routine at line 190. It should sort numbers and words into columns by numerical order, preferably for a printout.

When all the work on four-letter words is complete, you can create a similar set of columns for five-letter words, then six-, seven-, and eight-letter words. It might be worth your while to write to the Aegean Park Press, P.O. Box 2837, Laguna Hills, CA 92653, for their catalog of crypto books. One of these is their first book of pattern words arranged in columns as above, using a slightly different number-coding system. The book includes words of up to 10 letters, whose initial letters are repeated one or more times.

When you have a particularly stubborn series of letters in a cryptogram, reach for your binder of cue words and search the list for two or three likely ones that fit some fact you know about the message in hand. They are especially useful when you work on very short messages of words carefully chosen to skew the frequency profile.

Reader Response

I thank all you readers who have written to me, and only wish I could write to each of you personally. I keep every letter in a file that I pull each time I sit down to write this column, so you can be sure that your letters are influencing this series. Many of you have sent samples of your programming, and I am impressed with your abilities to adapt your CoCo to crypto work; I am learning from you.

I am solving most of the cryptograms you've sent in, but admittedly am sweating over others. A short "cold turkey" message is difficult for even a master analyst to decipher, and I am far from a finished expert. So, in future letters, do send just a hint of what the message is about if it is short.

"I am solving most of the cryptograms you've sent in, but admittedly am sweating over others."

If I were to intercept such a message in transmission, what would I be likely to know about its origin? If it came from a diplomatic office, would it be about an envoy in China or Australia? Look back over the earlier articles in this series, and note how I have always included some clue via the caption.

By the way, if you are determined to pursue crypto work, you might want to inquire about the scholarly journal, *Cryptologia*, published quarterly by the Rose Hulman Institute of Technology, Terre Haute, IN 47803. ■

Address correspondence to Karl Andreassen, 24750 Chianti Road, Cloverdale, CA 95425.

```
5 '==Word List Column Head
  Counter Program by Karl
  Andreassen, 1984.
10 CLS: '==filespec PATWORD1/CRP
20 CLEAR 500 :DIM W$(100),
  B$(100) :B=1
30 FOR X=1 TO 16
40 READ W$(X)
50 PRINT"*";
60 FOR Y=1 TO 4
70 FOR Z=1 TO 26
80 A$=CHR$(Z+64)
90 C=INSTR(W$(X),A$)
100 IF A$=MID$(W$(X),Y,1)THEN
  150ELSE GOSUB160
110 NEXT Z
120 NEXT Y
130 CL=CL+1 :B$(CL)=B$  :B$=""
140 NEXT X :IF X=17 THEN CLS
  :GOTO 190
150 B$=B$+STR$(C) :GOTO 120
160 B=B+1 :IF B=5 THEN B=1
170 RETURN
180 DATA"ABBA","COCO","ADAM","
  DEEP","BILL","NOON","DODO","
  AHAB","BAAL","AGEE","AJAR","
  FOOL","HUFF","BABE","HOOP","
  KILL"
190 FOR X=1 TO 16 :PRINT W$(X)"
  ="B$(X):NEXT
```

Program Listing. Word List Program

```
5   '==Word List Column Head Counter
    Program by Karl Andreassen, 1984.
10  '==filespec PATWORD1/CRP
20  '==Change arrays for longer list (*)
30  '==Loop to work all words in data list
    (*)
40  '==Load array with word list
50  '==Program working indicator
60  '==Letter loop for each word (*)
70  '==Alphabet loop to test each word/
    letter
80  '==Alphabet call
90  '==Assign number to each letter by
    column
100 '==Decision, record or increment
130 '==Load column head array
140 '==Change X=? for longer word list (*)
150 '==Concatenate column head numbers
160 '==Increment column counter (change
    B=? for longer words) (*)
190 '==Print to screen loop (*)
```

Table 1. Comment lines for the Program Listing. Lines requiring changes when number or length of words increased are marked with an asterisk (*).

BY ROBERT P. BUSSELL

THE EXECUTIVE KEYBOARD

Perhaps the most frequent complaint about the Color Computer concerns its keyboard. Of course there are good replacements available, but they're somewhat expensive.

I wanted a comfortable, efficient keyboard (and preferably an inexpensive one), and I also wanted the convenience of a numeric keypad and some special program-function keys, so I decided to build my own.

There was a bit of a personal challenge in this decision, because I wanted to prove to myself that a programmer could successfully tackle a hardware project. I've always wanted to try one, but have just been afraid to start. So with this simple but worthwhile project, I broke my hardware phobia. If there are any of you out there with the same feeling, here's a good place to begin.

Build a more efficient—and inexpensive—keyboard for your CoCo with this simple hardware project.

Keyboard Selection

I found that the many keyboards available commercially fell into two categories. One group offered bare keyboards without any electronics, and the other contained various electronic components that were necessary to interface with many different microprocessors.

The Color Computer performs all keyboard processing using an onboard peripheral interface adaptor (PIA) and the Basic ROM to read the keys and provide key debounce. Thus, you don't need a keyboard with electronics. See Table 1 for two sources of the keyboard I used.

I selected the Hitec 58-key keyboard and the 15-key numeric keypad for this project. You will also need three feet of 20-wire ribbon cable and a 16-pin female connector to attach the cable to the keyboard header on the computer.

If you want a power-on indicator, you will need an LED and a 100-ohm resistor. You can use a Radio Shack jumbo red LED (part number 276-041). You will also need a roll of 24-gauge insulated wire for wiring the key matrix.

California Digital P.O. Box 3097 B Torrance, CA 90503 800-421-5041 213-679-9001	Hitec 58-key keyboard Hitec 15-key numeric Both for	$24.95 $ 9.95 $29.90	(HIK-58) (HIK-15) (HIK-5815)
Jameco Electronics 1355 Shoreway Road Belmont, CA 94002 415-592-8097	Hitec 58-key keyboard Hitec 14-key numeric	$19.95 $ 9.95	(K-58) (K-14)

Table 1. Parts Suppliers

Cabinet Construction

I called this construction project an Executive Keyboard because I wanted a keyboard that would look good on

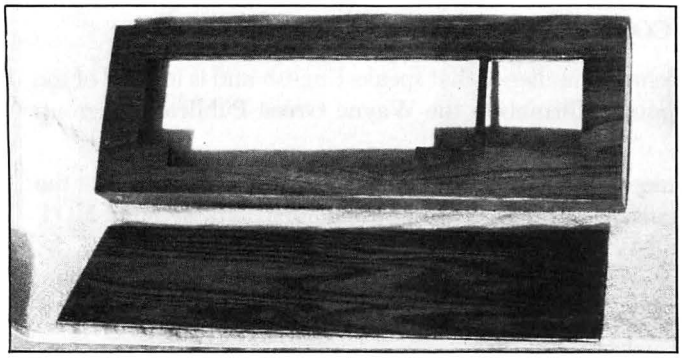


Photo 1. Top View of the Keyboard Cabinet

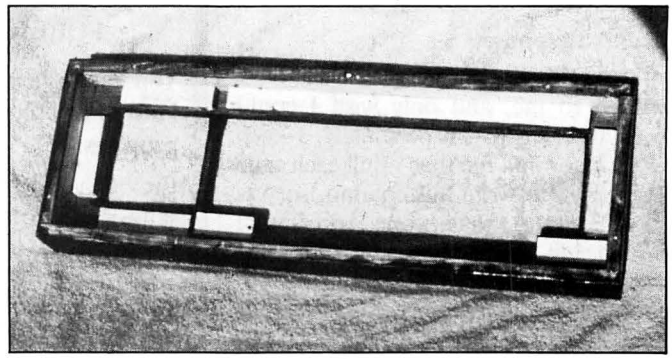


Photo 2. Bottom View of the Keyboard Cabinet

my desk and because I wanted it to be light and movable enough so that I could put it in my lap while my feet were on my desk.

Photos 1 and 2 illustrate the cabinet construction. Tools required to build it include a sabre saw with a fine blade, a screwdriver, a hammer, a hand drill, and an X-acto knife (see Table 2).

I made the top of the cabinet from ¼-inch plywood with a veneered finish on one side. You can usually find veneered plywood at a larger lumber yard or a cabinet shop. The sides are made from 2-by-½-inch pine furring strips covered with Weldwood wood trim.

Begin the cabinet by preparing a template for the keyboard cutout. The dimensions for the template are shown in Fig. 1.

Cut out the plywood top according to the specifications, and be particularly careful not to break the small strip between the keyboard and the keypad. Lay the top aside for the moment.

Cut out the furring strips for the sides so that they make a frame the same size as the top. I was unable to locate 2-by-½-inch strips for the sides, so I improvised by using two 1-inch strips. (Note: 2-by-½-inch lumber is really approximately 1¾-by-⅜-inch.)

When you've cut out the sides, lay them in place on the top to make sure all the pieces are the right size. Use some wood glue and small finishing nails to tack the sides of the frame together. When the glue has dried, you are ready to fasten the sides to the top.

Lay the top, finished side down, on a smooth flat surface. Glue the sides to the underside of the top. If you do not have wood clamps, put some heavy weights on the sides to hold them firmly in place while these pieces dry overnight.

You are now ready to complete the project. First, insert both your keyboard and keypad into the cabinet, and make sure that none of the keys rub on the side of the cutout. If they do, lightly sand or file the cutout where the binding occurs.

Use a wood block and sand the sides of the cabinet until they are smooth. Cut out four strips of wood trim, one for each side, and cut each strip slightly longer than the side.

For best results, perform the next procedure one side at a time. Put a coat of contact cement on the side of the cabinet and on the inside of the wood trim. Let these dry for about half an hour. Now firmly press the wood trim to the side of the cabinet and let it dry for at least two hours.

When the cabinet is dry, use an X-acto knife and carefully trim off the excess wood on all four sides. The cabinet is now ready for sanding and finishing.

I lined the inside of the cabinet with 1-by-½-inch strips (see Photo 2). These provide support for mounting the keyboard and should be glued in

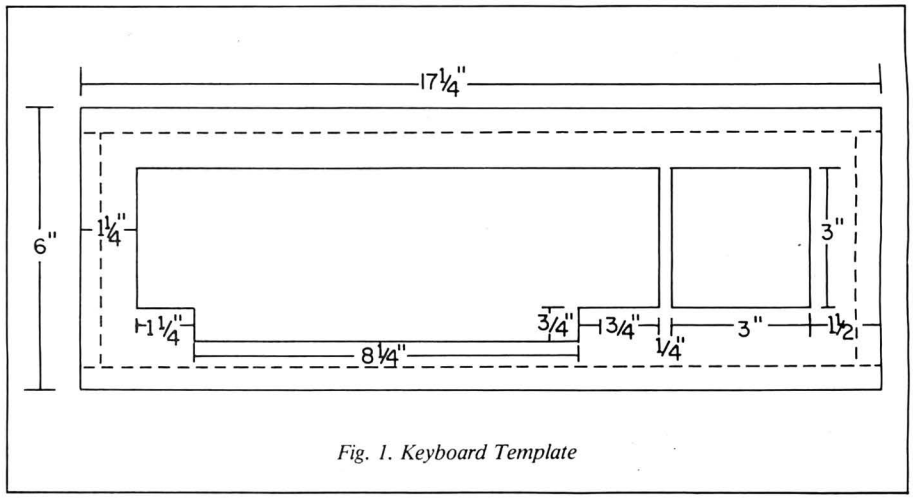


Fig. 1. Keyboard Template

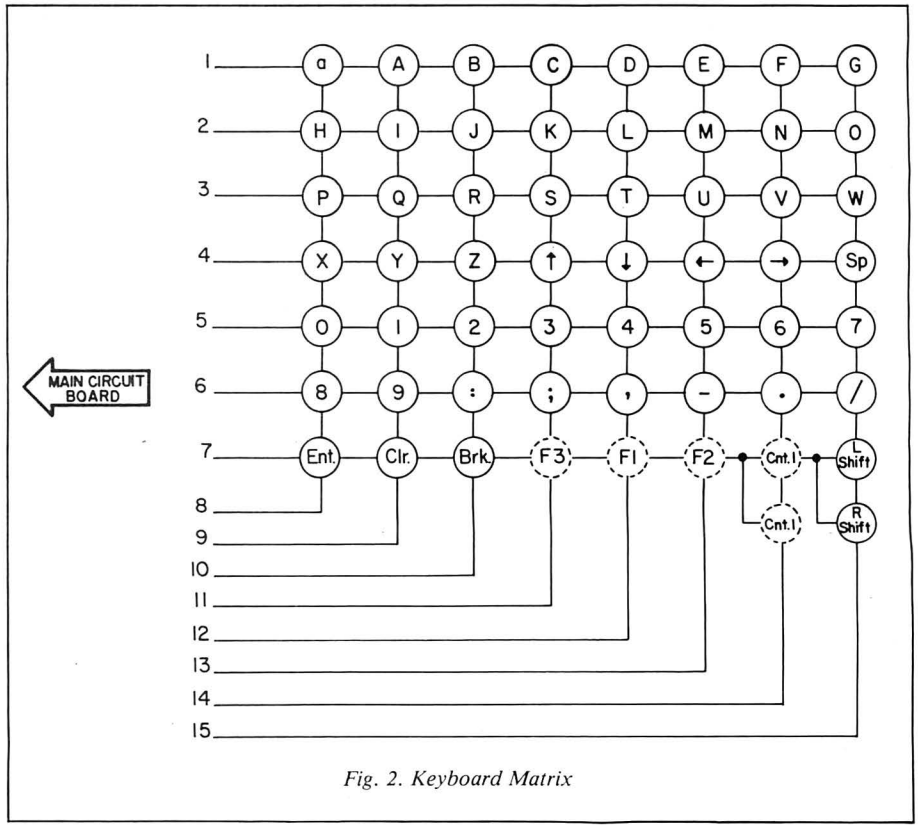


Fig. 2. Keyboard Matrix

Sabre Saw (fine blade)
Small Soldering Iron (pointed tip)
Screwdriver
Hammer
Hand Drill
Wire Stripper/Cutter
Needle-Nose Pliers
X-acto Knife
Finishing Nails

Wood Glue
Contact Cement
Super Glue
Epoxy Glue
20-Wire Ribbon Cable
16-Pin Female Connector
24-Gauge Insulated Wire
LED (optional)
100-Ohm Resistor (optional)

Table 2. List of Necessary Tools and Parts

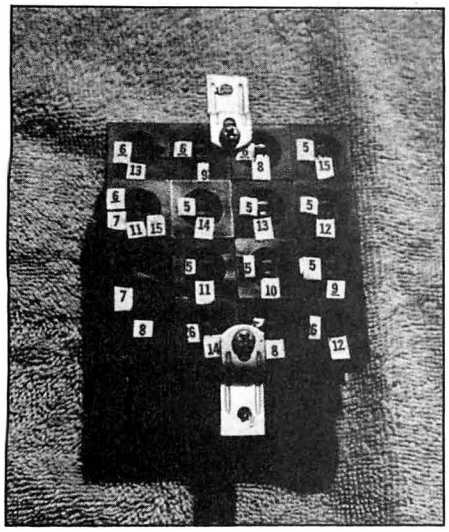


Photo 3. The Bare Numeric Keypad

Key	Basic Command Mode		Program Mode	
	Normal	Shifted	Normal	Shifted
F1	=	null	CHR$ 189	CHR$ 1
F2	g	4	g	4
F3	@	null	@	CHR$ 19
Control	null	V	CHR$ 4	CHR$ 214

Table 3. Program Function Keys

at this time. I also glued support posts at the ends and the middle of the cabinet to hold the bottom cover when it is installed. These posts should be cut to a height that will allow the bottom cover to fit flush.

As an alternative to constructing this cabinet, you may purchase a Model DTE-20 universal keyboard for $34.95 from Jameco Electronics (see Table 1). A third alternative is to mount the keyboard directly in place of the Color Computer keyboard. This requires some modification to the computer cabinet and, in my opinion, is not esthetically pleasing.

Wiring the Keyboard

Wiring the keyboard and numeric keypad is a simple task. You need a small soldering iron (20 watts) with a pointed tip, a wire stripper and cutter, and a pair of needle-nose pliers (see Table 2).

The Color Computer uses a row/column matrix to determine which key has been pressed. Figure 2 shows the key-assignment matrix. The five keys shown in dotted lines at the bottom right corner are the additional keys included on the Hitec keyboard.

Each key switch on the keyboard and the keypad is a single-pull, single-throw (spst) switch with two connections. One side connects rows of the matrix and the other side connects columns of the matrix. For example, the @ key and the letters A–G are connected to line 1, while the other side of each switch connects @, H, P, X, 0, 8, and the enter keys to line 8.

There are four unused positions in the key matrix, and the Hitec keyboard has five extra keys. I have assigned both keys labeled Control (adjacent to the space bar) to the same row and column (7,14).

You are now ready to begin wiring the keyboard and keypad. Photo 3 shows the bare keypad. You might want to use small pieces of masking tape to number the wires that you will connect to each switch.

Figure 3 shows the keyboard and keypad as you would view it while doing the wiring. I've annotated each key in the figure with the key label and the row and column wire number. Since you've got to make more than 150 connections, I recommend that you follow the procedures below:

1. Wire the keyboard first.
2. Begin with the lowest wire number.
3. Begin at the bottom of the board.
4. Work to the top of the board, one row at a time. For example, connect wire 1 from the B key to the C key to the A key, and so forth, for every key that uses wire 1.
5. When you have connected the last switch in the highest row, connect an 8-inch wire to this switch. Label the wire with the appropriate number.
6. Repeat this procedure for all 15 wires.
7. Follow steps 2–6 to wire the numeric keypad, but when you get to step 5, make the wire approximately 14 inches long.

(Note: Remember that wire numbers 1–7 always connect to the left side of the switch, and wire numbers 8–15 connect to the right side.)

When making the connections to the switches, use 24-gauge wire. Strip about ⅛ inch off the end of the wire and bend it into a small loop. Press the loop over a connection and crimp it with the pliers.

Solder it in place using a small amount of solder and as little heat as possible to prevent damage to the switch. Check each switch as you solder it, making sure that there is no contact between the two connections on each switch. This completes the wiring of the keyboard and keypad.

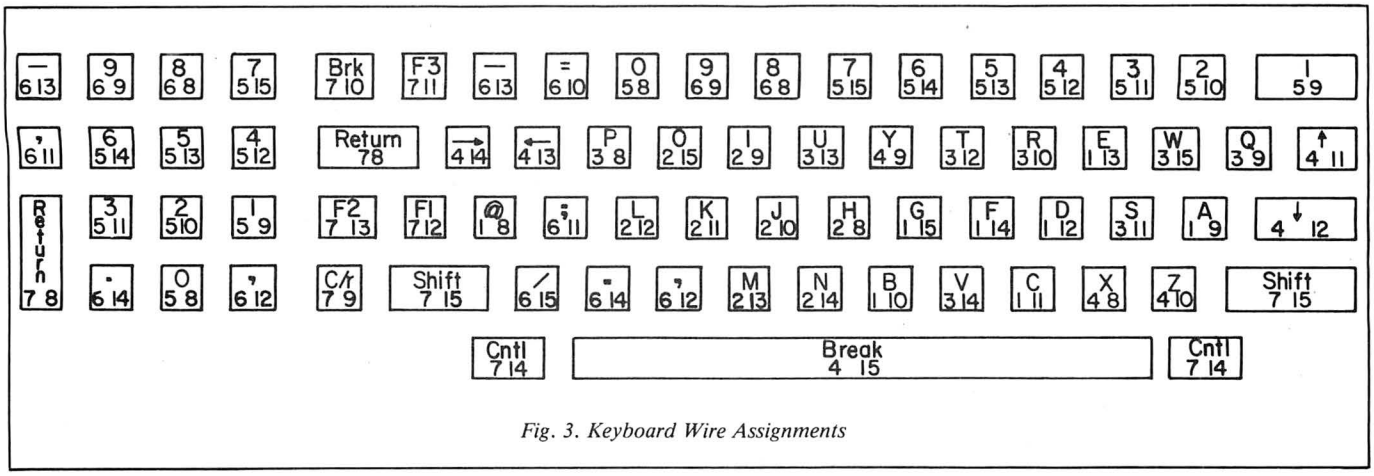


Fig. 3. Keyboard Wire Assignments

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Photo 4 illustrates the completed wiring on the keyboard.

Installing the Keyboard and Numeric Keypad

You are now ready to install the keyboard and numeric keypad into the cabinet. If you're using a commercial enclosure like the DTE-20, my instructions might only serve as a general guide in your installation.

If you want a power-on/off indicator, you should install it at this time. Very gently pry off the keycap marked "Caps Lock." Underneath you'll see two small holes that extend through the keyboard. Insert the RS 276-041 LED leads through these holes.

The LED base is round, except for one flat surface. Insert the LED with the flat side facing the shift key. Use a drop of Super Glue to hold the LED in place. Replace the keycap and press it a few times to make sure that the LED does not bind on the key.

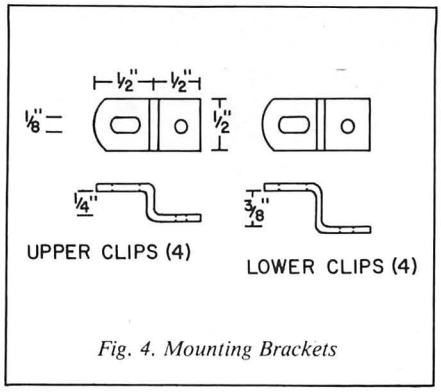

Fig. 4. Mounting Brackets

To secure the keyboard and keypad in the cabinet, you need to make eight mounting brackets (five for the keyboard and three for the keypad). I used some spare storm-window retainer clips, but you can make brackets from ½-inch strapping. Shape the clips as shown in Fig. 4.

The dimensions shown are approximate. You might have to experiment with shims to get the key height exactly where you want it. I adjusted my keyboard so that the bottoms of the keycaps were just below the surface of the top.

Photo 5 is a bottom view showing the keyboard and keypad in place and the placement of the mounting brackets. I affixed the brackets to the keyboard and keypad by using ¼-inch self-tapping screws and a coating of Super Glue.

Mount the brackets between adjacent key switches. Mark the locations of the screw holes and drill them just deep enough to penetrate the plastic surface of the keyboard. Use a drill bit that is slightly smaller in diameter than the self-tapping screws. Do not use screws longer than specified, as they could interfere with the key-switch mechanisms.

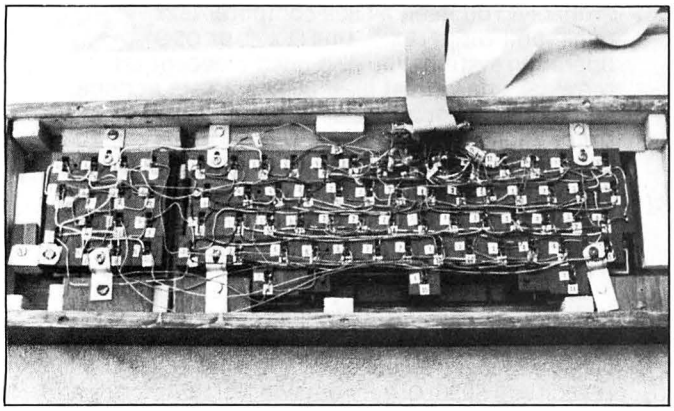

Photo 5. Position of Mounting Brackets

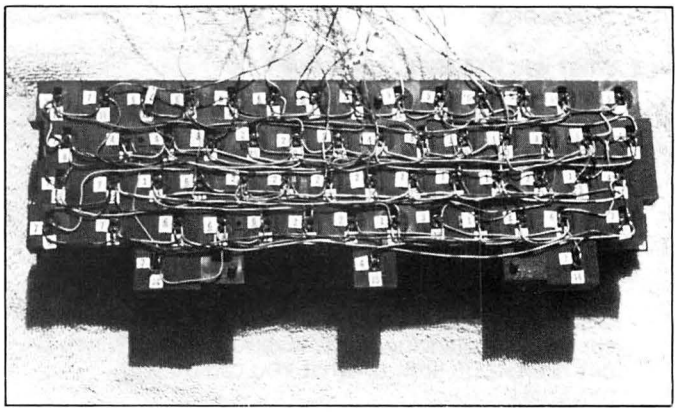

Photo 4. The Completed Wiring

Install the mounting brackets on the keyboard and keypad. Place the keyboard and keypad in the cabinet and check the fit. If everything fits as desired, you can fasten the components to the cabinet using ½-inch flat-head wood screws.

If the height is not exact, use shims to adjust it. Examine the mounted components to make sure that none of the brackets touch the key switch contacts or bare wires.

Final Wiring

You are now ready to begin the final wiring of the keyboard project. First, you must connect wires 5–15 on the keypad to the keyboard.

Starting with wire number 5, route the wire to a switch on the keyboard with the number 5 on it. Cut off any excess wire and strip the end. Make a loop on the end as described earlier, and solder it to the switch. Repeat this procedure for the remaining wires. Again, check your work to make sure that there are no shorts across the switch contacts.

Next, connect the keyboard to the ribbon cable. To do this you will need a small piece of 10-hole-to-the-inch perforation board, about 2 by 1 inches. Separate about 1½ inches of each wire of the ribbon cable. Strip about ⅛ inch off each wire and lightly coat it with solder.

Refer to the keyboard ribbon-cable drawing in Fig. 5 for the next procedure. Insert each wire in the cable through the top row of the perf board. Notice that you don't need wire numbers 3 and 4 nor hole number 7 on the perf board. If you want a power-on indicator, connect wire numbers 1 and 2 to the LED now.

Insert a 100-ohm resistor in the position shown in Fig. 5. Route the right end of the resistor as shown, and connect it to wire 2 of the ribbon cable. Place the perf board at the top center of the keyboard. Solder a wire from the lead of the LED nearest the shift key to the other end of the resistor.

Now connect a wire from the other lead of the LED to wire 1 of the ribbon cable. Cut any excess leads extending beyond the point at which you've attached the wires to the LED.

I added the perf board to relieve

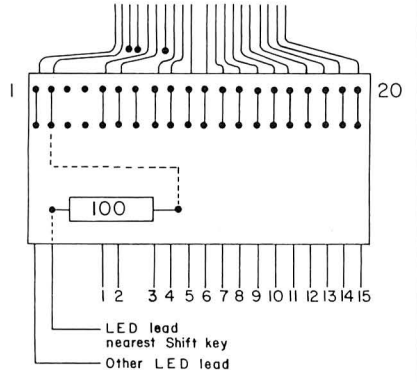

Fig. 5. Ribbon Cable Keyboard End

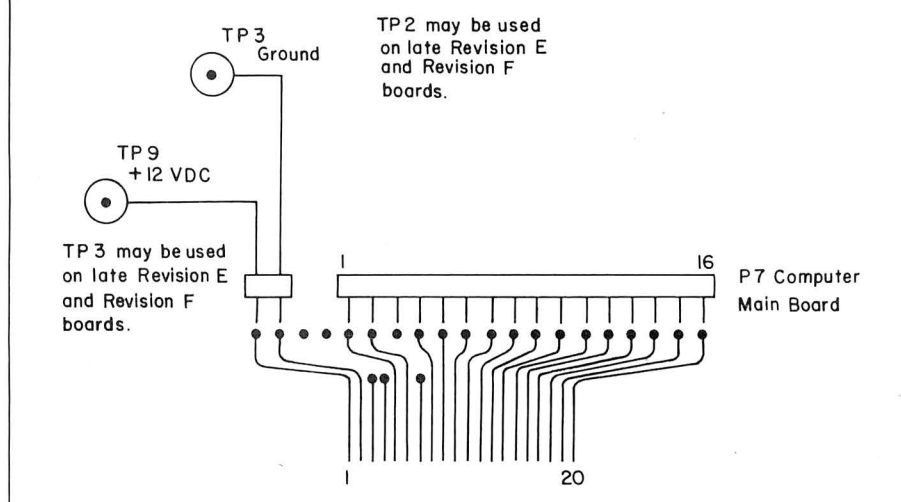

Fig. 6. Ribbon Cable Computer End

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any strain on the cable if it is pulled. With this board located at the top center of the keyboard, feed all wires connected between the keyboard and the ribbon cable through the bottom of the perf board and connect them on top of it. Cut off any excess wire.

Wires 1–15 from the keyboard connect to wires 5, 6, and 8–20 of the ribbon cable in that order, as shown in Fig. 5. I've reserved the unconnected wires 3 and 4 for later use, such as a reset switch.

After I checked out the keyboard, I coated the perf board solder connections with epoxy glue to prevent them from moving and perhaps causing a short circuit.

The wiring layout for connecting the ribbon cable at the computer connector is the same as the one you just finished. You will need a 20-pin female connector that is spaced 10 pins to the inch. I was unable to find one locally, so I used a 16-pin DIP socket that I cut in half for the connection to P7 on the computer.

Figure 11 shows the wiring for this connector. The ribbon-cable wires 5, 6, and 8–20 connect to pins 1, 2, and 4–16 of P7 on the main computer board.

You must also make a 2-wire connector to connect wire 1 to TP9 on the computer board and wire 2 to TP3. Use a push-on connector to attach the wires to the test points TP3 and TP9. Now you can hook up the keyboard for testing.

If your computer is a late revision-E or revision-F board, the test points for hooking up the power-indicator light might be different. TP3 is the +12 volts and connects to wire 1, and TP2 is the ground that connects to wire 2. Because of the many board configurations, I recommend that you check these test points with a voltmeter prior to using them.

There are also revision-F boards that do not have a removable cable between the keyboard and the main circuit board. Since I do not have access to a revision-F CoCo and cannot verify the procedure, I am reluctant to discuss the installation of the cable.

Test and Operation

Carefully check your wiring for shorts, particularly between the two contacts on the same switch and cold or unsoldered connections. If all looks well, you are ready to remove the existing keyboard and install the new one.

To remove the old keyboard, turn off all power to the computer. Turn the computer over and remove the seven screws holding the cover. Return the computer to the upright position and lift off the top cover. This exposes the keyboard.

If you look at the top middle section of the keyboard, you will see a ribbon cable that extends from the main circuit board to a point under the keyboard. You will also see a connector where the cable fastens to the computer. Very gently slide this connector back from the computer. Now you can remove the keyboard.

Connect the ribbon cable to P7 on the main board where you removed the old cable. The left side of P7 is marked 1 and the right side is marked 16. Wire 5 of the ribbon cable should line up with the number 1 and wire 20 should line up with 16. If you are using the power-on indicator, then connect wire 1 to TP9 and connect wire 2 to TP3. This completes the installation.

Turn the power on to the computer. You should see the normal sign-on message with the OK? prompt and a flashing cursor. If the screen displays any other characters, it indicates a short in the wiring.

The power-on indicator should also be lit at this time. If it is not, the most likely problems are improper wiring or a reversal of wires 1 and 2. If the LED glows faintly, you probably have a resistor with too high a value. If a short exists, correct it before continuing the test.

Type each character on the keyboard and numeric keypad. Each one should appear on the screen as you type it. If you get more than one character per key, then you've connected at least one key switch to another wire number.

The screen should display all displayable characters as you type them. If it doesn't, there is probably a missing connection or cold solder joint on that switch.

You should also test each key while pressing the shift key. Test the shift key with the zero key to make sure that the upper/lowercase switch works.

I've wired some new additions into this keyboard. The key marked "Tab" on the numeric keypad displays either a semicolon or a plus sign depending on the shift key. See Table 3 for a description of the added function keys.

I find that using the F1 key for the equal symbol when writing a Basic program is convenient. The values returned in Table 3 are valid for the Basic 1.1 ROM. To determine the values returned for the 1.0 ROM, use the following short routine:

```
10 A$=INKEY$
20 IF A$="" THEN 10
30 PRINT ASC(A$)
40 GOTO 10
```

The Basic keyboard handler (POLCAT) at address A1C1 hex does not know what to do with these new keys that you've added, so the routine returns the contents of the next eight memory locations at the end of the POLCAT lookup table.

Once everything is working properly, install a cover on the bottom of the keyboard. I also installed feet on the keyboard to tilt it. I hope you have as much fun constructing yours as I had with mine. ■

Address correspondence to Robert P. Bussell, 104 Barley Court, Lexington Park, MD 20653.

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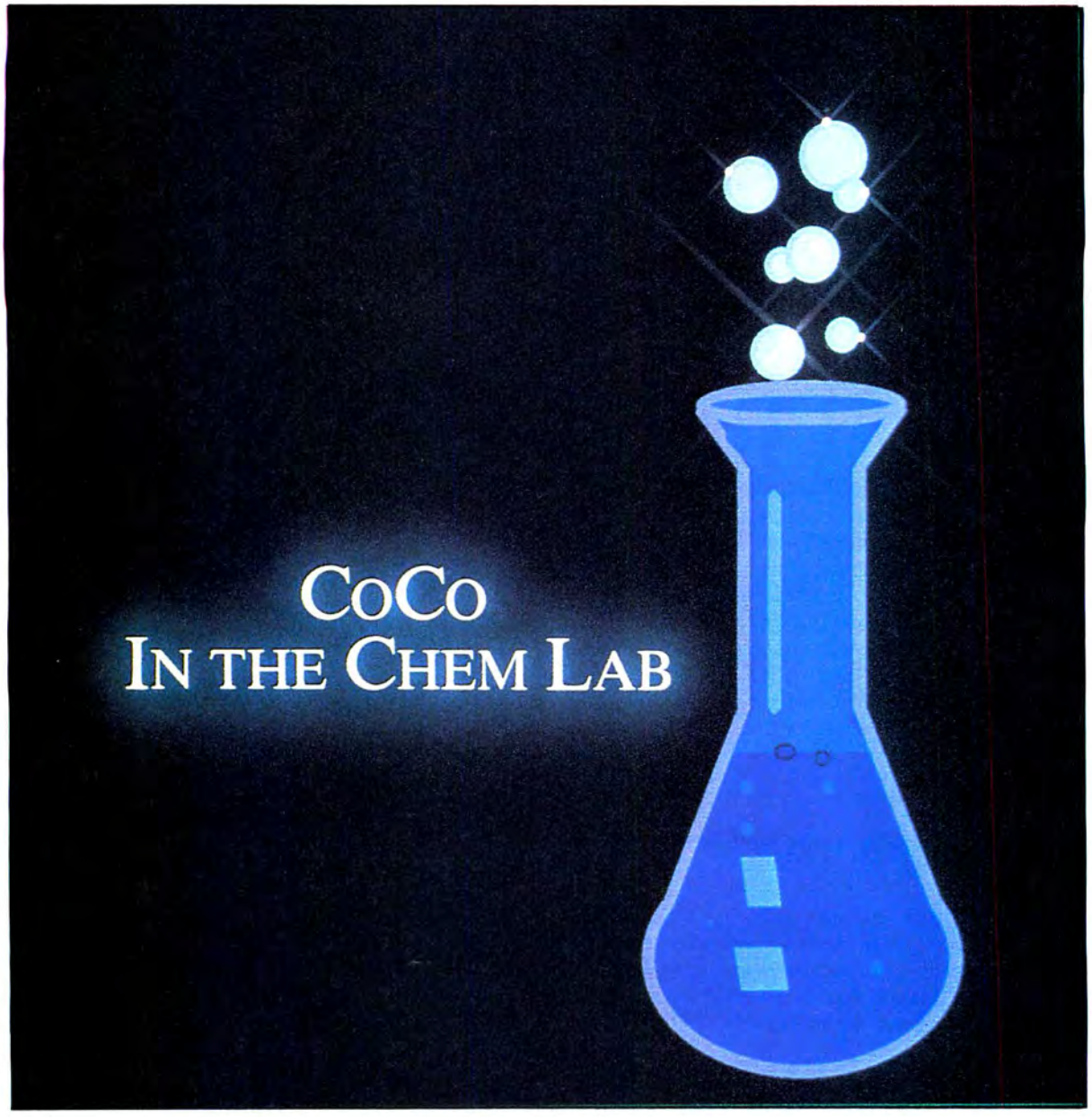
BY JAMES K. HARDY

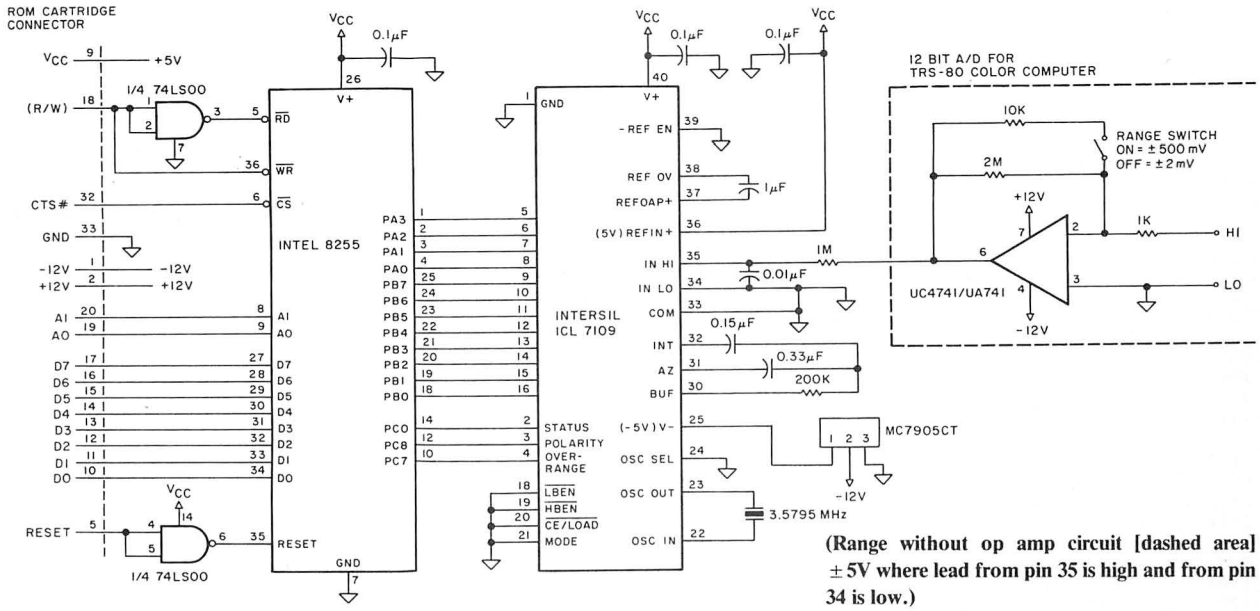


With this converter the Color Computer goes to work on experiments in analytical chemistry.

In the chemical laboratory computers and computerized instrumentation play an important role. Systems incorporated into modern equipment handle such routine functions as sampling, sample preparation, instrument control, and calibration, as well as data collection. Data interpretation, a job that often had to be handled manually or passed to a mainframe computer, can now be accomplished by an onboard unit.

As a result, students must know the fundamentals of computer use in data collection and interpretation.

Unfortunately, the costs associated with computerized instruments often preclude their use in the teaching laboratory. In fact, even if the equipment is available, it is often so good that the



(Range without op amp circuit [dashed area] ±5V where lead from pin 35 is high and from pin 34 is low.)

Fig. 1. Schematic for 12-Bit A/D Converter Board

student learns little more than what button to push to obtain the desired results.

I use a 16K Color Computer to expose students to the use of computers in the analytical chemistry laboratory. The unit's high-resolution graphics makes it particularly useful for data display. In this case, I use a color monitor and a Radio Shack Line Printer VII, though the printer is optional for the experiments subsequently developed.

The interface board designed for use in the laboratory program consists of an Intersil ICL 7109CPL, 12-bit A/D (analog to digital) converter and an Intel 8255 programmable peripheral interface (PPI). The board derives its power and reference voltages from the CoCo, and you install it by plugging it into the ROM cartridge connector.

The unit is designed to handle A/D conversions over a range of +/−5 volts at a continous rate of 7.5 conversions per second. Since the equipment to be interfaced to the system produced analog signals of either from 0–1 mV or −100 to +100 mV, I incorporated an operational amplifier. The board, including all other components, costs about $50 to construct.

Interface Construction

Figures 1 and 2 illustrate the schematics and board layout for the A/D interface. Table 1 lists all required parts. You can order them from any electronics dealer. The unit represents an adaptation of the one described by William Barden in his book *TRS-80 Model I, III, and Color Computer Interfacing Projects* (Howard W. Sams & Co. Inc.).

It makes use of a Vector 3719-1 DIP plugboard. By making a cut along the second column of holes and through the eighth pin area on each side of the board, and removing the pin areas, you produce a 40-pin connector that fits into the ROM cartridge connector. Figure 3 gives the resulting board pin numbering.

Operation

Once the board is inserted and the computer turned on, the unit represents four memory locations as shown in Table 2. You need only two address lines since any address from C000 through FFEF (hex) is directed to the ROM connector. Any call to these addresses also serves to make the CTS line (pin 32) from the CoCo go to logical zero, instructing the PPI that it is being ad-

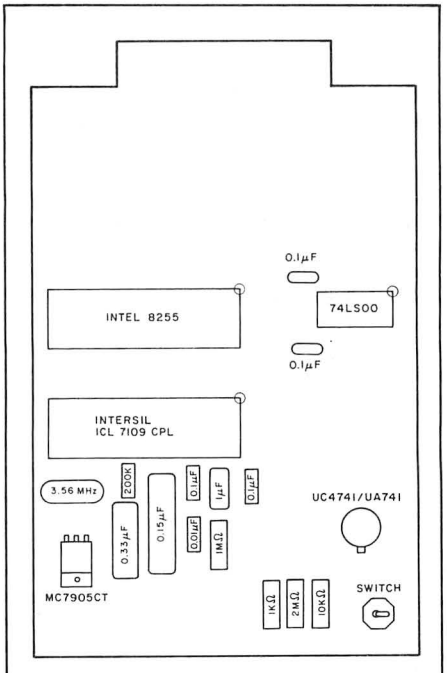


Fig. 2. Board Layout for 12-Bit A/D Converter board.

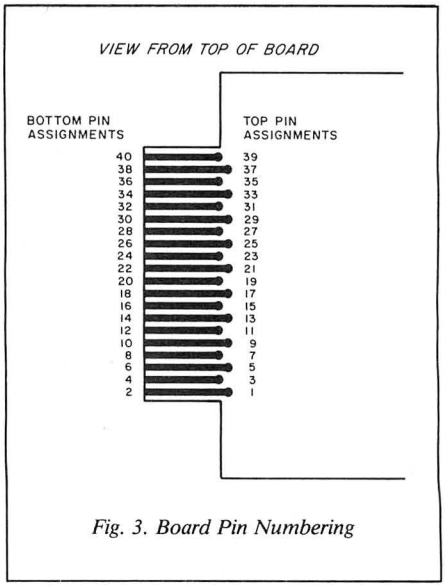


Fig. 3. Board Pin Numbering

System Requirements

16K RAM
Extended Color Basic

```
10 CLEAR:PCLEAR4:PMODE4:PCLS:DIM
A(300),PEAK(10,1):POKE&HC003,155
:LINE(0,180)-(255,180),PSET:LINE
(0,0)-(0,180),PSET:CLS
20 PRINT"GC INTEGRATOR":PRINT"NO
W ESTABLISHING BASELINE"
30 FOR I=1TO100:GOSUB530:A2=A2+X
40 IF X>A1 THEN A1=X
50 NEXTI:A=INT(A2/100):A1=(A1-A)
*2:IFA1<1THENA1=1
60 PRINT"INJECT SAMPLE THEN HIT
<ENTER>"
70 A$=INKEY$:IFA$=""THEN70
80 SCREEN1,1:TIMER=0
90 GOSUB530:IFT>=3000THEN140
100 IF A(T/10)<X THEN A(T/10)=X
110 IFX>1000THENX=1000
120 PSET(T/3000*256,180-.18*X)
130 GOTO90
140 FOR I=2TO297
150 IF A(I)>A1 AND A(I)>A(I-1) A
ND A(I)<A(I+1) AND A(I)<A(I+2) T
HEN 180
160 NEXTI
170 GOTO390
180 P=P+1:IFP>10THEN390
190 LINE(I/300*256,180)-(I/300*2
56,0),PSET
200 FOR J=I TO 297
210 PEAK(P,0)=PEAK(P,0)+A(J):IFA
(J)>1000THENX=1000ELSEX=A(J)
220 IFA(J-1)>1000THEN X1=1000ELS
EX1=A(J-1)
230 LINE((J-1)/300*256,180-.18*X
1)-(J/300*256,180-.18*X),PSET
240 IF A(J)>A(J+3) AND A(J)>A(J+
2) AND A(J)>=A(J+1) THEN 270
250 NEXTJ
260 GOTO390
270 PEAK(P,1)=INT(J/.6)/100:Q=IN
T(J/300*256)
280 FOR K=J+1TO 298
290 IF A(K)>1000THENX=1000ELSEX=
A(K)
300 IF A(K-1)>1000THENX1=1000ELS
EX1=A(K-1)
310 LINE((K-1)/300*256,180-.18*X
1)-(K/300*256,180-.18*X),PSET
320 IF A(K)<=1 THEN 340
330 IF A(K+3)<A(K) AND A(K+2)<=A
(K) AND A(K+1)<=A(K) AND A(K-1)>
=A(K) THEN PEAK(P,0)=PEAK(P,0)+A
(K):GOTO360
340 LINE (K/300*256,180)-(K/300*
256,0),PSET
350 GOTO 380
360 NEXT K
370 GOTO 390
380 PAINT (Q,179),1,1:I=K+1:GOTO
150
390 FOR M=130TO150:SOUNDM,1:NEXT
M
400 A$=INKEY$:IFA$=""THEN400
410 CLS:PRINT"RESULTS":PRINT"RT
(MIN)","AREA"
420 FORI=1TOP:PRINTPEAK(I,1),PEA
K(I,0):NEXT
430 PRINT"TOUCH <1> TO RERUN"
440 PRINT"       <2> TO GET PRINT
OUT"
450 A$=INKEY$:IFA$="1"THEN GOTO1
0
460 IF A$<>"2"THEN450
470 PRINT#-2,"CHROMATOGRAPHIC RE
SULTS"
480 PRINT#-2,"PEAK#","RT (MIN)",
"AREA"
490 FOR I=1TO P
500 PRINT#-2,I,PEAK(I,1),PEAK(I,
0)
510 NEXTI:PRINT#-2:PRINT#-2
520 GOTO 10
530 B=PEEK(&HC002):C=PEEK(&HC000
)*256+PEEK(&HC001):T=TIMER/6
540 IF B=0THEN C=2100-C:GOTO 570
550 IF B=32THEN C=C+2100:GOTO 57
0
560 GOTO 530
570 X=C-A
580 IF X<0THEN X=0
590 RETURN
```

Program Listing 1. GAS

dressed. The R/W line (pin 18) instructs the chip if a read or write is to be done.

Prior to using the board, the PPI must be initialized to establish how the three registers (A, B, and C) are to be used. In this case, a POKE 49155, 155, or POKE &HC003, 155 instructs the PPI that all three registers are to be used as inputs.

This initialization must be done every time you turn on or reset the computer. You can find a more complete description of the operation and various modes for the Intel 8255 PPI in P.F. Goldsbrough's *Microcomputer Interfacing With the 8255 PPI Chip* (Howard W. Sams & Co. Inc.).

Once you have selected the operating range (switch on = +/−2 mV, switch off = +/−500 mV or +/−5 V if no op amp is installed) you can read the signal by PEEKing addresses 49152 (4 most-significant bits) and 49153 (8 least-significant bits).

Recombine the 12 bits to produce a decimal number by X = PEEK (49152)*256 + PEEK(49153). However, as designed, values of 0–2,048 counts will be obtained based on magnitude alone. As a result in the +/−500 mV range both +250 and −250 mV result in the same value (1,023 counts). To account for signal polarity, register C (address 49154) must also be read.

A value of zero indicates a positive signal where a value of 32 indicates that it is negative. The overrange and status lines are also incorporated into the C register. As a result, values greater than 127 indicate that the signal is outside the range of the converter, and values of one or 33 indicate that the A/D converter is in the process of updating the registers. The *Intersil Databook* (Intersil Inc., 10710 N. Tantau Ave., Cupertino, CA 95014) gives more information regarding the various signals that the ICL 7109CPL produces.

In order to obtain the 0–4,095 count full-scale range, use the following subroutine when reading data:

```
1000 Y = PEEK(49154):X = PEEK(49152)*
256 + PEEK(49153)
1010 IF Y = 0 THEN X = X + 2048 : GOTO 1040
1020 IF Y = 32 THEN X = X − 2048 : GOTO
1040
1030 GOTO 1000
1040 RETURN
```

You can use this subroutine when overrange values are not expected, and it prevents reading a value when the registers are being updated. If overrange values are possible then add:

```
1005 IF Y >= 128 THEN PRINT" SIGNAL
OVERRANGE ":STOP
```

As some data sampling is time dependent, you can use the TIMER function:

```
1040 T = TIMER:RETURN
```

The value, T, will be in 1/60-second in-

ICs

1	Intel 8255 programmable peripheral interface
1	Intersil ICL 7109CPL 12 bit A/D converter
1	74LS00 TTL high-speed Positive NAND gate
1	UC4741/UA741 single op amp

Resistors (1/4 watt, 5 percent)

1	2M ohm
1	1M ohm
1	200k ohm
1	10k ohm
1	1k ohm

Capacitors

1	0.01 microfarad
3	0.1 microfarad
1	1 microfarad
1	0.15 microfarad (mylar)
1	0.33 microfarad (mylar)

Misc.

1	MC790CT voltage regulator
1	3.5795 MHz TV crystal
1	Vector 3719-1 DIP plugboard
1	14-pin IC socket
2	40-pin IC socket
1	SPST switch

Table 1. Parts List

Memory Location

Hex	Decimal	Value
C000	49152	4 most-significant bits from A/D converter (Register A)
C001	49153	8 least-significant bits from A/D converter (Register B)
C002	49154	Register C—Contains values for polarity status and overrange
C003	49155	PPI control register

Table 2. Memory Location Assignments

↙ See List of Advertisers on page 131

crements, and you can easily convert it to seconds or minutes. Prior to using this function, a TIMER = 0 must be given at the start of a time-dependent experiment.

Our chemistry department uses two laboratory experiments using this system. We use one as an integrator for the collection and interpretation of gas chromatographic data, and the other for the potentiometric titration of a weak acid. Both experiments use programs written in Extended Basic and operate using less than 16K of memory.

Chromatographic Integrator

Gas chromatography is a method used for the determination of volatile substances. With this technique, the sample mixture is converted to a gas and forced to travel through a column using an inert gas flow.

Each component travels down the column at different rates based on various chemical and physical properties. At the end of the column, each substance passes through a detector, producing a signal. Each component results in a Gaussian-shaped peak to be produced when the detector response versus time is displayed.

The area under the peak is proportional to the amount of the component present, and the apex of the peak (in units of time) indicates which substance it is. By comparison to a standard mixture, you can identify the peaks and determine the percentage of each substance.

Program Listing 1, GAS, is used in conjunction with a Varian Model 1200 gas chromatograph equipped with a column capable of separating alcohols, though any similar system will work. As the unit produces analog signals from 0–1 mV, the +/−2 mV range is set on the board.

The student is given a known and an unknown mixture of three alcohols (methanol, ethanol, and propanol) to separate. After initially establishing the instrument's baseline, the program instructs him to inject his sample.

The computer then collects and displays the data. No attempt at interpretation is made at this point. The values are simply stored in an array as a function of time (to the nearest second).

At the end of the analysis (set at five minutes) the program locates each peak, determines its area and retention time (the apex of each peak) in minutes, and fills in the peaks to highlight them. As many as 10 peaks will be searched for, though only three should be present, and you can add the ability to search for additional peaks.

A tone sounds when interpretation is completed. Touching any key results in the retention times and areas for each peak being displayed. The student is then responsible for the necessary calculations. Figure 4 represents data for a typical separation.

The results obtained are comparable to those obtained from a commercial integrator. The program works well for samples requiring short analysis times. While the time of analysis has been set for five minutes, it could readily be increased up to 18 minutes. Beyond this, the timer rolls over.

Potentiometric Titration Of a Weak Acid

You can characterize many pure weak acids by titration with a strong base and monitoring the solution acidity with a pH electrode. This electrode produces an electrical response proportional to the concentration of the hydrogen ion in solution.

"The results obtained are comparable to those obtained from a commercial integrator. The program works well for samples requiring short analysis times."

During the titration of a weak acid, the pH (− log of the hydrogen ion concentration) slowly rises for most of the titration. Near the end of the titration, there is a sudden jump in pH followed by another slow rise. The point where the change in pH versus ml base added is the largest corresponds to the endpoint of the titration.

If you know the concentration of the base and the mass of the acid, you can calculate the equivalent weight. Also, once you find the volume required for complete titration, you can determine the pKa as it is the pH of the solution at 50 percent titration. You can then use the two factors to identify an unknown acid from a list.

In this experiment, the computer obtains its signal from a Corning Model 125 pH meter, but you can use any brand. The meter produces a signal of from −100 to +100 mV for pH values of from 0–14, so the switch on the board is set to the +/−500 mV range.

The student first standardizes the unit using two solutions of known pH, and then titrates an unknown acid with a solution of sodium hydroxide (a strong base) of known concentration. He adds a small amount of base, telling the computer how much has been added, and the computer reads the pH and displays the results. This process repeats.

As the titration proceeds, a titration curve is produced on the screen. The accuracy of this type of titration is a function of how many data points are obtained just before and after the endpoint. This is accomplished by reducing the amount of base added in this area. Since the student can actually see the curve as it is produced, he knows when to begin using smaller volumes.

After adding a total of 50 ml (or less at the student's discretion) the program locates the titration endpoint, calculates

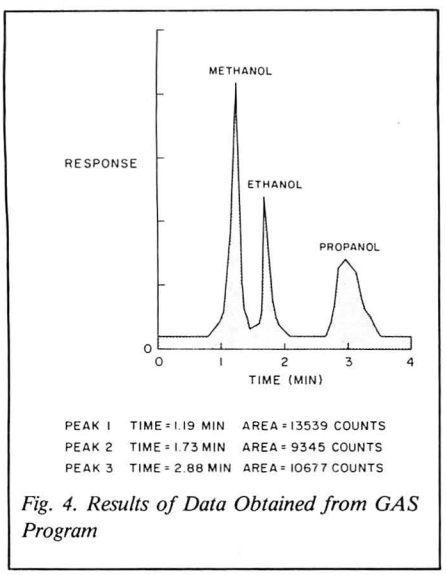


Fig. 4. Results of Data Obtained from GAS Program

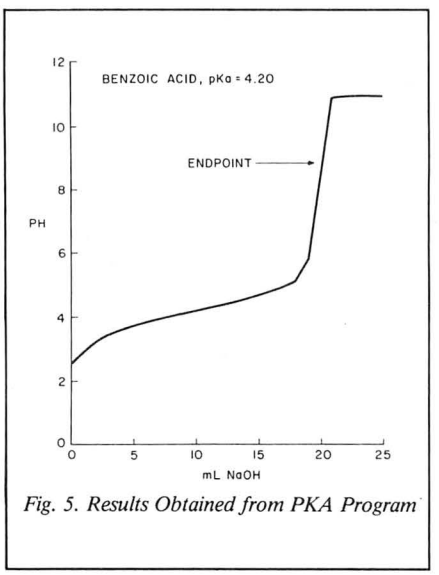


Fig. 5. Results Obtained from PKA Program

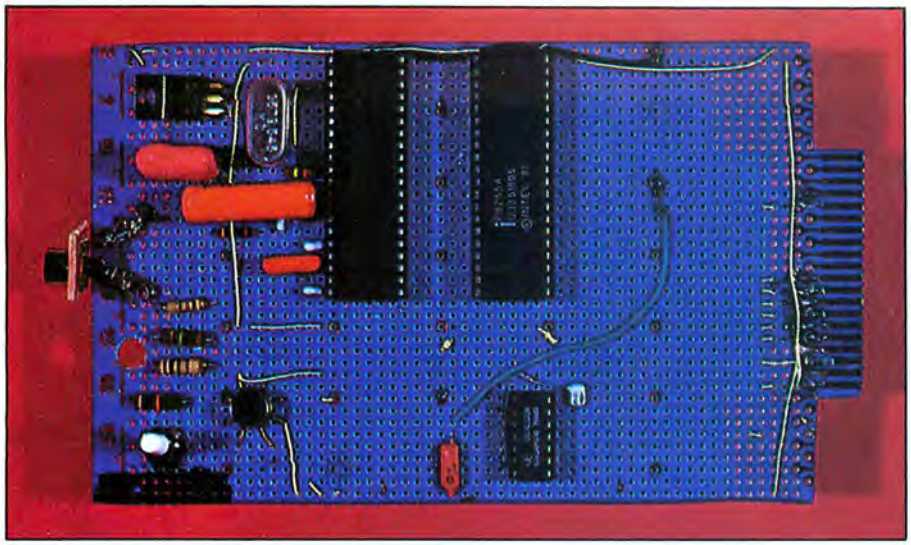


Photo. An Assembled 12-Bit A/D Converter Board

the pKa and equivalent weight for the acid, and produces a printout. The results obtained are actually better than when the student does the experiment without the computer. (See Program Listing 2, PKA.)

After a semester of evaluation with 50 students, response has been good. In fact, they would rather use the CoCo-interfaced gas chromatograph than the unit equipped with a $2,400 commercial integrator. The major complaint has been that only two computer-assisted experiments are available to date. ■

Address correspondence to James K. Hardy, Department of Chemistry, The University of Akron, Akron, OH 44325.

```
10 CLEAR:PCLEAR4:PMODE4:PCLS:CLS
:DIMA(500)
20 POKE 49155,155
30 PRINT@96,"POTENTIOMETRIC TITR
ATION"
40 A$=INKEY$:IF A$=""THEN40
50 CLS:PRINT"CALIBRATION SECTION
"
60 PRINT"PLACE THE PH ELECTRODE
IN THE    BUFFER INDICATED.  USE
PH=2      BUFFER TO ADJUST PH MET
ER."
70 FOR I=1 TO 4:READX:PRINT"PUT
ELECTRODE IN PH=";X;"BUFFER"
80 INPUT"HIT <ENTER> WHEN READY"
;A$:FOR J=1TO 50
90 GOSUB 1110
100 A(I)=X
110 NEXT J:A(I)=A(I)/50
120 NEXT I
130 DATA 2,10
140 S1=((A(1)*2+A(2)*10)-6*(A(1)
+A(2)))/32
150 Y1=((A(1)+A(2))-S1*12)/2
160 PRINT"CALIBRATION VALUES":PR
INT"PH","RESPONSE"
170 RESTORE:FORI=1TO2:READ X:PRI
NT X,A(I):A(I)=0:NEXT I
180 INPUT"HIT <ENTER> TO CONTINU
E";A$
190 CLS:INPUT"ENTER YOUR SAMPLE
NUMBER";SN$
200 INPUT"ENTER SAMPLE MASS IN G
RAMS";MASS
210 INPUT"ENTER NORMALITY OF NAO
H";NAOH
220 INPUT"ENTER YOUR NAME";NM$
230 INPUT"PREPARE YOUR SAMPLE AN
D HIT      <ENTER> TO BEGIN";A$
240 LINE(12,40)-(12,180),PSET:LI
NE(12,180)-(212,180),PSET
250 FOR I=40 TO 180STEP10:PSET(1
0,I,1):PSET(8,I,1):NEXTI
260 FORI=12TO212STEP20:PSET(I,18
2,1):PSET(I,184,1):NEXTI
270 ML=0
280 A(ML)=0
290 GOSUB 1110
300 A(ML)=(X-Y1)/S1
310 PSET(12+ML*.4,180-A(ML)*10,1
):SCREEN1,1
320 IF ML>=500 THEN 530
330 A$=INKEY$:IF A$=""THEN330
340 CLS:PRINT"MILLILITERS USED="
;ML/10
350 PRINT"PH AT LAST READING=";I
NT(A(ML)*100)/100
360 PRINT"DO YOU WISH TO :"
370 PRINT"  <R>EREAD LAST VALUE"
380 PRINT"  <D>ELETE LAST VALUE"
390 PRINT"  <E>NTER A NEW READIN
G"
400 PRINT"  <S>TOP TITRATION"
410 PRINT:PRINT"TOUCH APPROPRIAT
E LETTER"
420 A$=INKEY$:IF A$=""THEN420
430 IFA$="E"THEN490
440 IFA$="D"THEN480
450 IFA$="R"THENPRESET(12+ML*.4,
180-A(ML)*10):GOTO290
460 IF A$="S"THEN530
470 GOTO 410
480 PRESET(12+ML*.4,180-A(ML)*10
)
490 CLS:PRINT"ADD ADDITIONAL NAO
H AND ALLOW   TO MIX"
500 INPUT"ENTER NEW ML VALUE";ML
:ML=ML*10
510 IF ML>500THENGOTO500
520 GOTO 280
530 CLS:PRINT"DATA ANALYSIS SECT
ION"
540 PRINT"A TONE WILL SOUND WHEN
 THE      ANALYSIS IS COMPLETE.
 AT THAT  TIME, TOUCH ANY KEY FO
R THE     FINAL RESULTS."
550 PRINT"HIT <ENTER> TO START"
560 A$=INKEY$:IF A$=""THEN560
570 SCREEN 1,1
580 TEST=0:FORI=0TOML:J=I+1
590 IF A(J)=0THENJ=J+1:IF J>=500
 THEN 640 ELSEGOTO590
600 IF (A(J)-A(I))/(J-I)>TEST TH
EN TEST=(A(J)-A(I))/(J-I):M1=I:M
2=J
610 LINE (12+(I)*.4,180-A(I)*10)
-(12+(J)*.4,180-A(J)*10),PSET
620 I=J-1:IF I>=500 THEN 640
630 NEXT I
640 ML=(M1+M2)/20
650 EW=MASS/(ML/1000*NAOH)
660 ML=ML*10
670 EP=(A(M1)+A(M2))/.2
680 LINE (ML*.4,180-EP)-(24+ML*.
4,180-EP),PSET
690 EW=INT(EW*100)/100
700 IF A(ML)>0THEN760
710 ML=ML/2
720 M1=ML:M2=ML
730 IF A(M1)=0THENM1=M1-1:GOTO73
0
740 IF A(M2)=0THEN M2=M2+1:GOTO7
40
750 PKA=(A(M1)+A(M2))/2:ML=(M1+M
2)/2:GOTO 770
760 PKA=A(ML)
770 LINE(12,180-PKA*10)-(12+ML*.
4,180-PKA*10),PSET
780 SOUND 100,5:SOUND200,8:SOUND
 50,3
790 A$=INKEY$:IF A$=""THEN790
800 CLS:PRINT"FINAL RESULTS"
810 PRINT"OPERATOR :";NM$
820 PRINT"SAMPLE NUMBER :";SN$
830 PRINT"EQ. WT. :";EW;" G/MOLE
"
840 PKA=INT(PKA*100)/100
850 PRINT"PKA :";PKA
860 PRINT"TURN ON PRINTER THEN H
IT <ENTER>"
870 A$=INKEY$:IF A$=""THEN870
880 SCREEN 1,1
890 PRINT#-2,"REPORT FORM.  POTE
NTIOMETRIC TITRATION."
900 PRINT#-2,"OPERATOR :";NM$
910 PRINT#-2,"SAMPLE NUMBER :";S
N$
920 PRINT#-2,"EQ. WT. :";EW;"GRA
MS/MOLE"
930 PRINT#-2,"PKA :";PKA
940 PRINT#-2,"ACID FOUND.......
......................"
950 COUNT=10
960 PRINT#-2,"ML","
          PH"
970 PRINT#-2,"  ","0
          7
         14"
980 PRINT#-2,"  ","-------------
-------------------------------
-----------"
990 FOR I=0TO490 STEP 10
1000 IF COUNT<10THEN PRINT#-2,"
 ",ELSE PRINT#-2,I/10,:COUNT=0
1010 EE=0
1020 FOR DD=0TO9:IF A(I+DD)>EE T
HEN EE=A(I+DD)
1030 NEXT DD
1040 A$=""
1050 IF EE=0THENPRINT#-2,":":GOT
O 1080
1060 FOR J=0TO EE*4:A$=A$+" ":NE
XTJ
1070 PRINT#-2,":";A$;"*"
1080 COUNT=COUNT+1
1090 NEXT I
1100 CLS:PRINT"THAT'S ALL FOLKS.
.........":END
1110 Y=PEEK(49154):X=PEEK(49152)
*256+PEEK(49153)
1120 IF Y=0THENX=X+2048:GOTO 115
0
1130 IF Y=32 THEN X=X-2048:GOTO
1150
1140 GOTO 1110
1150 RETURN
```

Program Listing 2. PKA

BY PHILIP MCLAUGHLIN

ARE THE STARS RANDOM?—PART I

A simple point-setting routine leads to some powerful, mainframe-like problem-solving techniques.

The depth and detail of stars in a clear sky challenge the imagination. Man has long perceived patterns, from simple crosses and lines to outlines of people and animals. The system of astrology categorizes still higher-order patterns. More abstractly, so does astronomy. For similar reasons, setting points at random on the computer screen is one of the easiest, most effective forms of computer graphics.

It can be done on just about any small computer. Moderate resolution such as the 255-by-192-point mode of the Color Computer brings out subtle aspects of the pattern.

```
10 PMODE 4,1: SCREEN,1
20 PCLS
100 PSET (RND(255),
RND(192))
110 GOTO 100
```

A display generated by one of these

routines evokes questions. First, how is the distribution of points on the screen similar to the distribution of stars?

If the random-number generator is smooth, the pattern on the screen is more evenly distributed than the stars, which are arranged in clumps and clusters. How can you alter the screen routine to better demonstrate the clustering of stars in the real universe?

Those who solve problems in terms of physical forces might assign mass to each point on the screen and calculate gravitational forces. Applying Newton's equation to each pair of stars, this is not difficult to set up.

```
FORCE = MASS/(DISTANCE * DISTANCE)
```

The position of each star is altered according to the total (resultant) forces imposed by the others. Doing this calculation repeatedly for every possible pair is the Numerical Method of Classical Physics.

Calculating forces works fine for a handful of stars, but when thousands are involved, running time for the program could amount to years. Another problem with force-type calculations is that values go to infinity when the points get close together. This is not realistic.

Fortunately, the random-point-setting routine suggests another line of attack. Discard any preconceived causes and look at the stars and the points on the screen.

If the random-number generator were extremely smooth (well distributed) and completely random, the probability of a point being set would be exactly the same at any place on the screen. A probability map of the screen field would be totally flat.

A similar analysis of a picture of the night sky, however, gives different results. *The probability that a star will be found in a certain part of the sky is related to the nearness of other stars to that place.* This suggests that you can alter the point-setting routine to place new stars nearer to preexisting stars.

Photo 1. Random Distribution

Photo 2. Clustered Distribution

A Prejudiced Distribution

You can do this a number of ways. The positions of the preexisting stars can be stored in an array or buffer. A convenient number that doesn't take up too much memory in a 16K computer is 1,000. In Program Listing 1, the X horizontal positions are stored in memory bytes 14000–14999 and the Y coordinates from 15000–15999.

Given this array of initial positions, you want to, in a random manner, introduce new positions derived from it. First a loop begins:

```
1210 FOR SR = 1TO1000
```

Then you might pick one of the preexisting positions at random (the NB = RND(1000) in line 1216). From this value, NB between 1 and 1000, pointers are derived to a pair of coordinates in the array.

```
1220 NX = 14000 + NB
:NY = 15000 + NB
```

System Requirements

16K RAM
Extended Color Basic
Graphics Printer (optional)
Disk Drive (optional)

Calculate a new position by taking a random angle and distance from the old one. First an angle:

```
1305 AN=RND(360)
```

And then a distance:

```
1410 DS=RND(65315)
```

Because you want near distances to be more likely than far ones, you weight the value of DS.

```
1420 DS=RG*255/SQR(DS)
```

The maximum screen width is 255, and RG is an interaction radius that you can adjust in the program. Line 1420 approximates Newton's Inverse Square Law in a probabilistic manner. Note too that there are many ways to weight the distance that do not involve extracting a square root.

At this point you have an old position in Cartesian (X,Y) coordinates, and an offset from it in the form of an angle and a distance (polar coordinates). Next comes a polar-to-Cartesian conversion.

```
1510 XX=DS*COS(AN)
1520 YY=DS*SIN(AN)
```

After conversion the offset is added to the old position.

```
1550 X=XX+PEEK(NY)
:Y=YY+PEEK(NY)
```

You can POKE the newly derived positions into the array (not necessarily in the same place as the old) and display them on the screen.

```
1710 POKE 14000+SR,X
:POKE 15000+SR,Y
1810 PSET(X, Y)
```

Then loop back to randomly change another position.

```
1899 NEXT SR
```

This routine is included in Program Listing 1, Stars. You can run it as option 1 (Formation of Clusters from Random Distribution).

Within minutes the screen distribution is uneven. In half an hour, the equivalent of millions of years in the formation of star clusters passes. This statistical method does not follow the path of any particular star, but it calculates general properties of large aggregates in as many hours as other methods might in months.

As the patterns evolve, their shapes often suggest objects in the night sky. Some shapes seem more stable than others, and many clusters are globular or elliptical. Most are elongated.

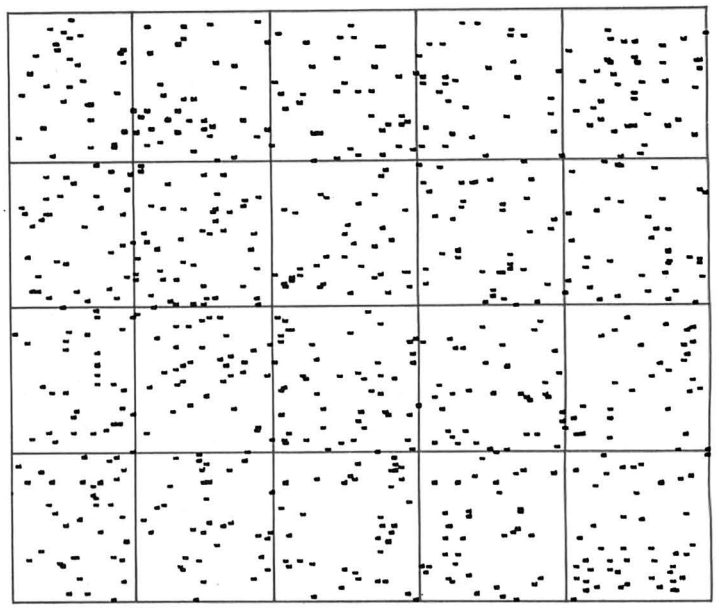


Fig. 1. Random Distribution, Generation 0

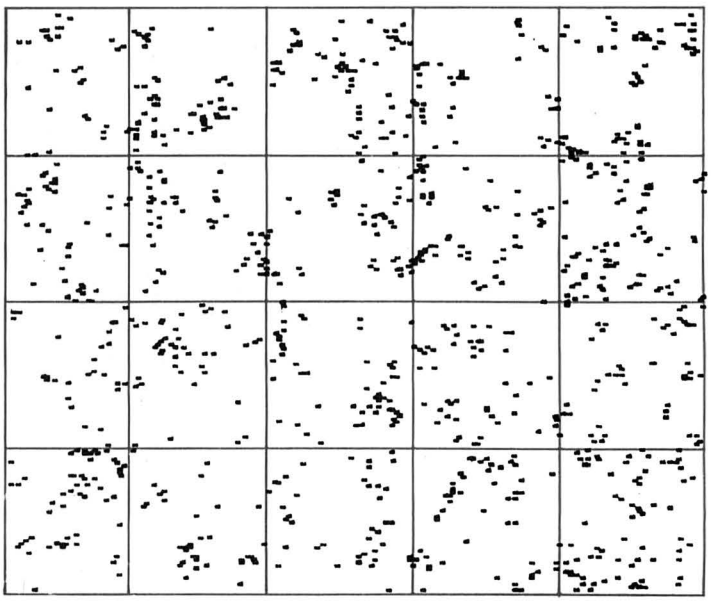


Fig. 2. Random Distribution, Generation 1

After the clusters stabilize, they might grow or shrink or seem to move across the screen. One important aspect of this routine is that it works on a limited number of points. When a certain number of stars have been plotted, an old star must die for a new star to be born. Real stars are constantly dying and being born, and star clusters lose and gain members.

The clusters on your screen experience net gains at the leading edges and net losses at the trailing edges. Sometimes a local concentration or subcluster seems to drift off, leaving a trail as it moves through space.

Cluster Analysis

If you look for any particular formation long enough, you will probably see it. Theoretically, any configuration of points is possible although many are unlikely. This is similar to watching the shapes of the clouds. Any shape is possible, but statistics favor some general types.

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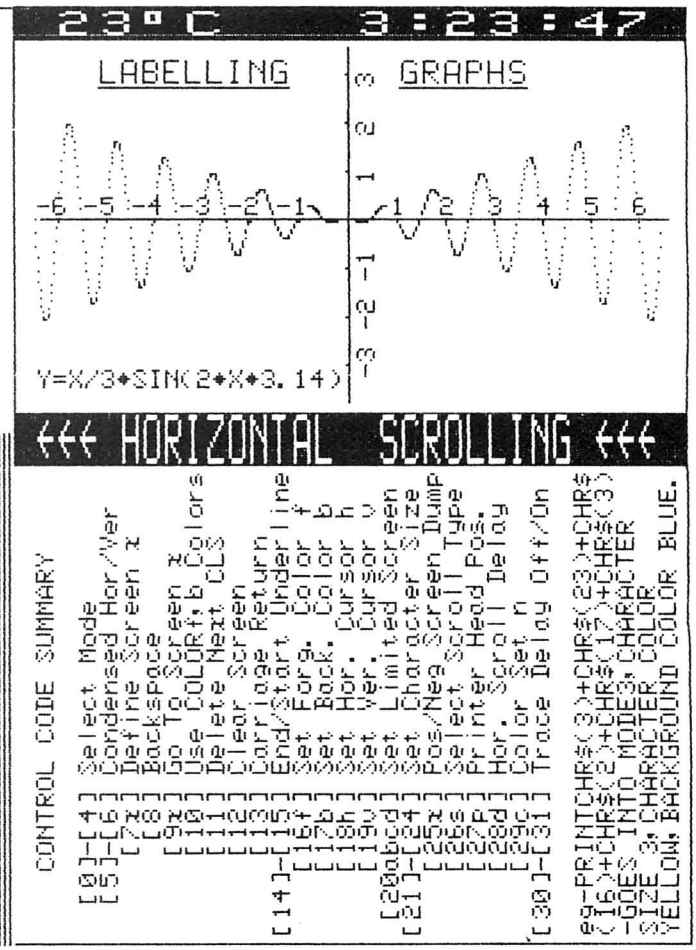

↙ See List of Advertisers on page 131

Patterns you see are due to any of the following:

- imagination,
- spurious artifacts in the pseudo-random-number generator,
- statistically unlikely configurations (flukes happen constantly), and
- *genuinely stable or statistically favored distributions.*

Subjective descriptions such as swirly blob leave something to be desired as a basis for analysis, so Cluster Analysis, a mathematical discipline, is used to count them; describe their shapes, sizes, and distributions; and keep track of their movements and changes.

The program here outputs data to disk in a form that can be processed by such routines. The math of Cluster Analysis is usually simple and repetitious, since it is based on procedures such as finding weighted centers of gravity and establishing density contours.

The results of cluster analysis depend on parameters of the routines and can be controversial.

Variations

By changing the parameters of the simulation it is possible to study other phenomena. For example, the initial points might be at one or more fixed locations instead of distributed randomly across the screen. The program option 2, Growth from Fixed Points, sets things up in such a manner. In this case, instead of seeming to clot or condense, the distributions grow from two preset locations.

At first, you see two tight, globular clusters. After another generation (iteration loop) or so, these have spread and changed to look like miniature galaxies. Although there are only 1,000 stars in this demonstration, features such as the dense, elliptical central nucleus, a diffuse outer halo of stars, and a tendency to form subclusters or satellite galaxies, approximate real galaxies.

At this stage of the demonstration spiral arm structures appear. With a limited number of points computed, these are probably due to cyclical patterns in the pseudo-random-number generator. Given more stars and a longer period of time in the simulation, would such structures be statistically favored?

Monte Carlo Methods And Lattice Structures

Monte Carlo methods in computer science are similar to statistical sampling methods that might be used in taking a national opinion poll. Instead of

```
0 'ARE THE STARS RANDOM?'  HOT C
OCO VERSION
1 CLS:PRINT"RUN AGAIN":PRINT"COL
DSTART COMPUTER IN CASE OF   TRO
UBLE":PMODE0,1:PCLEAR4:CLEAR200,
13990:GOSUB100:GOTO30000
2 'PHILIP MCLAUGHLIN
3 'HYBRID TECHNICAL
20 PMODE4,1:SCREEN1,1:PCLS
30 PSET(RND(255),RND(192))
40 IF INKEY$<>""THEN RETURN
50 GOTO30
100 PMODE4,1:SCREEN1,1:PCLS
110 FORZZ=1TO150:PSET(RND(255),R
ND(255))
120 NEXT:RETURN
200 GOSUB100:GOTO200
1000 REMARK  weighted
1005 PI=3.14159:RC=PI/180:REM de
fine pi and radian converter
1010 GOSUB17000
1090 CLS6:PRINT@128,"    INPUT 1
 TO SET UP AUTO DATA STORAGE TO
DISK OR CHANGE PRESETPARAMETERS.
        OTHERWISE    PRESS  'E
NTER
' FOR NEXT STEP":INPUTZ9:ONZ9 GO
SUB15000
1095 GOSUB15007'to load buffer
1100 GOSUB19000:IFDO=1THENGOSUB5
0000
1200 REMARK  pick neighborhood
1205 POKE14000,128 :POKE15000,12
8
1210 FORSR=1TO1000
1215 NB=RND(SR):IFSR=1THENNB=0
1216 IFFF=1 THENNB=RND(1000)
1220 NX=14000+NB:NY=15000+NB
1300 REMARK  gets angle
1305 AN=RND(360)
1310 AN=AN*(PI/180):REM convert
to radians
1400 REMARK  gets radial distanc
e
1410 DS=RND(65315)
1420 DS=RG*255*1/SQR(DS):REMDS=R
G*(255-SQR(DS)):DS=RG*SQR(DS):RE
MDS=RG*LOG(DS)
1500 REMARK  convert polar to ca
rtesian
1510 XX=DS*COS(AN)
1520 YY=DS*SIN(AN)
1530 XA=XA+XX:YA=YA+YY:I=I+1
1550 X=XX+PEEK(NX) :Y=YY+PEEK(NY
)
1600 REMARK  trap offscreen valu
es
1605 X1=X1+X:Y1=Y1+X
1610 IFX<0 ORY<0THEN1215
1620 IFX>255 OR Y>192 THEN1215
1700 REMARK  record coordinates
of new point
1710 POKE14000+SR,X:POKE15000+SR
,Y
1800 REMARK  display new point
1805 XP=XP+X:YP=YP+Y:II=II+1
1810 PSET(X,Y)
1812 IFCU=1THENPRESET(PEEK(14000
+SR+1),PEEK(15000+SR+1))
1898 IFINKEY$<>""THENGOSUB14000
1899 NEXT:T1=T1+TIMER:C1=C1+1:T0
=T0+TIMER/60:TIMER=0
1903 GE=GE+1
1905 PN=PN+1:IF DO=1 ANDPN=>GS T
HEN GOSUB 50000
1910 FF=1:SOUND1,100
1920 GOTO1210
14000 REMARK interupt
14030 CLS3:TT=TIMER
14080 PRINT"interupt AFTER "GE"
GENERATIONS.":IFGE=0THEN14125
14090 PRINT"CALCULATING TIME"INT
(T0/6)/10"MIN.
14110 PRINT"MINUTES PER GENERATI
ON"INT(T1/C1/36)/100
14125 PRINTRG"SCREEN WIDTHS=INFI
NITY"
14130 PRINT"MEAN DRIFT  X"XA/I,"
Y"YA/I
14132 PRINT"MEAN CAL X"X1/I" Y"Y
1/I
14135 PRINT"MEAN PLOTTED "XP/II,
"Y"YP/II
14137 PRINT"PLOTTED POINTS"II" R
EJECTS"I-II
14140 PRINT"INPUT 1 TO CHANGE PA
RAMETERS":PRINT"2 SAVE CURRENT F
RAME TO DISK":PRINT"DEFAULT RESU
MES CALCULATION":INPUTZ9:ONZ9 GO
SUB1
5000,52000
14400 PMODE4,1:SCREEN1,1:TIMER=T
T:RETURN
15000 CLS6:PRINT"CURRENT INTERAC
TION RADIUS="RG:INPUT"CHANGE TO"
;RG:INPUT"CLEAR SCREEN";ZZ:IFZZ=
1THENPCLS
15002 CLS6:PRINT"INPUT 1 TO UNPL
OT 'DYING' STARS OR POINTS.  OTH
ERWISE THEY WILL REMAIN ON SCREE
N.":INPUTCU
15003 CLS6:PRINT"NORMALLY INPUT
1.  THIS CAUSES  NEW POINTS TO B
E CALCULATED AS APROBABILITY FUN
CTION OF THE     WHOLE BUFFER.":
INPU
TFF
15005 CLS6:PRINT"INPUT 1 FOR AUT
OMATIC STORAGE TODISK";:INPUTDO:
IFDO=1 THEN GOSUB 45000
15006 RETURN
15007 CLS6:PRINT@128,"INPUT SIMU
LATION OPTION":PRINT"1  FORMATIO
N OF CLUSTERS FROM      RANDOM D
ISTRIBUTION":PRINT"2  GROWTH FRO
M FI
XED POINTS":INPUTRD
15008 ONRD GOSUB18200,18500
15020 PMODE4,1:SCREEN1,1:RETURN
17000 'preset parameters
17100 RG=2:CU=1
17150 RETURN
18200 FF=1:REMARK random buffer
18210 CLS6:PRINT@128,"   FILLING
 BUFFER WITH RANDOM      POSITIO
NS.    (50 SECONDS)"
18220 FORZZ=14000TO15999:POKEZZ,
RND(255):PRINT@256,ZZ;:NEXT:RETU
RN
18500 REMARK two body
18520 CLS6:PRINT@128,"FILLING BU
FFER  (50 SECONDS)";
18525 HS=SL/2:ZZ=BB+HS
18530 FOR Z=BB TO ZZ:PRINT@256,Z
;:POKE Z,180:POKE Z+SL,80:NEXT
18540 FOR Z=ZZ TO BB+SL:POKE Z,8
0:PRINT@256,Z;:POKE Z+SL,120:NEX
T
18550 RETURN
19000 REMARK display buffer
19005 PMODE4,1:SCREEN1,1:PCLS
19010 FORZZ=1TO1000:PSET(PEEK(14
000+ZZ),PEEK(15000+ZZ)):NEXT
19020 RETURN
30000 CLS6:PRINT@133,"ARE THE ST
ARS RANDOM?";
30010 SL=1000:BB=16000-2*SL
30100 PRINT@352,"    INPUT SIMUL
ATION TYPE":PRINT@416,"1 'PURE R
ANDOM'
30160 PRINT"2 WEIGHTED OR 'PREJU
DICED'
30499 INPUTZ
30500 ONZ GOSUB20,1000
30999 GOTO30000
45000 PRINT"SAVE TO DISK EVERY (
HOW MANY)   GENERATIONS";:INPUTG
S:PN=0:RETURN
50000 '********diskout
50010 PN=0
50050 FR$="GEN"+STR$(GE)
50100 SAVEM FR$,&H36B0,&H3E80,&H
36B0
50200 RETURN
52000 CLS3:DIR'single frame to d
isk
52100 PRINT"INPUT NAME OF FRAME
TO BE SAVED.  MUST BE A LEGAL FI
LENAME.":INPUTFR$:GOTO50100
```

Program Listing 1. Stars

sampling the outputs of some process, Monte Carlo procedures use random values as inputs for further processing.

These procedures give an estimate when the exact solution would require a prohibitively long calculation. In the Stars simulation you sample the preexisting star positions at random to arrive at the new positions instead of using calculations based on all of them.

A familiar example of a mathematical lattice structure is John Horton Conway's simulation game, Life.

The rules of Life are demonstrated by counters or gamepieces on a checkerboard. If a piece is placed on a square, it is said to give birth. If it is removed, it dies. Starting from some initial configuration of pieces on the board, the rules determine what pieces will die and which empty squares will give birth in the next generation.

A checkerboard is the field for a mathematical lattice structure whose formal elements are the rules. The fate of a particular cell in the lattice is a function of the occupancy state of its immediate neighbors. This occupancy (existence) state can be indicated by a binary one or zero.

Life simulations are popular first programs for beginning machine-language programmers because they require only simple logical operations and integer arithmetic. The integer simplicity typical of mathematical lattices or tessellations is important.

This Stars simulation is a variation of Life with some important differences. Conway's algorithm is deterministic, that is, if the cells in the grid or points in the lattice are in a certain configuration at the start of the demonstration, all configurations are predetermined. In Stars, the fate of the cell is probability function of the state of all the other cells in the lattice. Use of the Monte Carlo technique introduces an element of uncertainty.

Another difference is that Life is computationally space oriented and the programs typically keep track of all the cells in the grid, whereas this routine only keeps track of the cells that are "on."

About the Program

Stars is the actual lattice simulation that outputs data to disk in a form that can be read by View (Program Listing 2). View makes drawings of the display on the CGP-115 graphics printer (Figs. 1 and 2), and displays to the screen. Thus you can quickly view simulation sequences that take several hours to calculate.

Graphics printer commands are rapidly becoming standardized. The graphics outputs might work with some other plotters, possibly with small changes, but I cannot guarantee it. Stars works as a 16K cassette-based program except for the disk outputs.

Stars lets you see a simulation and allows you to change the parameters. After you run Stars, choose between the pure random routine described earlier, and the weighted routine. Pressing any key allows you to exit.

If you choose the weighted routine, you can change parameters or set up automatic data-saving to disk. Skip this step by pressing enter.

The next choice determines initial distribution of the points. Random distribution and growth from fixed locations are the two options.

Interrupt the simulation at any time by pressing any key. When this happens, you see a chart showing the number of generations, running time, and some statistical information about the plotted points. You can save the current frame to disk, or you can change parameters before returning to the simulation. The running time clock is stopped during interrupts.

The prompts to View are self-explanatory. It works only after data has been supplied to the disk by Stars. Files created by the auto-save function of Stars have the prefix GEN followed by the generation number. When reading single frames from the disk, you must supply the correct file name, including the extension.

Next month I will continue this exploration of lattice structures and Monte Carlo methods as they are used in the Stars program. ■

Address correspondence to Philip McLaughlin, 712 Roberts St., Denton, TX 76201.

Program Listing 2. View

```
0 'VIEWER PRINTER FOR 'ARE THE S
TARS RANDOM?'  HOT COCO VERSION
1 CLS:PRINT"RUN AGAIN":PRINT"COL
DSTART COMPUTER IN CASE OF   TRO
UBLE":CLEAR200,13990:PMODE0,1:PC
LEAR4:PMODE4,1:SCREEN1,1:PCLS:GO
TO30
000
3 '*************
4 'PHILIP MCLAUGHLIN
5 'HYBRID TECHNICAL
18999 '************
19000 REMARK display buffer
19005 PMODE4,1:SCREEN1,1:PCLS
19010 FORZZ=1TO1000:PSET(PEEK(14
000+ZZ),PEEK(15000+ZZ)):NEXT
19020 RETURN
29999 '************
30000 'main menu loop
30010 SL=1000:BB=16000-2*SL
30020 CLS6:PRINT@169,"VIEWER-PRI
NTER";:PRINT@196,"FOR 'STARS' SI
MULATION";
30030 PRINT@288,"  INPUT 1 TO VI
EW PRERECORDED     MOVIE SEQUENC
E":INPUTMU:IFMU=1THEN54000
30040 CLS6:PRINT@288,"INPUT 1 TO
 VIEW CURRENT BUFFER":INPUTMU:ON
MU GOSUB19000
30045 GOSUB35500
30050 CLS6:PRINT"INPUT 1 TO LOAD
 SINGLE FRAME    FROM DISK":INPU
TMU:ONMU GOTO35000
30100 CLS6:PRINT@288,"  INPUT 1
TO VIEW CONTROLLED      MOVIES":
INPUTMU:IFMU<>1THEN30000
30150 CLS6:PRINT"controls":PRINT
@288,"INPUT 1 TO BLANK SCREEN BE
TWEEN FRAMES":INPUTBF
30160 GOSUB55000
30999 GOTO30000
35000 'frame from disk
35100 DIR:INPUT"CORRECT NAME OF
FRAME";FR$:LOADM FR$
35200 GOSUB19000'to display
35300 GOSUB35500:GOTO30000
35500 CLS6:PRINT@128,"INPUT 1 TO
 DRAW CURRENT FRAME ONGRAPHIC PR
INTER":INPUTMU:IFMU<>1THEN RETUR
N
39999 '************
40000 REMARK graphics printer
40005 PR=-2
40010 CLS6:PRINT"INPUT TITLE TO
BE PRINTED":INPUTT$
40015 INPUT"COMMENTS";T1$
40020 PN=0:SR=0
40030 PRINT#PR,CHR$(17):PRINT#PR
,""'set upper left corner
40050 PRINT#PR,CHR$(18):PRINT#PR
,"R0,-35":PRINT#PR,"I"
40055 GOSUB40500'draw reticle
40060 FOR Z1=1 TO 10:FOR ZY=1500
0 TO 15999:GOSUB40200:NEXT:NEXT
40080 PRINT#PR,"M0,-410":PRINT#P
R,"S1":PRINT#PR,"A":PRINT#PR,T$:
PRINT#PR,T1$
40190 RETURN
40200 YY=PEEK(ZY):IFYY>Z1*19 OR
YY<(Z1-1)*19 THEN RETURN
40220 ZZ=INT(PEEK(ZY-1000)*1.8):
FORZ9=1TO2:PRINT#PR,"M"+STR$(ZZ)
+","+STR$(-YY*2)
40240 SR=SR+1
40280 PRINT#PR,"J3,0,0,-2,-3,0,0
,2,2,-2"
40290 NEXT
40300 RETURN
40500 'reticle
40510 PRINT#PR,"C1"
40520 PRINT#PR,"X1,18,26,X0,-20,
19,X1,-18,26,X0,20,19"
40530 PRINT#PR,"R90,0":PRINT#PR,
"X0,-20,19":PRINT#PR,"R90,0":PRI
NT#PR,"X0,20,19":PRINT#PR,"R90,0
":PRINT#PR,"X0,-20,19":PRINT#PR,
"R90
,0":PRINT#PR,"X0,20,19":PRINT#PR
,"H"
40540 PRINT#PR,"R0,-100":PRINT#P
R,"X1,18,26":PRINT#PR,"R0,-100":
PRINT#PR,"X1,-18,26":PRINT#PR,"R
0,-100":PRINT#PR,"X1,18,26"
40590 PRINT#PR,"C0"
40900 RETURN
45000 INPUT"PRINT EVERY";GS:PN=0
:RETURN
50000 '********diskout
50050 FR$="GEN"+STR$(GE)
50100 SAVEM FR$,&H36B0,&H3E80,&H
36B0
50200 RETURN
54000 'preset movie
54100 BF=1:NF=10:GOSUB55150:RETU
RN
55000 '********diskin
55100 INPUT"how many generations
";NF
55150 PMODE4,1:SCREEN1,1:PCLS
55200 FORLP=0TONF:FR$="GEN"+STR$
(LP):LOADM FR$
55250 IFBF=1THENPCLS
55300 GOSUB19010
55350 NEXT:IFINKEY$=""THEN55150E
LSERETURN                    END
```

BY BOB A. JACK

KAN YU SPEL?

If you're a "one in a million" who spells all words correctly, read no further. You don't need this utility. However, if you're like me, who has a hard time remembering the whole alphabet, you need SVP.

The main program I use for writing anything is Radio Shack's Disk Color Scripsit. This is a good word-processing program, but it doesn't help my poor spelling. I wrote SVP (Spelling Verifier Program) to check the accuracy of my words.

SVP reads an ASCII file sentence, extracting one word at a time and comparing it against the words stored in its various files. If the word is matched, SVP passes over that word. If it does not find the word, it stops, lists the sentence, and shows you the word it cannot find. It then gives you three options for handling the word. This is handy for finding words that are spelled incorrectly. You can then look them up in a dictionary and later correct your text file.

SVP has three files: temporary, short word, and long word. SVP first scans the temporary file. If the word is not found in the temporary file, SVP then determines if it is a short word—four or fewer letters—or a long word—five to 15 letters. It then scans either the short-word or long-word file.

If it does not find the word, SVP jumps to a routine that asks you whether you want to store the word in the temporary file, skip the word, or end the verifier. If you store or skip the word, it processes the next word.

If you quit the verifier process, SVP jumps to a subroutine that asks you if you want the temporary-storage buffer printed, the temporary-storage buffer merged with the short-word and long-word files, or if you want to quit the program.

Poor spellers can breathe a sigh of relief. SVP will check the accuracy of the words you write.

The print routine prints out the temporary buffer, producing five columns of words. The program automatically POKEs into location 009B hex, which is the printer-width storage location. Since my printer has a line width of 80 characters, I used 80 in this statement. After it is done printing, it POKEs the word-storage location to 132 characters, which is the standard width. You can alter this statement to suit your printer.

The files are stored in two different positions. The temporary file and short-word file are stored in the memory using dimensional statements. The long-word file is stored on the disk. This is a direct file that lets you access the words individually. The word can be any length from five to 15 characters. Each record in the direct file is 15 characters long.

If you use the store-temporary-buffer command, the program merges the temporary buffer into the short-word and long-word files. I have about 5,000 words in my files and it takes about five minutes to merge the files. Until you build a large volume of words, your merge should be much faster. Microsoft's Basic has a routine built into it that stops program execution when all the string space is used. It then clears its string space and continues on with program execution. This can happen almost any time. The computer appears to lock up for about 30 seconds and then continues with its operation. While this is somewhat frustrating, it's one of those things that can't be helped.

To use the program you must first create an ASCII file on disk using Scripsit or any word processor that handles ASCII files. Insert the file in drive 1. Next insert the SVP disk in drive 0 and type RUN "SVP". I recommend that you use one disk for SVP alone because as you save the temporary words it fills up the disk.

The program loads the short-word file and then clears the screen and asks you for the file name of the program to be verified. You must also type in the extension or you will get a disk error. Do not use the drive number as the program assumes that the files are on disk 1.

At this point the program asks you if you want to skip any lines. Sometimes you might want to check only portions of the file, stop and save the temporary words, then later come back and check the rest. If you stop the verifier before finishing a file, it tells you how many lines you have checked. It is a good idea to make a note of this figure for later use. After answering the line-skip prompt, the program clears the screen and begins verifying. It stops only after it encounters an unfound word.

A good way to build the verifier's vocabulary is to check letters or manuscripts you have already written. This gives you an excellent list of words you normally use. What's interesting is to check someone else's letters or memos. I have a normal working vocabulary of about 1,500 words used in speaking and

System Requirements

32K RAM
Extended Color Basic
Two Disk Drives

TOM MIX SOFTWARE

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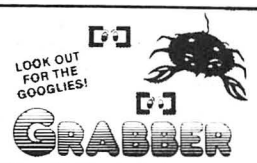
CU*BER

32K Mach. Lang.
$27.95 TAPE
$30.95 DISK

Approaches the excitement and challenges of any Video Arcade. The hazards of CU*BER are many. Help CU*BER change the colors on the pyramid while avoiding many of the dangers always present. Vipers, the Nurd, the Dork, bonus points all add up to another exciting release from Tom Mix Software.



Arcade Action. Method of play you are the Grabber. The object is to grab the 8 treasures and store them in the center boxes. You start with 3 Grabbers and get extra ones at 20,000 points. Watch out for the googlies! Super high resolution graphics.

32K Machine Language

$27.95 TAPE **$30.95 DISK**

AIR TRAFFIC CONTROLLER

32K Ext. Basic
$28.95 TAPE
$31.95 DISK

Air Traffic Controller is a computer model of an air traffic control situation in which Remotely Piloted Vehicles (RPV's) are operated by the controller in landing on and taking off from designated runways.

DEVIL ASSAULT

16K Machine Language
$27.95 TAPE
$30.95 DISK

Devil Assault is a multi-level multi-screen game in which bird-like creatures, robots and the devil himself assault your home base which you must defend.

BUZZARD BAIT

By RUGBY CIRCLE

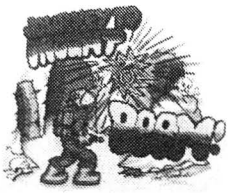
32K Machine Language

$27.95 Tape $30.95 Disk

We've done it again! You thought the King was great? wait 'till you see this!! Outstanding high resolution graphics, tremendous sound make this "Joust" type game a must for your software collection. As you fly from cloud to cloud you will enjoy sky high excitement dealing with the challenges presented to you by this newest release by Tom Mix Software.

JOURNEY TO MT. DOOM

32K Mach. Lang.
$27.95 DISK ONLY



The Necromancer is about to wage war on earth. He needs his lost gold ring to acquire the power to do so. You must find the ring, take it to Mt. Doom and destroy it in the flames from which it came, thus eliminating the Necromancer's evil powers.

"THE FROG"

ARCADE ACTION
This one will give you hours of exciting play... Cross the busy highway to the safety of the median and rest awhile before you set out across the swollen river teaming with hidden hazards. Outstanding sound and graphics.

16K MACHINE LANGUAGE
$27.95 TAPE
$30.95 DISK

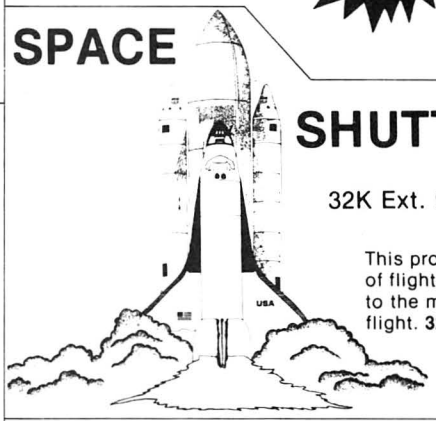
JUNIOR'S REVENGE

Climb vines, avoid obstacles & creatures to save your father from Luigi.

32K CASS $28.95
32K DISK $31.95

NEW

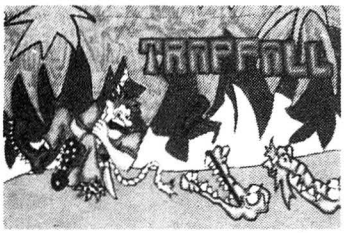
SPACE SHUTTLE



$28.95 TAPE
$31.95 DISK

32K Ext. Basic

This program gives you the real feeling of flight. Full instrumentation complete to the max. Actual simulation of space flight. **32K Extended Basic**

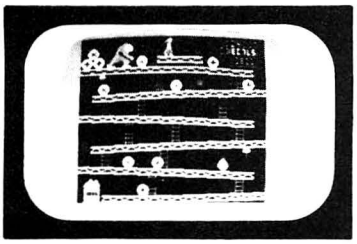


"TRAPFALL"

By KEN KALISH

ARCADE ACTION
The "Pitfalls" in this game are many. Hidden treasures, jump over the pits, swing on the vine, watch out for alligators, beware of the scorpion. Another game for the Color Computer with the same high resolution graphics as "The King."

16K MACHINE LANGUAGE
TAPE $27.95
DISK $30.95



THE KING

32K Machine Language
$26.95 TAPE
$29.95 DISK

ARCADE ACTION - How high can you climb? Four full graphic screens. Exciting Sound - Realistic graphics. Never before has the color computer seen a game like this. Early reviews say: Just like the arcade Simply outstanding!

OTHER GREAT GAMES

PROTECTORS - Exciting fast paced arcade game that looks and plays like the popular arcade game "DEFENDER".
32K Machine Code **Tape $24.95** **Disk $27.95**

COLOR GOLF - Now sit at your computer and play nine or eighteen holes. Outstanding graphics in the fairway or on the green. Helps your game. **32K Extended Basic** **$17.95**

'YAAZEE" (C) 1983 - Yaazee is a 2 player game using five dice to get the best poker hand. After game is loaded flashing digit below player number determines which player rolls dice at the start of the game. **16K Machine Language Ext. Basic** **$19.95**

BIRD ATTACK - A fast paced machine language arcade game. Shoot the birdmen before they descend upon you. Watch out for their bombs! **16K Machine Language** **$21.95**

MAZE RACE - Maze race is a one or two player game. Play either against the built in timer or against your favorite opponent. **16K Machine Code** **$17.95**

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writing, not counting specialized words or names. When checking someone else's work you will find that although you are using the same language, the words used are somewhat different.

In the beginning you must look up a lot of words, but after a short while you will build a file of words that matches your writing style. ■

Address correspondence to 8371 White Road, Burbank, OH 44214.

Program Listing. SVP

```
10 '
20 ' SVP
30 ' BY
40 ' BOB JACK
50 ' 1983
60 '
70 GOTO 2210
80 DIM W$(1000),T$(500)
90 W2=1
100 OPEN "D",#2,"SWORDS"
110 CLOSE
120 OPEN "I",#2,"SWORDS"
130 FOR W1=1 TO 1000
140 IF EOF(2) THEN 170
150 INPUT #2,W$(W1)
160 NEXT W1
170 CLOSE
180 OPEN "D",#3,"LWORDS",15
190 FIELD #3,15 AS W9$
200 IF LOF(3)<1 THEN W=2:GOTO 23
0
210 GET #3,1
220 W=VAL(W9$)
230 CLS:PRINT@32*4+5,"INSERT SOU
RCE DISK"
240 PRINT@32*5+5,"IN DRIVE ONE"
250 PRINT@32*7+5,"NAME OF ASCII
FILE"
260 PRINT@32*8+5,"DON'T FORGET E
XTENTION"
270 PRINT@32*9+5,"NO DRIVE NUMBE
R PLEASE !!!"
280 PRINT@32*11+5,"";:SOUND 200,
3
290 INPUT "---> ";F$
300 OPEN "I",#1,F$+":1"
310 CLS:PRINT@32*7+5,"SKIP ANY L
INES (Y-N)"
320 SOUND 200,3
330 Q$=INKEY$:IF Q$="" THEN 330
340 IF Q$="N" THEN 520
350 IF Q$<>"Y" THEN 320
360 PRINT TAB(5);"HOW MANY 1 TO
";
370 SOUND 200,3
380 INPUT SK
390 IF SK<>INT(SK) OR SK<1 THEN
310
400 CLS
410 FOR J=1 TO SK
420 IF EOF(1) THEN 2200
430 LINE INPUT #1,L$
440 LL=LL+1
450 PRINT L$
460 NEXT J
470 PRINT:PRINT "SKIP MORE --- (
Y-N) "
480 SOUND 200,3
490 Q$=INKEY$:IF Q$="" THEN 490
500 IF Q$="Y" THEN 360
510 IF Q$<>"N" THEN 480
520 CLS
530 IF EOF(1) THEN 1420
540 INPUT #1,C$
550 LL=LL+1
560 PRINT C$
570 B=1:E=LEN(C$)
580 W$=""
590 IF W2>499 THEN 1370
600 FOR P=B TO E
610 H$=""
620 H$=MID$(C$,P,1)
630 IF H$=>"a" AND H$=<"z" THEN
690
640 IF H$=>"A" AND H$=<"Z" THEN
680
650 IF H$="'" THEN 690
660 IF LEN(W$)>0 THEN 720
670 GOTO 700
680 NU=ASC(H$):NU=NU+&H20:H$=CHR
$(NU)
690 W$=W$+H$
700 NEXT P
710 IF LEN(W$)<1 THEN 530
720 B=P
730 F=LEN(W$)
740 IF F<2 OR F>15 THEN 580
750 K=1:H=W2:L=1:S=INT(H/2)
760 IF S<1 THEN 850
770 IF W$=T$(S) THEN 580
780 IF W$<T$(S) THEN H=S ELSE L=
S
790 S=INT((H-L)/2)+L
800 IF H-L>1 THEN 770
810 IF W$=T$(H) THEN 580
820 IF W$=T$(L) THEN 580
830 K=L
840 IF T$(L)<W$ THEN K=H
850 IF F>4 THEN 940
860 H=W1-1:L=1:S=INT(H/2)
870 IF W$=W$(S) THEN 580
880 IF W$<W$(S) THEN H=S ELSE L=
S
890 S=INT((H-L)/2)+L
900 IF H-L>1 THEN 870
910 IF W$=W$(H) THEN 580
920 IF W$=W$(L) THEN 580
930 GOTO 1070
940 F1=15-F
950 TW$=W$+STRING$(F1," ")
960 H=W-1:L=2:S=INT(H/2)
970 IF S<1 THEN 1070
980 GET #3,S
990 IF TW$=W9$ THEN 580
1000 IF TW$<W9$ THEN H=S ELSE L=
S
1010 S=INT((H-L)/2)+L
1020 IF H-L>1 THEN 980
1030 GET #3,H
1040 IF TW$=W9$ THEN 580
1050 GET #3,L
1060 IF TW$=W9$ THEN 580
1070 CLS:PRINT C$:PRINT@32*9,W$
1080 PRINT@32*9+17,"<-- CAN'T FI
ND";
1090 PRINT@32*11+3,"T      TEMPOR
ARY SAVE"
1100 PRINT@32*12+3,"C      CONT.
- NO SAVE"
1110 PRINT@32*13+3,"Q      QUIT S
PELLING VER."
1120 SOUND 200,3
1130 Q$=INKEY$:IF Q$="" THEN 113
0
1140 IF Q$="C" THEN 1270
1150 IF Q$="Q" THEN 1370
1160 IF Q$<>"T" THEN 1120
1170 PRINT@32*15,W$;
1180 PRINT@32*15+17,"TEMPORARY S
AVE";
1190 IF W2=K THEN 1230
1200 FOR J=W2 TO K STEP -1
1210 T$(J)=T$(J-1)
1220 NEXT J
1230 T$(K)=W$
1240 W2=W2+1
1250 IF F<5 THEN SW=SW+1
1260 IF F>4 THEN LW=LW+1
1270 CLS:PRINT C$
1280 GOTO 580
1290 CLS:PRINT@32*7+10,"PRINTING
"
1300 POKE &H009B,80
1310 FOR X=1 TO (W2-1)
1320 PRINT#-2,T$(X),
1330 NEXT X
1340 PRINT#-2,"":PRINT#-2,""
1350 POKE &H009B,132
1360 GOTO 1420
1370 CLS:PRINT@32*7+8,"YOU HAVE
CHECKED"
1380 PRINT@32*8+10,LL;"LINES"
1390 PRINT@32*15+5,"<ANY KEY> TO
 CONTINUE";
1400 SOUND 200,3
1410 Q$=INKEY$:IF Q$="" THEN 141
0
1420 CLS:PRINT@32*2+5,"YOU HAVE
IN TEMPORARY"
1430 PRINT@32*4+5,SW;"SHORT WORD
S"
1440 PRINT@32*5+5,LW;"LONG WORDS
"
1450 PRINT@32*7+5,"P      PRINT T
EMP. WORDS"
1460 PRINT@32*8+5,"S      SAVE TE
MP. WORDS"
1470 PRINT@32*9+5,"Q      END PRO
GRAM"
1480 SOUND 200,3
1490 Q$=INKEY$:IF Q$="" THEN 149
0
1500 IF Q$="P" THEN 1290
1510 IF Q$="Q" THEN 2200
1520 IF Q$<>"S" THEN 1480
1530 CLS:CLOSE
1540 IF SW=0 THEN 1790
1550 PRINT@32*7+5,"SAVING SHORT
WORDS"
1560 KILL "SWORDS/DAT"
1570 OPEN "O",#2,"SWORDS"
1580 X=1
1590 IF W1<2 THEN I=1:GOTO 1740
1600 FOR I=1 TO (W2-1)
1610 IF LEN(T$(I))>4 THEN 1690
1620 IF T$(I)=W$(X) THEN 1690
1630 IF T$(I)<W$(X) THEN 1680
1640 PRINT #2,W$(X)
1650 X=X+1
1660 IF X<W1 THEN 1620
1670 GOTO 1740
1680 PRINT #2,T$(I)
1690 NEXT I
1700 FOR LP=X TO (W1-1)
1710 PRINT #2,W$(LP)
1720 NEXT LP
1730 GOTO 1780
1740 FOR LP=I TO (W2-1)
1750 IF LEN(T$(LP))>4 THEN 1770
1760 PRINT #2,T$(LP)
1770 NEXT LP
1780 CLS:CLOSE
1790 IF LW=0 THEN 2190
1800 PRINT@32*7+5,"SAVING LONG W
ORDS"
1810 OPEN "D",#1,"LWORDS",15
1820 OPEN "D",#2,"TEMP",15
1830 FIELD #1,15 AS W1$
1840 FIELD #2,15 AS W2$
1850 X=2:Z=2
1860 IF W<3 THEN I=1:GOTO 2080
1870 FOR I=1 TO W2-1
1880 IF LEN(T$(I))<5 THEN 2000
1890 GET #1,X
1900 IF T$(I)=W1$ THEN 2000
1910 IF T$(I)<W1$ THEN 1970
1920 LSET W2$=W1$
1930 PUT #2,Z
1940 Z=Z+1:X=X+1
1950 IF X<W THEN 1890
1960 GOTO 2080
1970 LSET W2$=T$(I)
1980 PUT #2,Z
1990 Z=Z+1
2000 NEXT I
2010 FOR LP=X TO W-1
2020 GET #1,LP
2030 LSET W2$=W1$
2040 PUT #2,Z
2050 Z=Z+1
2060 NEXT LP
2070 GOTO 2140
2080 FOR LP=I TO W2-1
2090 IF LEN(T$(LP))<5 THEN 2130
2100 LSET W2$=T$(LP)
2110 PUT #2,Z
2120 Z=Z+1
2130 NEXT LP
2140 LSET W2$=STR$(Z)
2150 PUT #2,1
2160 CLOSE
2170 KILL "LWORDS/DAT"
2180 RENAME "TEMP/DAT" TO "LWORD
S/DAT"
2190 SOUND 200,3
2200 CLOSE:CLS:END
2210 PCLEAR 1
2220 FILES 3,3000
2230 CLEAR 12000
2240 GOTO 80
```

END

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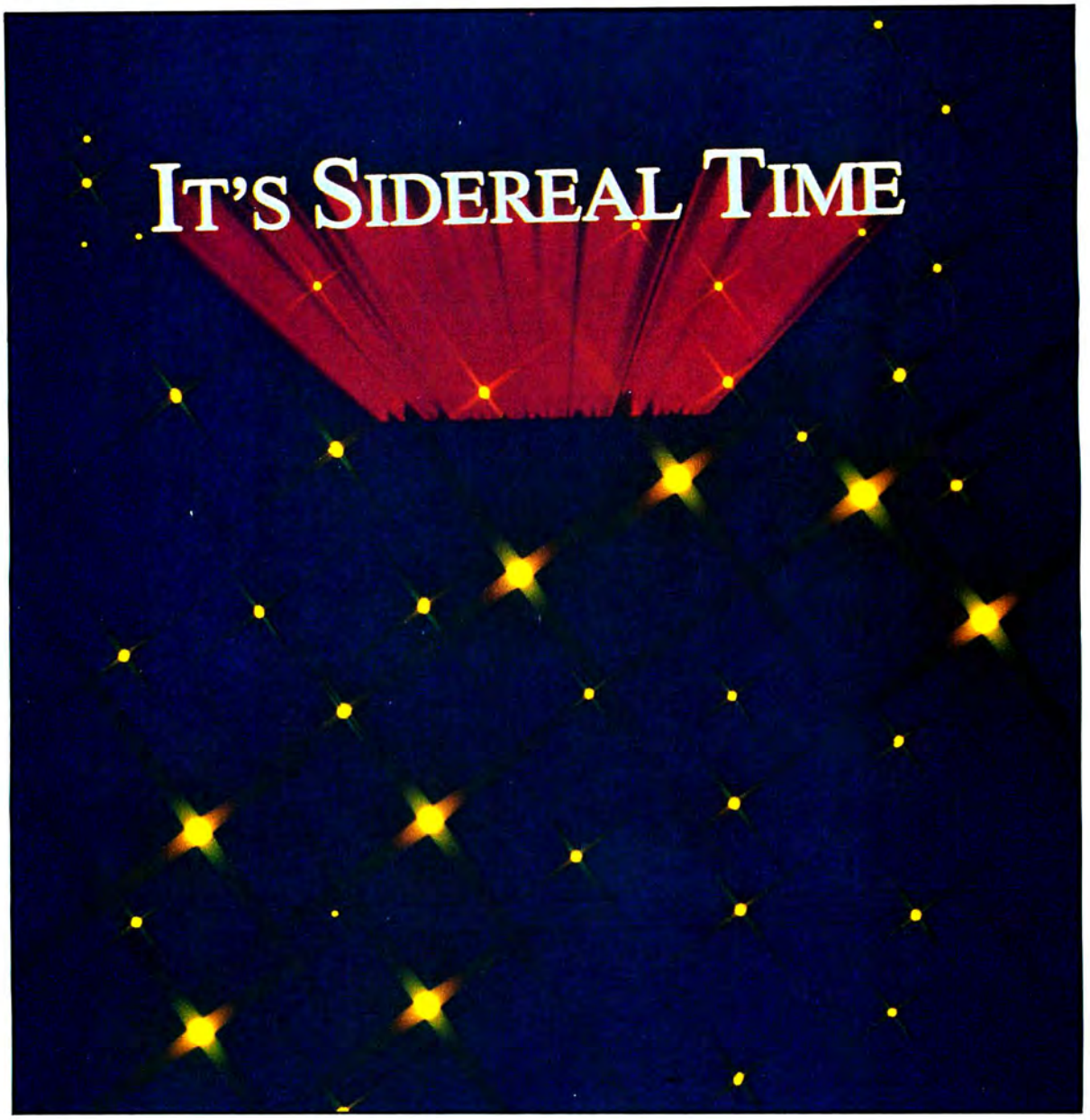
BY AL BURZYNSKI

IT'S SIDEREAL TIME



Astronomy buffs can use their CoCos to figure sidereal time and get a map of the heavens.

An amateur astronomer not knowing the sidereal time is like a CoCo programmer not knowing Basic. Without it, the stars and planets are just twinkles in the sky. But add sidereal time and you have an organized map of the heavens.

Sidereal Time will compute the hour of right ascension that is at your zenith at any time you desire for any point on the Earth with an average accuracy of one second.

A Brief Astronomy Lesson

The apparent spherical sky above us is mapped out in lines similar to our earthly lines of longitude and latitude. They are called right ascension (RA) and declination (DEC) respectively.

The lines of RA are divided into 24

major units called hours and are numbered 0–23. Each hour segment is further subdivided into 60 minutes and each minute into 60 seconds.

The lines of DEC are called degrees. Ninety of them exist south of the celestial equator and are negative DEC, and 90 exist north of the celestial equator and are positive DEC.

Now the zenith is the point that is directly overhead. When you are on a fixed point on the Earth, the DEC line will always remain the same, but the hours of RA will be constantly drifting westward. The sidereal time for that particular fixed point is the hour of RA that is at that zenith.

Knowing the sidereal time, you can reference any celestial object to your zenith and determine if that object is within your viewing range at that time.

The Program

When typing in the Program Listing, pay particular attention to letters O and numbers 0 as well as I and 1. When you are satisfied with your entry, run the program.

You now see the main menu with options of:

<S>INGLE
<D>AILY
<M>ONTHLY
<E>XIT
WHICH?

Responding with an S lets you make a single longitude, date, and time entry. The output will be the sidereal time for that entry.

The output for the D response is the sidereal time for every hour on the hour for the date of your choice. See Fig. 1 for a typical daily listing.

The M response will give the sidereal time for every day of the month of your choice at the hour you select. This is very useful if you do your star gazing at about the same time regularly. See Fig. 2 for a typical monthly listing.

If you want to exit the program and return to Basic, press the E key.

When you are prompted to enter the longitude, input it in the form of degrees, minutes, and east or west longitude. (121 degrees, 45 minutes west must be entered as 121,45,W. Be sure to include both commas and do not use decimal parts of minutes.)

Time inputs must be in the 24-hour system followed by the time zone (EST,

```
SIDEREAL TIME FOR
   SEP.19, '83
 98D. 30M. W. LONG.
**********************

   CDT: SIDEREAL:
   0000=2216:10
   0100=2316:20
   0200=0016:30
   0300=0116:40
   0400=0216:50
   0500=0317:00
   0600=0417:09
   0700=0517:19
   0800=0617:29
   0900=0717:39
   1000=0817:49
   1100=0917:59
   1200=1018:09
   1300=1118:18
   1400=1218:28
   1500=1318:38
   1600=1418:48
   1700=1518:58
   1800=1619:08
   1900=1719:18
   2000=1819:27
   2100=1919:37
   2200=2019:47
   2300=2119:57
```

Fig. 1. Daily Listing

```
SIDEREAL TIME FOR
   SEP.   '83
 98D. 30M. W. LONG.
**********************

 2000 CDT: SIDEREAL:
  SEP. 1 = 1708:29
  SEP. 2 = 1712:26
  SEP. 3 = 1716:23
  SEP. 4 = 1720:19
  SEP. 5 = 1724:16
  SEP. 6 = 1728:12
  SEP. 7 = 1732:09
  SEP. 8 = 1736:05
  SEP. 9 = 1740:02
  SEP.10 = 1743:58
  SEP.11 = 1747:55
  SEP.12 = 1751:52
  SEP.13 = 1755:48
  SEP.14 = 1759:45
  SEP.15 = 1803:41
  SEP.16 = 1807:38
  SEP.17 = 1811:34
  SEP.18 = 1815:31
  SEP.19 = 1819:27
  SEP.20 = 1823:24
  SEP.21 = 1827:21
  SEP.22 = 1831:17
  SEP.23 = 1835:14
  SEP.24 = 1839:10
  SEP.25 = 1843:07
  SEP.26 = 1847:03
  SEP.27 = 1851:00
  SEP.28 = 1854:56
  SEP.29 = 1858:53
  SEP.30 = 1902:50
```

Fig. 2. Monthly Listing

Program Listing. Sidereal Time

```
10 'SIDTIME
20 '
30 'AL BURZYNSKI  18 SEP 83
40 '4323 EAGLE NEST
50 'SAN ANTONIO,TX. 78233
60 '
70 YY-84
90 DATA 6,39,23,8,41,36,10,35,56
100 DATA 12,38,9,14,36,26,16,38,
39
110 DATA 18,36,56,20,39,9,22,41,
22
120 DATA 0,39,39,2,41,52,4,40,9
130 'MONTHS AND DAYS/MONTH
140 DATA JAN.,31,FEB.,28,MAR.,31
,APR.,30,MAY ,31,JUN.,30,JUL.,31
,AUG.,31,SEP.,30,OCT.,31,NOV.,30
,DEC.,31
150 '24 HOUR PRINT DATA
160 DATA 0000,0100,0200,0300,040
0,0500,0600,0700,0800,0900,1000,
1100,1200,1300,1400,1500,1600,17
00,1800,1900,2000,2100,2200,2300
170 DIM ED(12),MM$(12),DM(12),HO
$(24)
180 'ED=EPHEM. DATA IN SECONDS O
N DAY PREVIOUS TO 1ST OF MONTH
190 FOR I=1 TO 12
200 READ A,B,C:ED(I)=3600*A+60*B
+C-236.555001:IF ED(I)=<0 THEN E
D(I)=ED(I)+86400
210 NEXT I
220 'MM$=NAME OF MONTHS, DM=DAYS
 PER MONTH
230 FOR I=1 TO 12
240 READ A$,A:MM$(I)=A$:DM(I)=A
250 NEXT I
260 'HO$=24 HOUR PRINT DATA
270 FOR I=1 TO 24
280 READ A$:HO$(I)=A$
290 NEXT I
300 GOSUB 990'HEADER
310 H=0:M=0
320 PRINTTAB(10)"ENTRY MODE:"
330 PRINT:PRINTTAB(10)"<S>INGLE"
340 PRINTTAB(10)"<D>AILY"
350 PRINTTAB(10)"<M>ONTHLY"
360 PRINTTAB(10)"<E>XIT"
370 PRINT:PRINTTAB(10)"WHICH";:I
NPUT A$
380 IF A$="E" THEN PRINT:PRINTTA
B(10)"BYE!":END
390 IF A$="S" THEN MD=1:PR=0 ELS
E IF A$="D" THEN MD=2 ELSE IF A$
="M" THEN MD=3 ELSE SOUND 150,5:
GOTO 300
400 IF MD<>1 THEN GOSUB 1300'PRI
NTER INFO
410 'INPUT ALL REQUIRED INFO
420 GOSUB 990:PRINTTAB(11)"LONGI
TUDE:":PRINT
```

Listing continued

System Requirements

16K RAM
Extended Color Basic
Printer (optional)

Listing continued

```
430 IF EW<>0 THEN PRINTTAB(6)LD;
"DEG.";LM;"MIN. ";EW$:PRINT:PRIN
TTAB(3)"SAME LONGITUDE AS BEFORE
";:INPUT A$:IF A$="N" THEN PRINT
:GOTO 440 ELSE 480
440 PRINTTAB(3)"(DEG,MIN,E OR W)
";:INPUT LD,LM,EW$
450 IF LD>180 OR LM>59 THEN SOUN
D 150,5:GOTO 440
460 IF LD=180 AND LM<>0 THEN SOU
ND 150,5:GOTO 440
470 IF EW$="E" THEN EW=1 ELSE IF
 EW$="W" THEN EW=-1 ELSE SOUND 1
50,5:GOTO 440
480 GOSUB 990:PRINTTAB(13)"DATE:
":PRINT
490 IF MD=3 THEN 500 ELSE 550
500 IF MM=0 THEN 530
510 PRINTTAB(12)MM$(MM);YY
520 PRINT:PRINTTAB(9)"SAME MONTH
";:INPUT A$:IF A$="Y" THEN 540
530 PRINT:PRINTTAB(6)"WHICH MONT
H (MM)";:INPUT MM:IF MM<1 OR MM>
12 THEN SOUND 150,5:GOTO 530
540 DD=1:GOTO 590
550 IF MM<>0 THEN PRINTTAB(11);:
PRINT USING"##";MM;:PRINT",";:PR
INT USING"##";DD;:PRINT",";:PRIN
TUSING"##";YY:PRINT:PRINTTAB(5)"
SAME DATE AS BEFORE";:INPUT A$:I
F A$="N" THEN PRINT:GOTO 560 ELS
E 650
560 PRINTTAB(6)"DATE (MM,DD)";:I
NPUT MM,DD
570 IF MM<1 OR MM>12 THEN SOUND
150,5:GOTO 560
580 IF DD<1 OR DD>31 THEN SOUND
150,5:GOTO 560
590 IF YY/4=INT(YY/4) THEN DM(2)
=29'LEAP YEAR
600 IF MD<>2 THEN 650
610 IF MD=2 THEN GOSUB 990:PRINT
TAB(11)"TIME ZONE:":PRINT
620 PRINTTAB(2)"WHICH TIME ZONE
ARE YOU IN?      (GMT,EST,...ETC.
)";:INPUT TZ$
630 GOSUB 1020:IF W=0 OR W=1 THE
N 610 ELSE 690
640 IF MD=2 GOTO 690
650 IF MD=2 THEN 610 ELSE GOSUB
990:PRINTTAB(13)"TIME:":PRINT
660 PRINTTAB(2)"TIME (HH,MM,ZONE
)";:INPUT H,M,TZ$
670 IF H>23 OR M>59 THEN SOUND 1
50,5:GOTO 660
680 GOSUB 1020:IF W=0 OR W=1 THE
N 660
690 A$=MID$(TZ$,1,1)
700 'TIME ZONE CORRECTION
710 G=0:IF A$="E" THEN G=G+5 ELS
E IF A$="C" THEN G=G+6 ELSE IF A
$="M" THEN G=G+7 ELSE IF A$="P"
THEN G=G+8
720 IF MID$(TZ$,2,1)="D" THEN G=
G-1'DAYLIGHT TIME
730 LC=240*LD+4*LM:SG=ED(MM)
740 SD=SG+EW*LC:IF SD=<0 THEN SD
=SD+86400
750 'SD NOW=SID TIME AT LONG REQ
UESTED AT 0000 STANDARD TIME (NO
T DAYLITE TIME).
760 SL=SD-EW*G*3600+G*9.85645836
:IF SL=<0 THEN SL=SL+86400
770 'SL NOW SID TIME @ LONG @ 00
00 STANDARD TIME.
780 IF MD=1 GOSUB 1060:GOSUB 820
:GOTO 300
790 IF MD=2 THEN 1050
800 IF MD=3 THEN 1380
810 'SID DRIFT/DAY, HOUR, MIN
820 DA=DD*236.555001
830 HA=H*3600+H*9.85645836
840 MA=M*60+M*.164274306
850 SD=INT(SL+DA+HA+MA+.5)
860 HO=INT(SD/3600)
870 MO=INT((SD-HO*3600)/60)
880 SO=SD-(HO*3600+MO*60)
890 'DAY ROLLOVER CORRECTION
900 IF HO=>48 THEN HO=HO-48
910 IF HO=>24 THEN HO=HO-24
920 'CONVERT SID TIME TO STRING
930 H$=STR$(HO):IF LEN(H$)=2 THE
N H$="0"+RIGHT$(H$,1) ELSE H$=RI
GHT$(H$,2)
940 M$=STR$(MO):IF LEN(M$)=2 THE
N M$="0"+RIGHT$(M$,1) ELSE M$=RI
GHT$(M$,2)
950 S$=STR$(SO):IF LEN(S$)=2 THE
N S$=":0"+RIGHT$(S$,1) ELSE S$="
:"+RIGHT$(S$,2)
960 IF MD=1 GOSUB 1150:PRINT:PRI
NTTAB(9)TH$;"=";H$;M$;S$:PRINT:G
OSUB 1350
970 RETURN
980 'HEADER SUB-RUT
990 CLS:A$=STRING$(17,"*"):PRINT
TAB(7)A$
1000 PRINTTAB(7)"* SIDEREAL TIME
 *":PRINTTAB(7)"*   FOR  1984
*":PRINTTAB(7)A$:PRINT:RETURN
1010 'VALID TIME ZONE?
1020 Z$=" GMTESTEDTCSTCDTMSTMDTP
STPDT"
1030 W=INSTR(1,Z$,TZ$):IF W=0 OR
 W=1 THEN SOUND 150,5:RETURN ELS
E RETURN
1040 'MODE TYPE HEADERS
1050 GOSUB 1060:GOTO 1220
1060 CLS:PRINT#PR,TAB(7)"SIDEREA
L TIME FOR"
1070 PRINT#PR,TAB(10)MM$(MM);
1080 IF MD=3 THEN PRINT#PR,"  ";
:GOTO 1100
1090 PRINT#PR,USING"##";DD;:PRIN
T#PR,",";
1100 PRINT#PR," '";:PRINT#PR,USI
NG"##";YY
1110 PRINT#PR,TAB(6);:PRINT#PR,U
SING"###";LD;:PRINT#PR,"D. ";:PR
INT#PR,USING"##";LM;:PRINT#PR,"M
. ";EW$;". LONG."
1120 A$=STRING$(21,"*"):PRINT#PR
,TAB(5)A$:PRINT#PR
1130 IF MD<>3 THEN 1200
1140 GOSUB 1150:GOTO 1180
1150 TH$=STR$(H):IF LEN(TH$)=2 T
HEN TH$="0"+RIGHT$(TH$,1) ELSE T
H$=RIGHT$(TH$,2)
1160 TM$=STR$(M):IF LEN(TM$)=2 T
HEN TM$="0"+RIGHT$(TM$,1) ELSE T
M$=RIGHT$(TM$,2)
1170 TH$=TH$+TM$:RETURN
1180 PRINT#PR,TAB(6)TH$;" ";TZ$;
": SIDEREAL:"
1190 RETURN
1200 PRINT#PR,TAB(9)TZ$;": SIDER
EAL:":RETURN
1210 '24 HOUR OUTPUT
1220 FOR I=1 TO 24
1230 GOSUB 820
1240 PRINT#PR,TAB(9)HO$(I);"=";H
$;M$;S$
1250 IF I=9 AND PR=0 GOSUB 1350
1260 H=H+1
1270 NEXT I
1280 IF PR=0 GOSUB 1350
1290 GOTO 300
1300 GOSUB 990
1310 'PRINTER INFO
1320 PRINTTAB(12)"PRINTER:":PRIN
T
1330 PRINTTAB(7)"OUTPUT TO PRINT
ER?              <Y> OR <N>";:IN
PUT A$:IF A$="N" THEN PR=0:RETUR
N ELSE IF A$="Y" THEN PR=-2:GOTO
 1340 ELSE SOUND 150,5:GOTO 1300
1340 PRINT:PRINTTAB(5)"MAKE SURE
 YOUR PRINTER          IS ON-LIN
E.":PRINT
1350 PRINTTAB(4)"HIT <ENTER> TO
CONTINUE";
1360 A$=INKEY$:IF A$="" THEN1360
1370 CLS:RETURN
1380 GOSUB 1060
1390 'MONTHLY OUTPUT
1400 FOR I=1 TO DM(MM)
1410 DD=I:GOSUB 820
1420 PRINT#PR,TAB(7)MM$(MM);:PRI
NT#PR,USING"##";I;:PRINT#PR," =
";H$;M$;S$
1430 IF PR=0 AND(I=9 OR I=24) TH
EN GOSUB 1350
1440 NEXT I
1450 IF PR=0 GOSUB 1350
1460 DD=1:GOTO 300
1470 END
```

END

EDT, CST, and so on). Thus 4:20 p.m. PST must be input as 16,20,PST. Again, be sure to include all commas. (Note: 12 p.m. is 0 hours, not 24 hours.) For the date prompts, respond numerically for all months. September 24 must be input as 9,24 (not Sep,24).

You can print out the final output of the program. When it asks if you want output to the printer, answer with Y or N. There are no special printer character codes used, therefore any printer should work.

"The program (Sidtime) was written to operate easily for U.S. time zones, both daylight and standard . . . you can use Greenwich Mean Time (GMT) with proper time adjustments."

After the output is listed to screen or printer, the program returns to the main menu. Continuing to use the program will cause previous inputs to become the default values. It will not be necessary, therefore, to input the same longitude or date over and over again. If you want to change the default value, enter N to the prompt "Same longitude?" or "Same date?", and then enter the new value.

It became very difficult (and lengthened the program considerably) to try and trap all invalid inputs. Therefore, the program will accept a date of February 31 and produce an output. To prevent strange outputs, use your common sense and do not input values that are out of range or incorrect. Also, respond fully to all prompts. Do not rely on just pressing the enter key as a yes or no response.

The program was written to operate easily for U.S. time zones, both daylight and standard. In addition, you can use Greenwich Mean Time (GMT) with proper time adjustments. To compute the sidereal time for longitudes outside of the U.S. time zones, convert the time to GMT and use GMT as the time zone. ■

Al Burzynski is a senior electronics technician and amateur astronomer. Write him at 4323 Eagle Nest, San Antonio, TX 78233.

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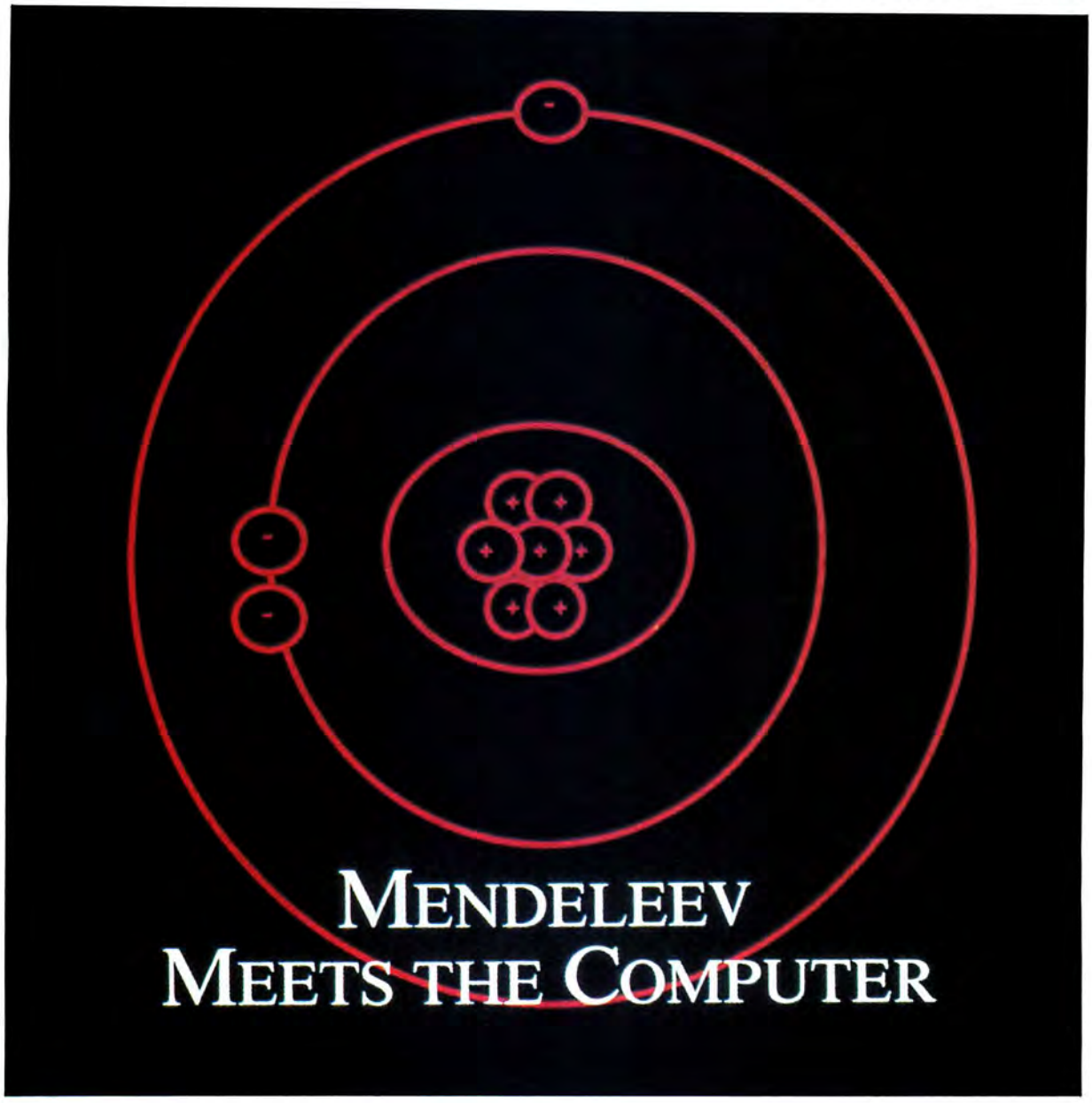


MENDELEEV MEETS THE COMPUTER

Learn to draw the Bohr orbital models of an atom from this tutorial on the Chemical Elements table.

Mendeleev Meets the Computer teaches the concepts used in drawing Bohr orbital models of an atom. It also teaches you how to use the information given by the Periodic Table of Chemical Elements. From this table you can identify the parts of an atom.

When you have done this, the computer asks you to type in the number of electrons, protons, and neutrons in selected elements. If you answer each of these questions correctly, it shows a picture of the Bohr orbital model for that element, and repeats this procedure for two more elements.

If you answer any one of the questions incorrectly the program loops you back to the equations and you must start at the beginning of the questions. Therefore, you have no other choice

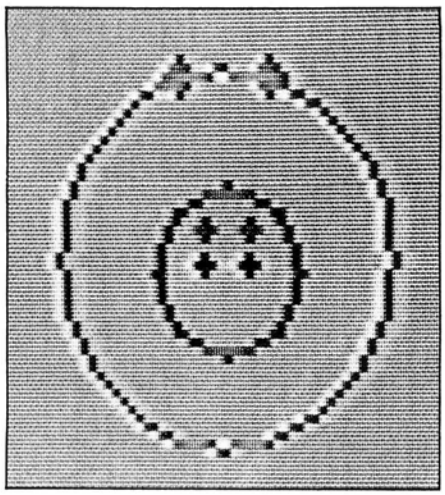


Photo 1. The Hydrogen Model

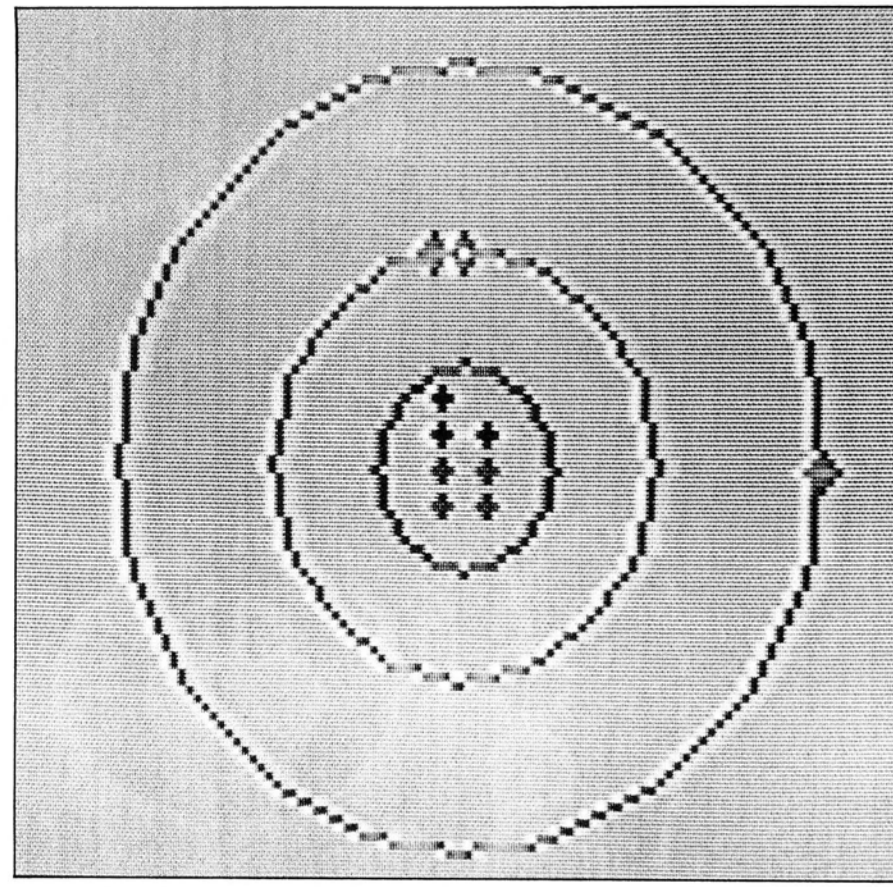


Photo 2. The Helium Model

than to learn the information.

The program displays element models using the CIRCLE command with various radii. The electrons and electron shells are the same color, as are the neutrons and the nucleus, and the protons are still another color. In the first model there are no neutrons present, so don't be alarmed when you see only two different kinds of dots.

The program uses x and y as variables in the beginning, with x equaling the position where an x is printed, and y the tone of the sound. It then uses a and b in the same way. The letter a equals x, and b equals y. The letter e is the value of the number of electrons in each element, p is the value of the number of the protons, and n is the value of the number of neutrons. ■

Address correspondence to Caitlin Dangler, 1 Marcus Drive, Morgantown, WV 26505.

System Requirements

16K RAM
Extended Color Basic

Program Listing. Mendeleev Meets the Computer

```
10 CLS(3)
15 '#####OPENING SCREEN#####
20 PRINT@96,"          "
30 X=104:Y=10
40 PRINT@X,"X":SOUNDY,2
50 IFX=119THEN80
60 X=X+1:Y=Y+1:GOTO40
70 IFX=119THEN100
80 PRINT@128,"          ":PRINT@1
36,"X":SOUND26,2:PRINT@139,"MEND
ELEEV":PRINT@151,"X":SOUND27,2:P
RINT@160,"          ":PRINT@168,
"X":SOUND28,2:PRINT@183,"X":SOUN
D29,2:PRINT@192,"          ":PRIN
T@200,"X":SOUND31,2
90 PRINT@205,"MEETS":PRINT@215,"
X":SOUND32,2:PRINT@224,"
  ":PRINT@232,"X":SOUND33,2:PRINT
@247,"X":SOUND34,2:PRINT@256,"
        ":PRINT@264,"X":SOUND35,
2:PRINT@266,"THE COMPUTER":PRINT
@279,"X":SOUND36,2
100 PRINT@288,"          "
110 A=296:B=37
120 PRINT@A,"X":SOUNDB,2
130 IFA=311THEN150
140 A=A+1:B=B+1:GOTO120
150 PRINT@448,"PRESS ENTER TO CO
NTINUE":INPUTX
160 CLS(0):PRINT@192,"##########
DEVELOPED BY###########
CAITLIN DANGLER       ##
SOUTH JUNIOR HIGH     ##
MORGANTOWN,WV.        ##########
######################":PRINT@44
8,"PRESS ENTER":INPUTX
165 '#####MUSIC#####
166 PLAY"T5L4FFL8FL4FG+L8GL4GL8F
L4FL8EL2F"
168 '#####STORY LINE#####
170 CLS(4):PRINT@64,"IT IS THE Y
EAR 2050, CANCER NOW HAS A CURE,
 BUT NEW AND MORE     COMPLEX DIS
EASE HAS EVOLVED.     YOU ARE A W
ORLD FAMOUS           SCIENTIST A
ND YOU HAVE TO RACE   AGAINST THE
 CLOCK TO SAVE THE    POPULATION
OF THE WORLD."
180 PRINT@352,"DO YOU WANT A CLU
E ON HOW TO     APPROACH THE PROB
LEM?(Y/N)":INPUTX$
190 IFX$="Y"THEN200 ELSE220
200 CLS(4):PRINT@192,"THIS DISEA
SE HAS NOT BEEN       RESEARCHED
 VERY WELL, THEREFORE,IT DOESN'T
 HAVE A NAME SO WE    WILL CALL
IT D-1. WE THINK D-1   HAS SOMET
HING TO DO WITH       CHEMICAL
ELEMENTS."
210 PRINT@448,"PRESS ENTER":INPU
TX
220 CLS(4):PRINT@256,"SINCE COMP
UTERS HAVE BEEN       DEVELOPED
 AND IMPROVED         SCIENTIST
S HAVE FAILED TO KEEP   UP WITH
THEIR BASIC SKILLS"
230 PRINT@448,"PRESS ENTER":INPU
TX
233 '#####MUSIC#####
235 PLAY"T203L16CP16O2L32GP32GP3
2L8AGP8L16BP16O3C"
240 CLS(4):PRINT@192,"YOU HAVE A
LSO FAILED TO KEEP UP WITH YOUR
SKILLS. BECAUSE OF    THIS YOU E
ITHER HAVE TO RELEARN THE MATERI
AL OR FIND YOUR NOTES FROM YOUR
9TH GRADE SCIENCE     CLASS"
250 PRINT@448,"PRESS 1 TO LEARN
2 TO LOOK FOR  NOTES":INPUTX
260 IFX=1THEN270ELSE330
265 '#####PERIODIC TABLE EXPLANA
TION#####
270 CLS(4):PRINT@128,"BY LOOKING
 AT THE PERIODIC TABLEYOU CAN ID
ENTIFY THE PARTS OF ANATOM. IF Y
OU ARE LOOKING AT AN  ELEMENT ON
 THE TABLE,YOU WILL   DISCOVER T
HE ATOMIC MASS, WEIGHTAND SYMBOL
.":PRINT@448,"PRESS ENTER":INPUT
X
290 CLS(4):PRINT@256,"THERE ARE
THREE BASIC PARTS OF  AN ATOM:TH
E ELECTRON,THE NEUTRON AND THE P
ROTON":PRINT@448,"PRESS ENTER":I
NPUTX
300 CLS(5):PRINT@160,"THE ATOMIC
 NUMBER OF AN ELEMENT IS ALSO TH
E NUMBER OF ELECTRONS IN THE MOD
EL.THE NUMBER OF      ELECTRONS
IS EQUAL TO THE NUMBER OF PROTON
S.THE NEUTRONS ARE    EQUAL TO T
HE ATOMIC MASS MINUS  THE NUMBER
 OF "
310 PRINT@384,"ELECTRONS OR PROT
ONS":PRINT@448,"PRESS ENTER":INP
UTX
320 GOTO360
```

Listing continued

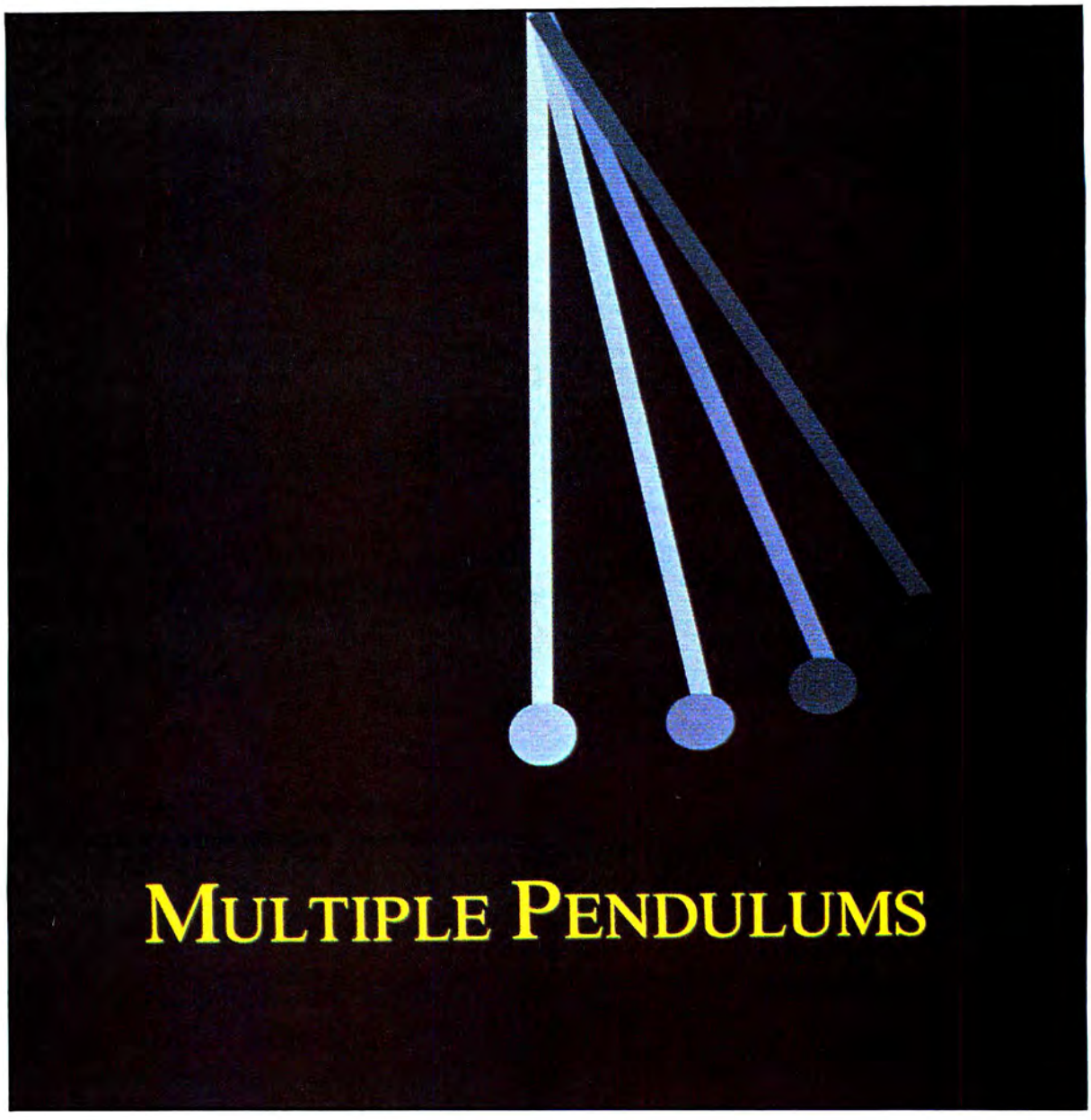
Listing continued

```
330 CLS(5):PRINT@160,"YOU MUST E
ITHER BE A VERY       ORGINIZED
PERSON OR A VERY YOUNG SCIENTIST
.":PRINT@448,"PRESS ENTER":INPUT
X
335 '#####EQUATIONS#####
340 CLS(5):PRINT@160,"ELECTRONS=
ATOMIC NUMBER          ELECTRONS=
PROTONS                NEUTRONS=A
TOMIC MASS-ELECTRONS   NUCLEUS=PR
OTONS & PROTONS        ELECTRONS/
SHELL=2,8,8,16"
350 PRINT@448,"PRESS ENTER":INPU
TX
360 CLS(5):PRINT@192,"NOW THAT Y
OU HAVE REFRESHED YOURMEMORY,LET
'S GET STARTED ON      SAVING THE
 WORLD.YOU CAN DO THISBY DRAWING
 BOHR ORBITIAL MODELS FOR THE 5
ELEMENTS WICH WE THINK COMPOSE D
-1.":PRINT@448,"PRESS ENTER":INP
UTX
365 '#####HYDROGEN BOX#####
370 CLS(5):PRINT"THE FIRST MODEL
 YOU HAVE TO DRAW IS HYDROGEN"
380 PRINT@96,"
   ######          ATOMIC MASS --
>  #1   #        ELEMENT SYMBOL--
>  # H  #        ATOMIC NUMBER --
>  #  1 #
   ######"
390 PRINT@448,"PRESS ENTER":INPU
TX
395 '#####USER INPUT#####
400 CLS(5):PRINT@128,"HOW MANY E
LECTRONS IN THE BOHR  ORBITAL MO
DEL?":INPUTE:IFE=1THEN410ELSE340
405 '#####USER INPUT#####
410 PRINT@224,"HOW MANY NEUTRONS
 IN THE BOHR   ORBITAL MODEL?":I
NPUTN:IFN=0THEN420ELSE340
415 '#####USER INPUT#####
420 PRINT@320,"HOW MANY PROTONS
IN THE BOHR   ORBITAL MODEL?":IN
PUTP:IFP=1THEN430ELSE340
425 '#####HYDROGEN GRAPHICS#####
430 PMODE1,1:PCLS:SCREEN1,1:CIRC
LE(128,96),2,6:CIRCLE(128,96),20
,8:CIRCLE(128,96),45,7:CIRCLE(12
8,55),4,7:FORZ=1TO460*5::NEXTZ:C
LS(2):PRINT@224,"!!!!!!!!! CONGR
ATULATIONS!!!!!!":PRINT@448,"PRE
SS ENTER":INPUTX
434 '#####MUSIC#####
435 PLAY"T3O2L24GP24O3CP24EP24L1
2GP12L24L3G"
437 '#####HELIUM BOX#####
440 CLS(2):PRINT"THE 2ND MODEL Y
OU HAVE TO DRAW  IS HELIUM"
450 PRINT@96,"
  ########          ATOMIC MASS-
->#4     #        ELEMENT SYMBOL-
->#  HE  #         ATOMIC NUMBER-
->#     2#
  ########":PRINT@448,"PRESS ENT
ER":INPUTX
455 '#####USER INPUT#####
460 CLS(2):PRINT@128,"HOW MANY E
LECTRONS IN THE BOHR  ORBITAL MO
DEL?":INPUTE:IFE=2THEN470ELSE340
465 '#####USER INPUT#####
470 PRINT@224,"HOW MANY NEUTRONS
 IN THE BOHR   ORBITAL MODEL?":I
NPUTN:IFN=2THEN480ELSE340
475 '#####USER INPUT#####
480 PRINT@320,"HOW MANY PROTRONS
 IN THE BOHR   ORBITAL MODEL?":I
NPUTP:IFP=2THEN490ELSE340
485 '#####HELIUM GRAPHICS#####
490 PMODE1,1:PCLS:SCREEN1,1:CIRC
LE(122,96),2,6:CIRCLE(134,96),2,
6:CIRCLE(122,88),2,8:CIRCLE(134,
88),2,8:CIRCLE(128,98),20,8:CIRC
LE(128,96),45,7:CIRCLE(140,55),4
,7:CIRCLE(116,55),4,7:FORZ=1TO46
0*5:NEXTZ
495 '#####MUSIC AND USER INPUT##
###
500 CLS(7):PRINT@224,"!!!!!!!!!
CONGRATULATIONS !!!!!!":PRINT@44
8,"PRESS ENTER":INPUTX:PLAY"T3O2
L24GP24O3CP24EP24L12GP12L24EP24L
3G"
505 '#####LITHIUM BOX#####
510 CLS(7):PRINT"THE 3RD MODEL Y
OU HAVE TO DRAW  IS LITHIUM"
520 PRINT@96,"
 ########          ATOMIC MASS--
>#  7    #       ELEMENT SYMBOL--
>#  LI   #        ATOMIC NUMBER--
>#     3 #
 ########":PRINT@448,"PRESS ENTE
R":INPUTX
525 '#####USER INPUT#####
530 CLS(7):PRINT@128,"HOW MANY E
LECTRONS IN THE BOHR  ORBITAL MO
DEL":INPUTE:IFE=3THEN540ELSE340
535 '#####USER INPUT#####
540 PRINT@224,"HOW MANY NEUTRONS
 IN THE BOHR    ORBITAL MODEL?":
INPUTN:IFN=4THEN550ELSE340
545 '#####USER INPUT#####
550 PRINT@320,"HOW MANY PROTRONS
 IN THE BOHR   ORBITAL MODEL?":I
NPUTP:IFP=3THEN560ELSE340
555 '#####LITHIUM GRAPHICS#####
560 PMODE1,1:PCLS:SCREEN1,1:CIRC
LE(122,88),2,6:CIRCLE(134,88),2,
6:CIRCLE(122,80),2,6:CIRCLE(122,
96),2,8:CIRCLE(122,104),2,8:CIRC
LE(134,104),2,8:CIRCLE(134,96),2
,8:CIRCLE(128,96),25,8:CIRCLE(12
8,96),50,7:CIRCLE(128,96),90,7
570 CIRCLE(128,48),4,7:CIRCLE(12
0,48),4,7:CIRCLE(218,96),4,7:FOR
Z=1TO460*5:NEXT:CLS(3)
580 PRINT"YOU HAVE SUCCESSFULLY
DRAW 3 OF THE 5 ELEMENTS!!HOWEVE
R,        KNOWLEDGE OF THE LAST
2 ELEMENTSCAN ONLY BE FOUND IN T
HE SOVIET UNION AND CHINA.PLEASE
 CONACT   OTHER YOUNG SCIENTISTS
 IN THOSE COUNTRIES"
590 PRINT@448,"HAVE A GOOD LIFE,
PRESS ENTER":INPUTX:GOTO10
```

END

✓ See List of Advertisers on page 131

BY PETER GIOVANONI



MULTIPLE PENDULUMS

Galileo watched the lamps swinging in a cathedral. You can take this physics problem one step further.

One of the standard problems in any physics class is that of the simple pendulum. You have probably heard the story about Galileo watching the swinging lamps in the cathedral and timing them with his pulse. But suppose you want to go on and consider the more complex situation of a series of pendulums attached end-to-end as in Fig. 1.

How can you calculate the position of each pendulum after a specified time had elapsed? What would the difference be if there were two or 10 tied end to end? The math gets more involved, but with your CoCo and the program described here, the dynamics of this problem are easily demonstrated. It should make an ideal project to supplement a high-school physics class.

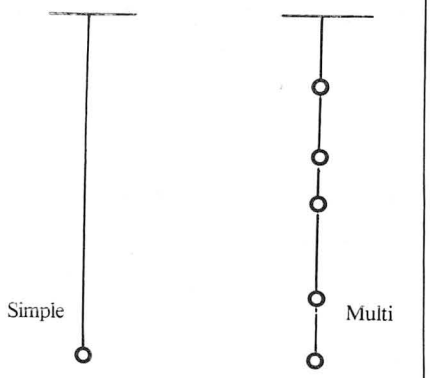


Fig. 1. Simple and Complex Pendulums

For a given set of initial conditions the computer draws a series of time-lapse pictures showing the changing arrangement of pendulum positions as the system swings through an arc established by an angle of the original release point. You determine the time between each frame and the total number of frames displayed.

Time is measured in seconds from time-zero, representing the initial state of the system. After completing the first set of drawings the computer shows you a menu of the following choices:

- new initial conditions,
- change some of the initial conditions,
- see last run for a certain time,
- see last run again, and
- end.

Table 1 summarizes how the Program Listing works. You can save the output by using a screen-print program with results like those shown in Fig. 2.

If you want to use this as a teaching aid, you need a brief excursion into the math. Solve problems of this type by using a Lagrangian Function formed by subtracting the total potential energy from the total kinetic energy. This produces a set of differential equations, one for each coordinate. Solve these to obtain the position as a function of time.

The equation for each pendulum therefore takes this form:

Eq. 1 $\ddot{\Theta} = -k^2 \Theta$

where Θ is the angle

10–25	Initialize and dimension arrays.
30–45	Input units to be used.
50–110	Input initial conditions.
115–160	Input time interval, set up for graphics, and advance frames.
165–210	Input next choice.
215–235	Draw system for specific time.
240–270	Input variables to be changed.
275–340	Change number of pendulums.
345–350	Check for more changes.
355–390	Change lengths.
395–425	Change angles.
430–460	Change velocities.
1000–1115	Find constants of equations of motion.
2000–2055	Find positions and draw pictures.

Table 1. Program Outline

Since there are no restrictions on which coordinate system to use, choose the one that makes the problem easiest to work. The system used for a set of pendulums is the length and the angle of displacement from the vertical for each pendulum in the set.

The initial conditions needed are the total number of pendulums, the length of each pendulum, the angle of each pendulum, and the velocity of each pendulum. The equations for the angle will be in this form:

Eq. 2 $\Theta = D*\mathrm{Sin}(kt - s)$

where D is the amplitude, k is the wave number, t is the time, and s is the phase angle.

Wave number is determined by the length and two constants. The first is the gravitational constant, g. If you are using the metric system, g equals 9.8 meters per second. In feet, g will be 32 feet per second. The second constant falls out of the Lagrangian Function and is built into the program as shown in lines 1005–1020 of the Listing.

D and s are solved together by differentiating Eq. 2 to get a velocity expression. (Put $t = 0$ into both equations.) Solving D and s in this way requires that both quantities are given in radians. Degrees multiplied by pi/180 makes the conversion. Velocity must be expressed as angular velocity. The program makes the conversion if given data in terms of linear velocity (see line 95, 320, or 450).

As stated before, the procedure works for any number of pendulums, but the program limits you to 10. Any more than this makes the picture too cluttered. If you want to try more, change lines 20 and 50.

Lengths can be of any size because a variable scale factor is used to fill the screen to the best advantage. The scaling is done by dividing 180 by the total length of all the pendulums.

Keep angles small, less than half a radian (about 27 degrees). Larger angles can cause the pictures to run off the screen. Also, the equations used in the program assumed small angles as this made the differential equations easier. The equations still give answers for the larger angles, but they do not approximate the real world as well as they should. ■

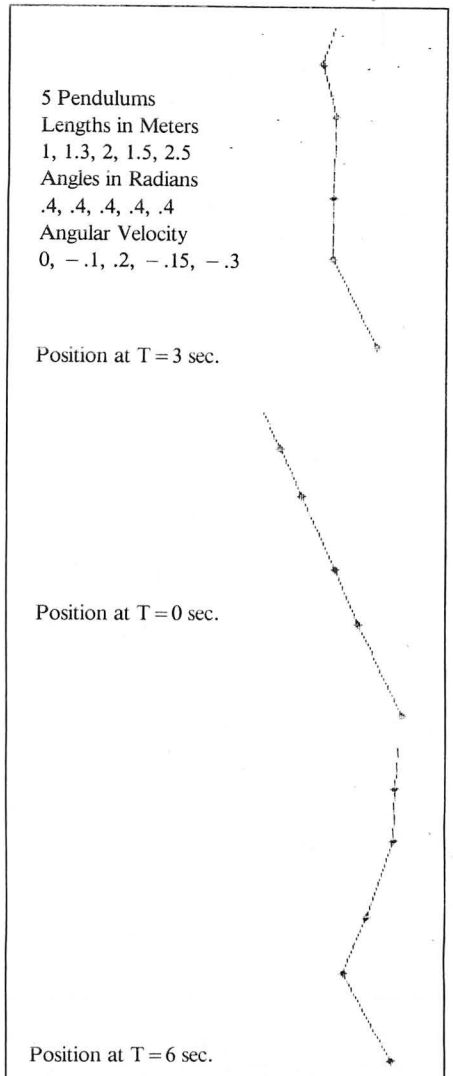


Figure 2. Sample Pendulum Printout Using a DMP-100 Printer and Radio Shack's Screen Print Program

System Requirements

16K RAM
Extended Color Basic
Printer (optional)

Peter Giovanoni is a physics and astronomy student at the University of Maryland. Write him at 315 Coffman Ave., Hagerstown, MD 21740.

```
10 REM MULTIPLE PENDULUMS
15 PI=3.1415927
20 DIM IA(10):DIM IV(10):DIM L(1
0):DIM X(10):DIM Y(10):DIM AN(10
):DIM K(10):DIM S(10):DIM D(10)
25 CLS
30 PRINT"  THIS IS A PROGRAM TO
SHOW THE MOTION OF PENDULUMS CON
NECTED   END TO END. YOU WILL CH
OOSE THE INITIAL CONDITIONS. AFT
ER FINAL FRAME IS DRAWN HIT ANY
KEY TO   CONTINUE."
35 INPUT"WILL YOU GIVE ANGLES IN
 DEGREES OR RADIANS(D/R)";A$
40 INPUT"WILL YOU GIVE LENGTH IN
 FEET OR METERS(F/M)";L$
45 INPUT"WILL YOU GIVE ANGULAR O
R LINEAR VELOCITY(A/L)";V$
50 INPUT"NUMBER OF PENDULUMS(2-1
0)";N:IF N<2 OR N>10 THEN 50
55 IF A$="D" THEN AC=PI/180 ELSE
 AC=1
60 IF L$="F" THEN G=32 ELSE G=9.
8
65 IF V$="A" THEN W$="ANGULAR" E
LSE W$="LINEAR"
70 TL=0
75 PRINT"GIVE LENGTH, ANGLE, AND
 "W$"  VELOCITY OF EACH PENDULUM
"
80 FOR C=1 TO N
85 PRINT C")"
90 INPUT L(C),IA(C),IV(C)
95 IF V$="L" THEN IV(C)=IV(C)/L(
C) ELSE IV(C)=IV(C)*AC
100 IA(C)=IA(C)*AC
105 TL=TL+L(C)
110 NEXT C
115 GOSUB 1000
120 INPUT" GIVE TIME BETWEEN FRA
MES AND   TOTAL NUMBER OF FRAMES
 DESIRED ";TI,NF
125 FR=0:SC=180/TL:T=0
130 PMODE 4,1:SCREEN 1,1
135 PCLS
140 GOSUB 2000
145 FOR CN=1 TO 460*TI
150 NEXT CN
155 T=T+TI:FR=FR+1
160 IF FR<=NF THEN 135
165 E$=INKEY$:IF E$="" THEN 165
170 CLS:PRINT"WHAT DO YOU WANT T
O DO NEXT"
175 PRINT"1) NEW INITIAL CONDITI
ONS"
180 PRINT"2) CHANGE SOME OF THE
INITIAL   CONDITIONS"
185 PRINT"3) SEE LAST RUN FOR A
CERTAIN   TIME"
190 PRINT"4) SEE LAST RUN AGAIN"
195 PRINT"5) END"
200 INPUT CH
205 ON CH GOTO 25,240,215,120,46
5
210 PRINT"NOT A CHOICE. PICK AGA
IN":GOTO 200
215 INPUT"WHAT TIME";T
220 PCLS:SCREEN 1,1
225 GOSUB 2000
230 D$=INKEY$:IF D$="" THEN 230
235 GOTO 165
240 CLS:PRINT"WHAT DO YOU WANT C
HANGED"
245 PRINT"1) NUMBER OF PENDULUMS
"
250 PRINT"2) LENGTHS OF PENDULUM
S"
255 PRINT"3) ANGLES OF PENDULUMS
"
260 PRINT"4) VELOCITIES OF PENDU
LUMS"
265 INPUT CH
270 ON CH GOTO 275,355,395,430:
GOTO 240
275 INPUT"NEW NUMBER OF PENDULUM
S(2-10)";NN
280 IF NN>N THEN 300
285 N=NN:TL=0
290 FOR C=1 TO N:TL=TL+L(C):NEXT
 C
295 GOTO 345
300 PRINT"GIVE LENGTH, ANGLE, AN
D "W$"  VELOCITY OF THE NEW PEND
ULUMS"
305 FOR C=N+1 TO NN
310 PRINT C")"
315 INPUT L(C),IA(C),IV(C)
320 IF V$="L" THEN IV(C)=IV(C)/L
(C) ELSE IV(C)=IV(C)*AC
325 IA(C)=IA(C)*AC
330 TL=TL+L(C)
335 NEXT C
340 N=NN
345 INPUT"ANY OTHER CHANGES(Y/N)
";B$
350 IF B$="Y" THEN 240 ELSE 115
355 INPUT"HOW MANY LENGTHS CHANG
ED";F
360 FOR H=1 TO F
365 INPUT"LENGTH TO BE CHANGED";
LC
370 TL=TL-L(LC)
375 INPUT"NEW LENGTH ";L(LC)
380 TL=TL+L(LC)
385 NEXT H
390 GOTO 345
395 INPUT"HOW MANY ANGLES CHANGE
D";F
400 FOR H=1 TO F
405 INPUT"ANGLE CHANGED";NA
410 INPUT"NEW ANGLE ";IA(NA)
415 IA(NA)=IA(NA)*AC
420 NEXT H
425 GOTO 345
430 INPUT"HOW MANY VELOCITIES CH
ANGED";F
435 FOR H=1 TO F
440 INPUT"VELOCITY TO BE CHANGED
";VC
445 INPUT"NEW VELOCITY";IV(VC)
450 IF V$="L" THEN IV(VC)=IV(VC)
/L(VC) ELSE IV(VC)=IV(VC)*AC
455 NEXT H
460 GOTO 345
465 END
1000 REM SUBROUTINE TO FIND CONS
TANTS IN EQUATION OF MOTION
1005 FOR D=1 TO N-1
1010 K(D)=SQR((N-D+1)*G/L(D)/2)
1015 NEXT D
1020 K(N)=SQR(G/L(D))
1025 FOR A=1 TO N
1030 IF IV(A)=0 THEN 1075
1035 S(A)=-ATN(K(A)*IA(A)/IV(A))
1040 IF S(A)=0 THEN 1100
1045 Q=0
1050 IF SGN(IV(A)/COS(-S(A)))<>S
GN(IA(A)/SIN(-S(A))) THEN Q=PI
1055 S(A)=S(A)+Q
1060 D(A)=IA(A)/SIN(-S(A))
1065 NEXT A
1070 GOTO 1115
1075 IF IA(A)=0THEN 1090
1080 S(A)=PI/2*SGN(IA(A))
1085 GOTO 1060
1090 S(A)=0:D(A)=0
1095 GOTO 1065
1100 D(A)=IV(A)/K(A)*SGN(IV(A))
1105 IF IV(A)<0 THEN S(A)=PI
1110 GOTO 1065
1115 RETURN
2000 REM SUBROUTINE TO FIND POSI
TIONS
2005 X0=127:Y0=0
2010 FOR E=1 TO N
2015 AN(E)=D(E)*SIN(K(E)*T-S(E))
2020 X(E)=L(E)*SIN(AN(E))*SC+X0
2025 Y(E)=L(E)*COS(AN(E))*SC+Y0
2030 LINE(X0,Y0)-(X(E),Y(E)),PSE
T
2035 CIRCLE(X(E),Y(E)),2
2040 X0=X(E)
2045 Y0=Y(E)
2050 NEXT E
2055 RETURN
```

END

Program Listing. Multiple Pendulums

✓ See List of Advertisers on page 131

BY SCOTT L. NORMAN

MICRONEYE— THE GIFT OF SIGHT

The Color Computer's senses are developing nicely. It has been easy to generate reasonably good speech for some time, and at least one voice-recognition program is available. Now, an innovative and affordable product makes it possible for lucky CoCos to acquire vision to go with their speech and hearing.

Micron Technology's breakthrough is available to CoCo owners. It gives eyes to your system.

The product is the MicronEye, a relatively inexpensive video camera based on a new concept in solid-state imaging devices. With the appropriate hardware interface and driver software, it can transmit binary images to a computer where they can be displayed, stored, or manipulated by additional software. This opens up many possibilities in pattern recognition, laboratory applications, and other areas.

When I say *binary* images, I am referring to visual appearance, in addition to the language of ones and zeros by which the computer operates. On a black-and-white TV receiver the images themselves will appear in strict black and white. The MicronEye has no gray-scale capability, although there are programming tricks that mimic such effects.

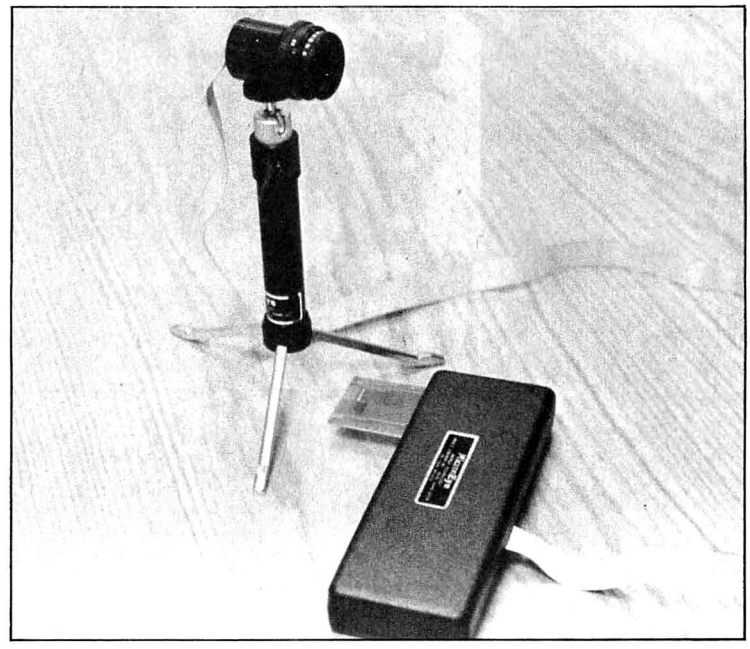


Photo 1. The MicronEye bullet model and its electronics module. That length of bare printed circuit board is a potential weak spot.

The camera's developer, Micron Technology, has thus far produced two different physical packages for its product. There are interface electronics and software drivers tailored to the Apple II Plus, IBM Personal Computer, Commodore 64, and the CoCo (Photo 1). Yet another model of the MicronEye can be used with any computer capable of supporting an RS-232 port.

At this stage, the Color Computer version of the MicronEye is probably more exciting because of its potential than because of any particular application that has been demonstrated. Up until now Micron Technology has devoted more of its resources to the development of the IBM and Apple versions. Therefore this article is less a review of a finished product than a subjective preliminary evaluation.

While the MicronEye is available for the CoCo, no one claims that it can simply be plugged in and used in some revolutionary application. A lot of soft-

ware development is needed before that happens. Who knows, perhaps this piece will inspire someone to do just the job.

The OpticRAM

The key to Micron Technology's ability to manufacture such a reasonably priced product is their proprietary image-sensing array, known as the OpticRAM. In essence, this is a 64K dynamic RAM with a window in the top of the package (Photo 2). Silicon's inherent photoconductivity is employed to make image sensors out of the individual memory cells.

In operation, each of the cells is initially charged to a fixed voltage and then remeasured after a specific time. Since silicon is not a perfect insulator, the charge would gradually leak away and the voltage drop to zero even if nothing else were done; because of its photoconductivity, however, this decay is faster where the material is illuminated. If a lens focuses an image on the surface of the OpticRAM, the cells corresponding to the brighter parts of the image lose their charge more rapidly than those in the dimmer parts.

This forms the basis for camera action. If the voltage on a cell has fallen below a certain threshold by the time that cell is measured, a digital signal corresponding to "bright" (a logic 1) is generated; if the voltage is still above threshold, the "dark" signal (a logic 0) is sent.

This two-level scheme is the best for simple systems. Although multiple thresholds might be established to set up a coarse gray scale, several bits would then have to be transmitted to the computer for each picture element. In the case of the Color Computer, there would be no point in doing so; each display pixel can only be on or off, so any information about tonality would be lost anyway.

The MicronEye's circuitry controls the entire charge/expose/measure/recharge cycle. It also has to perform a fair amount of signal processing to map the physical pattern of the chip's memory cells onto that of the computer's video display. The OpticRAM contains a pair of sensing arrays, each 256 elements long and 128 elements high, separated by a nonphotosensitive strip about 25 elements wide. The sensor arrays are actually five times as wide as they are high, however, and cannot simply be mapped onto the display without considerable distortion.

The software furnished with the MicronEye gives you the choice of displaying the information from just one array (the bottom one) or both. Although the two-array scheme fills more of the CoCo's screen with imagery, the images do not match at the boundary because of the gap between the sensors. Differences in sensitivity across the chip can also make it difficult to find control settings, which give a completely satisfactory image in this mode. For critical work, it is often best to stick with a single imaging array.

Several choices are available for the resolution of the final image: 512 by 128 elements (the left half of this image, that is), 256 by 128, 256 by 64, and 128 by 64. The application will generally dictate the user's choice of how many elements should be sampled.

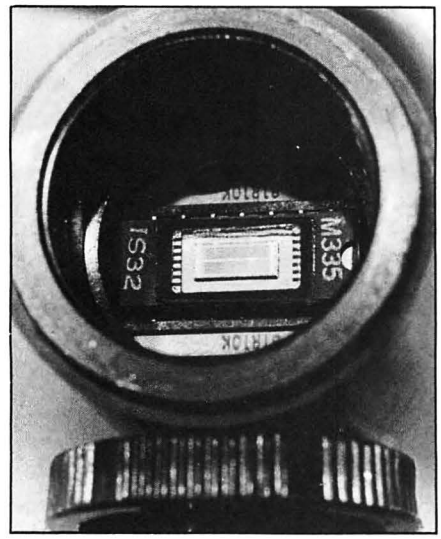


Photo 2. The OpticRAM image sensor chip. The light-sensitive regions are the two horizontal gray rectangles that occupy the middle of the chip.

Although the OpticRAM's imaging cells and read/write lines are not laid out in the exact configuration of conventional memory chips, the semiconductor technology is much the same; this helped Micron Technology keep development costs down. Other silicon image sensors, such as charge-coupled devices, require somewhat different technology and have yet to realize the economies of scale that are common in the semiconductor memory industry.

The Hardware

The two MicronEye packages are called the bullet and the camera. I had the opportunity to test the bullet, which puts the OpticRAM and a minimal amount of circuitry into a small cylindrical housing (tapped for a tripod screw), which attaches to a standard C-mount lens. The bulk of the electronics resides on a separate card that plugs into the CoCo's cartridge port and is connected to the bullet by a flat 16-conductor cable. Micron Technology recommends that the two be separated by no more than 5 feet to minimize noise effects; the stock cable is 4 feet long. Power drain on the computer is a modest 5 volts at 35–50 mA.

Most of the electronics for the camera model MicronEye are located with the Optic RAM. The resulting package is still relatively compact (the CoCo interface package is only about 3¼ by 8½ by 1 inches in size), and is easily mounted on a camera tripod. The connection to the computer is made via six-conductor modular telephone cord and can be fairly long.

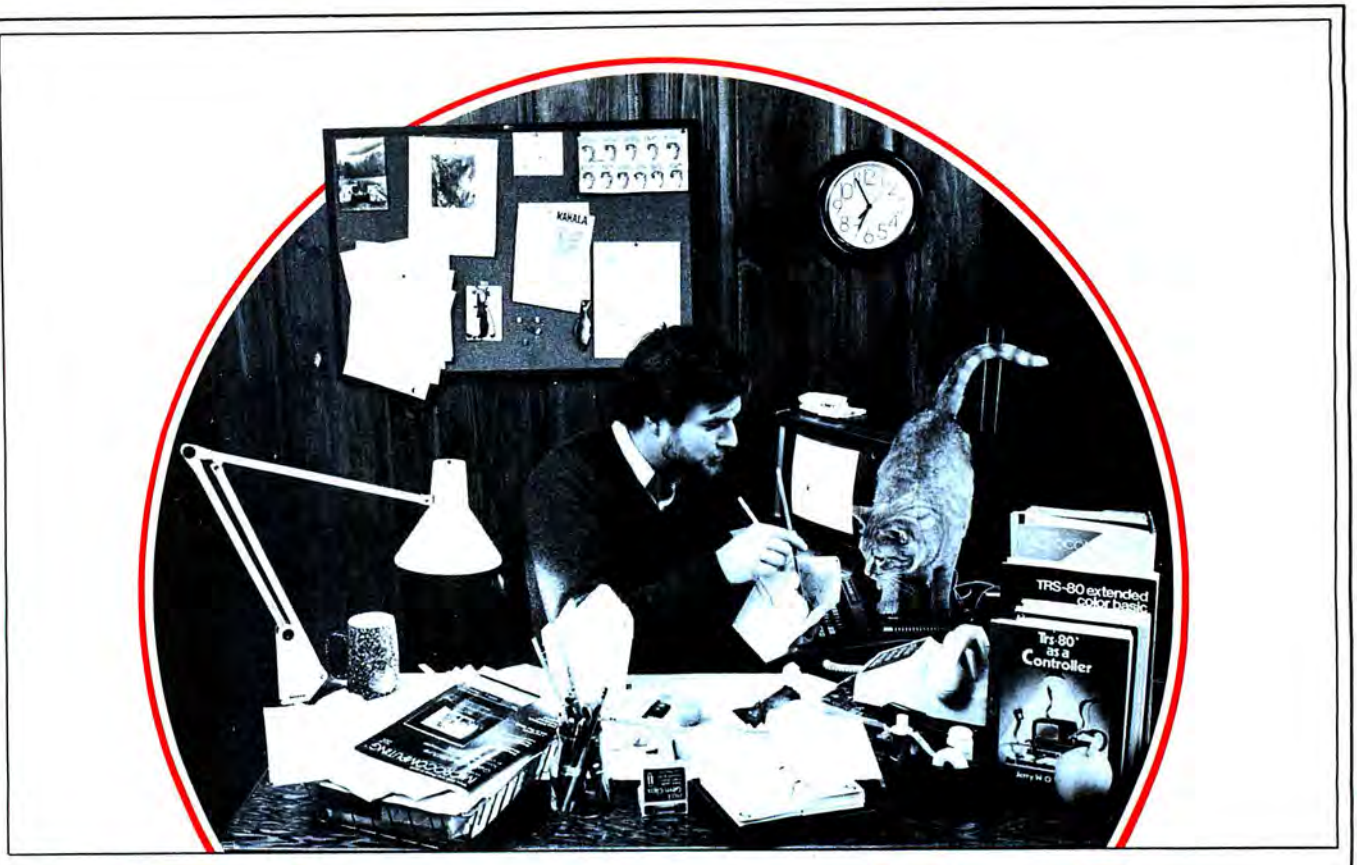
The RS-232 version looks like the camera model. It is fully self-contained, however, and capable of communicating with any computer that supports an RS-232 interface. A potential drawback is that communications speeds are limited by the capabilities of that interface—9,600 baud is the common maximum data rate. In contrast, the CoCo bullet model that I tested exchanges data and commands with the computer at 76,800 baud.

Even at such speeds, it takes a finite length of time to send a picture to the computer. Although the exposure time can be as short as 1 millisecond (1/1000 second), it still takes about 1.2 seconds to completely read out one of the MicronEye's imaging arrays in the highest-resolution mode. Thus the system is incapable of transmitting continuous action; the best you can do is a series of well-frozen snapshots.

In reality, this is not much of a drawback. MicronEye images are going to be subjected to some sort of computer processing in any real application, and that takes a while; there would be no practical way to handle, say, 60 images every second.

In addition to the interface electronics and the sensor itself, the standard MicronEye kit contains a C-mount lens, a small tripod (actually a single post with three spring-loaded feet and a locking ball joint), a cassette with the demonstration programs, and a manual. The lens furnished with the review unit had a 16 mm focal length and a maximum aperture of f/1.6, and focused to 0.3 meters. A fiber spacer ring was also furnished for closeup work; by unscrewing the lens and placing the ring between it and the MicronEye housing, it was possible to get down to lens-to-subject distances of 5 or 6 inches.

The choice of the C-mount system adds to the MicronEye's versatility;



Subroutines To Go

Help yourself to *Machine-Language Subroutines for the Color Computer*. It's a library of useful ready-to-use machine-language routines. Each subroutine is on the cassette that is included in the package. Many of the routines can be used in BASIC as well as machine-language programs. You'll find ROM subroutines, which are located in the interpreter ROMs of the Color Computer, and RAM subroutines, a collection of routines written by David McLeod.

What's inside

Each chapter contains a specific category of routine, giving a six-letter filename for each routine, a brief description of the routine and what it does, entry and exit requirements and a program listing or sample call. You'll learn about Color BASIC 1.1, Extended BASIC 1.0, Disk BASIC 1.0, numeric conversions, data processing routines, keyboard input routines, text output using high-resolution graphics, tape/disk input/output and multiple precision routines.

Easy to use

Machine-Language Subroutines for the Color Computer is packaged for ease of use while you are working at the computer. Each major section is marked with an index tab. Appendixes and an index of subroutines are included. If you are a machine-language programmer, you'll find *Machine-Language Subroutines for the Color Computer* a valuable addition to your program library. ⌐332

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loads of TV and 16 mm movie camera lenses are available to the experimenter. There are some bizarre possibilities; I had the opportunity to try the demonstrator with a 12.5–75 mm Canon TV zoom lens, at which point the MicronEye was clearly an attachment to the lens, rather than the other way around.

The bulk of the L-shaped interface board is surrounded by a welded plastic enclosure with only the portion that enters the computer protruding. I was happy to see gold-plated connector tabs on this section, but the lack of any substantial support is troublesome. As things stand, the weight of the entire electronics package is borne by the CoCo's internal cartridge connector and that cantilever section of bare board. There seemed to be a good chance of mechanical failure here, so I took to supporting the interface package on something during my experiments. Perhaps future versions will include an integral support.

Disk system operators should be pleased to learn that the MicronEye will operate in the Radio Shack Multi-Pak Interface (and, presumably, in other expansion units). With a little attention to address offsets and a few I/O commands, the driver software can be converted to disk. Graphics screens can also be saved on disk for more rapid retrieval.

The Software

The Color Computer demonstration cassette contains four files:

- MEYE, a Basic program that allows the user to experiment with the various parameters of the MicronEye system: number of sensor arrays, picture resolution, and exposure time;
- MEYEOBJ, a machine-language routine that actually interfaces the computer and the MicronEye;
- MEYEASM, the Assembly-language source file for MEYEOBJ; and
- MEYE2, a second Basic demonstrator. It is similar to MEYE, but uses slightly different menus and permits access to some different parameters.

Since both MEYE and MEYE2 call MEYEOBJ when they are run, it would be handy to have a second copy of MEYEOBJ on the tape, following MEYE2.

The demonstration programs provide most of the handles needed to begin working with the MicronEye. For example, here is how MEYE's main menu looks when the system is first powered up:

1) Run MicronEye
2) Change Arrays Used
3) Change Picture Size
4) Set Exposure Time
5) Reset to Initial Setup
6) Exit Program

SETUP: 1 ARRAY, 100 MSEC.
256 × 128 PICTURE

This incorporates all the options necessary to gain a feeling for the appearance of various picture "sizes" (resolutions). It also makes it fairly simple for the user to learn how critical the interaction between the aperture of the lens and the exposure time set by the sensor's electronic "shutter" can be.

MEYE2 has a slightly different menu, and also gives the user some insight into the digital command word sent to define the picture-taking parameters. For example, you can learn that the command $F8 (decimal 1248) is sent to define the startup parameters, and can see how this changes with changes in any of them. This can come in handy when users write their own MicronEye programs.

The programs are well documented

See List of Advertisers on page 131

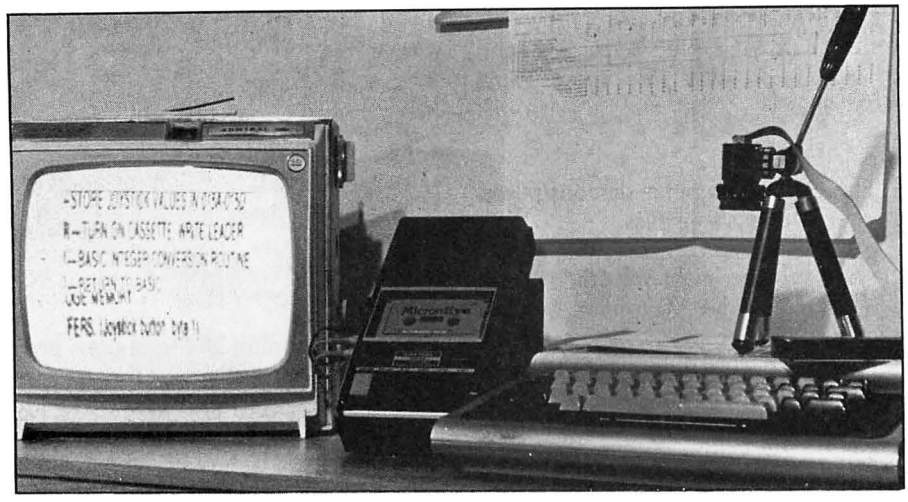

Photo 3. The author's CoCo, reading its own Nanos Systems reference card. The MicronEye's lens has been fitted with an extension ring for closeup work, and the bullet has been mounted atop a small photographic tripod; the subject is being held by the front legs of the tripod. Both OpticRAM arrays are being displayed on the TV screen. Note the mismatch (below the "Return to Basic" line).

(complete listings, bearing the name of program author Larry Bugbee, are included in the manual) and are short enough to encourage some experimentation.

The one obvious deficiency is the lack of a routine for saving an image for subsequent processing. This isn't much of a chore; the most you need do is save the 6,144 bytes corresponding to a hi-res graphics page. These lie between addresses 1536 and 7679, or $0600–$1DFF when a cassette system is used. Various offsets are needed by disk system operators, but there is no major problem.

In fact, some useful routines for saving and recalling MicronEye images have already been published in *Color Computer Magazine* (January 1984, p. 93). The major opportunities for cleverness now lie in devising programs that will do useful things with the digitized images that the system produces.

At the same time, the relative immaturity of the Color Computer implementation shows up in the demonstration programs. By way of contrast, the Apple software has provisions for automatic exposure control under conditions of changing illumination, as well as options for saving images on disk and printing them as positives or negatives. There is also a demonstration of grayscale imagery, using a superposition of images recorded at different exposure times.

The documentation furnished with the Apple and IBM PC versions also includes useful treatments of topics in optics and metrology. There is a discussion of alternative lens selection, based on consideration of the minimum feature size, which must be resolved in any particular application. Lighting is also treated: how to enhance contrast and so on.

Using the MicronEye

I did not find the bullet model's 4-foot interface cable to be much of a handicap, although it's not hard to imagine remote monitoring applications in which the longer reach of the camera model would be necessary. The biggest lesson I learned from my evaluation was the need for patience.

Remember that the MicronEye produces images by "slicing" any scene it views at a certain voltage level; everything below that level is represented as light, everything above as dark. Since the OpticRAM's output voltage is a linear function of the amount of light falling on it, two regions whose images differ only slightly in luminance can end up on opposite sides of the threshold. In conventional terms, the MicronEye is an extremely high-contrast device.

This is a common failing of inexpensive photodetectors. The human eye and photographic film respond logarithmically to changes in light intensity, allowing them to handle an enormous dynamic range of scene luminance. It takes a more complex detector structure than the MicronEye's to achieve this, however. Thus the user must learn that a small change in illumination, lens aperture, or exposure time can make a big difference in the appearance of the image.

While the aperture is adjusted mechanically, exposure time is controlled electronically through the interface programs; there is no shutter in the conventional sense. The MicronEye's crystal-controlled circuitry helps keep exposure timing reliable.

Any major changes in the exposure setting are best handled by invoking the appropriate option from one of the demonstration programs. Once you are close to the desired result, though, both programs let you make minor changes while watching the image on the screen. The CoCo's up- and down-arrow keys lengthen and shorten the exposure period, respectively. This is a very conve-

nient feature, but one that is not well highlighted in the manual.

The exposure times required for typical applications are not outlandish. Most of my experiments were conducted indoors, using only the regular incandescent lighting in my den. Typical settings for reading text or graphs printed on light paper were f/2 at 0.3–0.5 seconds. My photographic exposure meter indicated that film with an exposure index (E.I. rating) of about 10 would have required roughly the same.

This is not exactly world-beating sensitivity, but it does indicate that you can use the MicronEye in applications where only conventional lighting is available.

After I set up the MicronEye and target, obtaining an image was just a matter of setting the focus, choosing an exposure time, and watching the video screen while I varied the lens aperture by hand. Once a rough image was visible, I usually found it best to adjust the focus before attempting to refine the exposure. There is a good reason: Optical images have the highest contrast when they are in focus, so you need the best possible focus before attempting to properly position the MicronEye's own high-contrast characteristics on the scene's luminance distribution.

Once the initial thrill of seeing a decent image wears off, the user will generally notice that the MicronEye exhibits geometrical distortion. This comes about because the arrangement of light sensors on the chip does not correspond to the arrangement of pixels on the video screen.

When a single array was used in the 256-by-128 resolution mode, I found the MicronEye's field of view to be compressed by about 2.16:1 in the horizontal direction. That is, at the particular lens-to-subject distance I was using (about 125 mm), the 16 mm lens covered a region 44 mm wide and 11 mm high. This was converted to fill a video display 176 mm wide and 95 mm high; the result was obviously squashed horizontally.

This would be of little consequence in an actual image-processing application, since different mathematical scale factors could easily be defined for the horizontal and vertical directions. It is annoying for visual observations, though. Fortunately, there is an easy way out. By switching to the mode in which the left half of a 512-by-128-element picture was displayed, I reduced the compression factor in my closeup experiments to about 1.28:1. This might be improved a little at longer working distances, where the distortions of the wide-angle lens are less important.

Some Possible Applications

As some of the accompanying photos show, the MicronEye is capable of producing legible images of small print when used with a closeup lens. There can be no mistaking the fact that a sensor composed of discrete elements is used; nevertheless, the resolution is quite respectable.

This opens the possibility of all sorts of pattern-recognition experiments. Pattern recognition is one of the hot areas of computer science and robotics, and while the amateur experimenter is unlikely to make any major breakthroughs, there is a lot to be learned and a lot of fun to be had. The MicronEye provides a low-cost entry to the field—provided you are clever enough in your programming.

The device can also be used to get laboratory data into the computer for analysis. Any sort of experiment that produces a strip chart recording or other graph is fair game; once again, the key is in the analytical software. It would be easy to convert a photographic closeup stand (which usually comes with a pair of floodlight mounts) to hold the MicronEye, providing the user with a solid chart-reading station.

I have already mentioned remote monitoring applications. Once images can be digitized and recorded, it becomes simple to compare them and look for changes. Perhaps my lab background is showing, but I can imagine all sorts of uses for a computer system that can take action when the visual appearance of something changes.

I haven't even touched on the purely graphics aspects of the MicronEye. It should be possible to use it as one element in a computer graphics system, allowing the artistically inclined to create video images at least partially derived from hard copy. Use of the CoCo's coarser-resolution modes would permit color variations to enhance MicronEye imagery, as well.

These are just a few thoughts about the possibilities of this interesting new device. Like the computer itself, the MicronEye is likely to flourish as more and more people have the opportunity to work with it and to generate their own ideas.

(The MicronEye costs $295 and requires a 16K, Extended Color Basic CoCo. Write Micron Technology Inc., 2805 E. Columbia Road, Boise, ID 83706; phone 208-383-4000.)■

Address correspondence to Scott Norman, 8 Doris Road, Framingham, MA 01701.

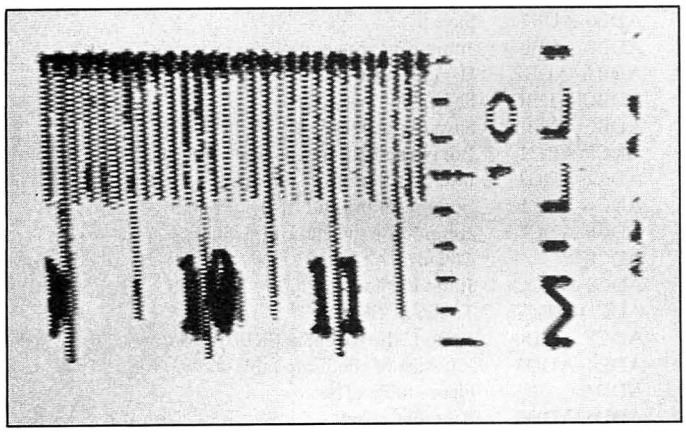

Photo 4a. Video display of crossed millimeter scales, illustrating the horizontal compression of the MicronEye's 256-by-128-element mode. The small divisions on the vertical scale are actually 1 mm apart, just like the divisions on the horizontal scale.

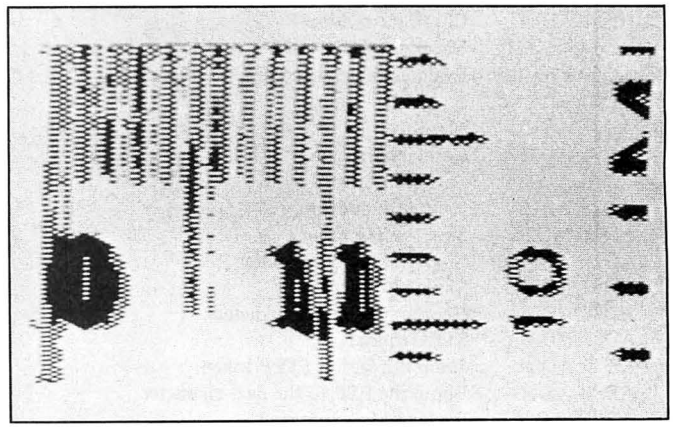

Photo 4b. A closer approximation to an accurate picture can be obtained by switching to the 512-by-128 (left half) mode. The graininess is a result of the layout of the MicronEye's sensor cells.

BY MARK D. GOODWIN

JOURNEY TO THE CENTER OF THE ROM—PART VII

This month's journey through the Color Basic ROM looks at areas such as the FOR, END, STOP, CONT, CLEAR, RUN, GO and RETURN commands; the interpreter routine; the keyboard routine; and the evaluate-expression routine. This Part VII of the series covers memory locations AD47 to B34A.—*eds.*

Address correspondence to Mark Goodwin, Star Route 79, Box 103, Orland, ME 04472.

AD47–AD9D Color Basic FOR Command

AD47–AD48	A = FOR flag value
AD49–AD4A	Set the FOR flag
AD4B–AD4D	Do LET
AD4E–AD50	Scan the stack for a matching VARPTR
AD51–AD52	Clean up the stack
AD53–AD54	Jump if a matching FOR frame wasn't found
AD55–AD56	X = start of the FOR frame
AD57–AD58	Remove the FOR frame from the stack
AD59–AD5A	B = number of words for memory check
AD5B–AD5D	Do memory check
AD5E–AD60	Scan to the next Basic statement
AD61–AD62	D = current Basic line number
AD63–AD64	Save the current Basic line number and the NEXT ESP
AD65–AD66	B = TO token
AD67–AD69	Check the syntax
AD6A–AD6C	Check for a TM error
AD6D–AD6F	Evaluate the expression
AD70–AD71	B = (SF1)
AD72–AD73	Mask the sign bit
AD74–AD75	Combine the sign with (MSB1)
AD76–AD77	Save the adjusted MSB1
AD78–AD7B	Y = return address
AD7C–AD7E	Save the TO value
AD7F–AD81	X = STEP default pointer
AD82–AD84	Move it to FPAC1
AD85–AD86	Get the next Basic character
AD87–AD88	STEP token?
AD89–AD8A	Jump if it isn't a STEP token
AD8B–AD8C	Bump the ESP to the next character
AD8D–AD8F	Evaluate the expression
AD90–AD92	B = (SF1)
AD93–AD95	Save the STEP value
AD96–AD97	D = FOR VARPTR
AD98–AD99	Save it
AD9A–AD9B	A = FOR token
AD9C–AD9D	Save it

AD9E–ADE3 Interpreter Routine

AD9E–ADA0	Call the Extended Color Basic link
ADA1–ADA2	Enable the interrupts
ADA3–ADA4	Check for BREAK or shifted @
ADA5–ADA6	X = current ESP
ADA7–ADA8	Save it as the location of the last byte executed
ADA9–ADAA	A = next Basic character
ADAB–ADAC	Jump if it's the end of the line
ADAD–ADAE	Colon?
ADAF–ADB0	Jump if it's a colon
ADB1–ADB3	Display SN error message
ADB4–ADB5	X = next Basic line pointer
ADB6–ADB7	Save it
ADB8–ADB9	Jump if it's the end of the program
ADBA–ADBB	D = current Basic line number
ADBC–ADBD	Save it
ADBE–ADBF	Save the new ESP
ADC0–ADC1	Bump the ESP to the next character
ADC2–ADC3	Interpret the Basic statement
ADC4–ADC5	Loop until the end of the program
ADC6–ADC7	Jump if it's the end of the line
ADC8	Token?
ADC9–ADCC	Jump if it isn't a token
ADCD–ADCE	Token > SKIPF?
ADCF–ADD0	Jump if the token > SKIPF
ADD1–ADD3	X = start of the jump table
ADD4	Figure table offset
ADD5–ADD6	B = table offset
ADD7	Point to the jump address
ADD8–ADD9	Bump the ESP to the next character
ADDA–ADDB	Jump to the routine

Listing continued

Listing continued

ADDC–ADDD Token = TAB(to <?
ADDE–ADDF Jump if the token = TAB(to <
ADE0–ADE3 Jump to the Extended Color Basic statements link

ADE4–ADEA Color Basic RESTORE Command

ADE4–ADE5 X = start of the Basic program pointer
ADE6–ADE7 Decrement it
ADE8–ADE9 Save it as the READ pointer
ADEA Return

ADEB–AE01 Keyboard Routine

ADEB–ADED Scan the keyboard
ADEE–ADEF Jump if a key wasn't pressed
ADF0–ADF1 Break?
ADF2–ADF3 Jump if it's a break
ADF4–ADF5 Shifted @?
ADF6–ADF7 Jump if it's a shifted @
ADF8–ADF9 Save the value of the last key pressed
ADFA Return
ADFB–ADFD Scan the keyboard
ADFE–ADFF Loop until a key is pressed
AE00–AE01 Jump

AE02–AE08 Color Basic END Command

AE02–AE04 Do CLOSE
AE05–AE06 Get the next Basic character
AE07–AE08 Jump

AE09–AE2F Color Basic STOP Command or Break Routine

AE09–AE0A Set carry to signal break
AE0B–AE0C Jump if it's not the end of the Basic statement
AE0D–AE0E X = current ESP
AE0F–AE10 Save it as the location of the last byte executed
AE11–AE12 Save the break flag
AE13–AE14 Clean up the stack
AE15–AE16 X = current Basic line number
AE17–AE19 Command mode?
AE1A–AE1B Jump if it's the command mode
AE1C–AE1D Save the break line number
AE1E–AE1F X = location of the last byte executed
AE20–AE21 Save it as the break ESP
AE22–AE23 Current device = video display
AE24–AE26 X = break message pointer
AE27–AE28 Break?
AE29–AE2C Jump if no break
AE2D–AE2F Jump

AE30–AE40 Color Basic CONT Command

AE30–AE31 Jump if it's the end of the Basic statement
AE32–AE33 B = CN error code
AE34–AE35 X = break ESP
AE36–AE39 Display CN error message if no break
AE3A–AE3B Save the break ESP as the current ESP
AE3C–AE3D X = break line number
AE3E–AE3F Save it as the current Basic line number
AE40 Return

AE41–AE74 Color Basic CLEAR Command

AE41–AE42 Jump if it's the end of the Basic statement
AE43–AE45 D = number of bytes of string space
AE46–AE47 Save it
AE48–AE49 X = start of the reserved-memory pointer
AE4A–AE4B Get the next Basic character
AE4C–AE4D Jump if it's the end of the Basic statement
AE4E–AE50 Check the syntax
AE51–AE53 X = new start of the reserved-memory pointer
AE54–AE55 Decrement it
AE56–AE57 Enough RAM?
AE58–AE59 Jump if there isn't enough RAM
AE5A–AE5B D = start of the reserved-memory pointer
AE5C–AE5D Figure the new start of the string-space pointer
AE5E–AE5F Jump if there isn't enough RAM
AE60–AE61 U = new start of the string-space pointer
AE62–AE64 Enough stack space?
AE65–AE66 Jump if there isn't enough RAM
AE67–AE68 Overlay the Basic program?
AE69–AE6A Jump if it will overlay the Basic program
AE6B–AE6C Save the new start of the string-space pointer
AE6D–AE6E Save the new start of the reserved-memory pointer
AE6F–AE71 Reset the Basic pointers
AE72–AE74 Display OM error message

AE75–AE85 Color Basic RUN Command

AE75–AE77 Call the Extended Color Basic link
AE78–AE7A Do CLOSE
AE7B–AE7C Get the next Basic character
AE7D–AE80 Jump if it's the end of the Basic statement
AE81–AE83 Reset the Basic pointers
AE84–AE85 Jump

AE86–AEBF Color Basic GO Command

AE86–AE87 B = current Basic character
AE88–AE89 Get the next Basic character
AE8A–AE8B TO token?
AE8C–AE8D Jump if it's a TO token
AE8E–AE8F SUB token?
AE90–AE91 Jump if it isn't a SUB token
AE92–AE93 B = number of words for memory check
AE94–AE96 Do memory check
AE97–AE98 U = current ESP
AE99–AE9A X = current Basic line number
AE9B–AE9C A = SUB token
AE9D–AE9E Save the GOSUB frame
AE9F–AEA0 Do GOTO
AEA1–AEA3 Jump to the interpreter
AEA4–AEA5 Get the next Basic character
AEA6–AEA8 Evaluate the line number
AEA9–AEAA Bump the ESP to the end of the line
AEAB–AEAC Bump the adjusted ESP
AEAD–AEAE D = GOTO line number
AEAF–AEB1 GOTO line number > current Basic line number?
AEB2–AEB3 Jump if the GOTO line number > the current Basic line number
AEB4–AEB5 X = start of the Basic-program pointer
AEB6–AEB8 Locate the GOTO line
AEB9–AEBA Display UL error message if the line wasn't found
AEBB–AEBC Decrement the memory pointer
AEBD–AEBE Save it as the new ESP
AEBF Return

AEC0–AEDF Color Basic RETURN Command

AEC0–AEC1 Jump if it's not the end of the Basic statement
AEC2–AEC3 A = dummy VARPTR value
AEC4–AEC5 Save it
AEC6–AEC8 Scan the stack
AEC9–AECA Reset the stack pointer
AECB–AECC Stack character = SUB token?
AECD–AECE Jump if it's a SUB token
AECF–AED0 B = RG error code
AED1–AED3 Ignore
AED2–AED3 B = UL error code
AED4–AED6 Display the error message
AED7–AED9 Display SN error message
AEDA–AEDB Get the stack frame
AEDC–AEDD Save the new Basic line number
AEDE–AEDF Save the new ESP

Listing continued

Listing continued

AEE0–AEE4 Color Basic DATA Command

AEE0–AEE1	Bump the ESP to the next Basic statement
AEE2–AEE4	Ignore

AEE3–AEE7 Color Basic REM or ' Command

AEE3–AEE4	Bump the ESP to the end of the Basic line
AEE5–AEE6	Save the new ESP
AEE7	Return

AEE8–AF13 Scan Routine

AEE8–AEE9	B = character to find
AEEA–AEEB	Ignore
AEEB	B = character to find
AEEC–AEED	Save the character to find
AEEE	B = stop scan character
AEEF–AEF0	X = current ESP
AEF1–AEF2	A = stop scan character
AEF3–AEF4	B = character to find
AEF5–AEF6	Save the character to find
AEF7–AEF8	A = next Basic character
AEF9–AEFA	Jump if it's the end of the line
AEFB–AEFC	Save the character to find
AEFD–AEFE	Character found?
AEFF–AF00	Jump if the character has been found
AF01–AF02	Bump the ESP
AF03–AF04	Character = quotation mark?
AF05–AF06	Loop if it's a quotation mark
AF07	Bump the character
AF08–AF09	Jump if it isn't a function prebyte
AF0A–AF0B	Bump the ESP
AF0C–AF0D	IF token?
AF0E–AF0F	Loop if it isn't an IF token
AF10–AF11	Bump the IF counter
AF12–AF13	Loop until the scan is done

AF14–AF41 Color Basic IF Command

AF14–AF16	Evaluate the expression
AF17–AF18	Get the next Basic character
AF19–AF1A	Go token?
AF1B–AF1C	Jump if it's a GO token
AF1D–AF1E	B = THEN token
AF1F–AF21	Check the syntax
AF22–AF23	A = (EXP1)
AF24–AF25	Jump if true
AF26–AF27	If counter = zero
AF28–AF29	Find the end of the line
AF2A	End of the line?
AF2B–AF2C	Jump if it's the end of the line
AF2D–AF2E	Get the next character
AF2F–AF30	ELSE token?
AF31–AF32	Loop if it isn't an ELSE token
AF33–AF34	Decrement the IF counter
AF35–AF36	Loop until the proper ELSE is found
AF37–AF38	Get the next character
AF39–AF3A	Get the next character
AF3B–AF3E	Do GOTO if it's numeric
AF3F–AF41	Jump to the interpreter

AF42–AF66 Color Basic ON Command

AF42–AF44	Evaluate the expression
AF45–AF46	B = GO token
AF47–AF49	Check the syntax
AF4A–AF4B	Save the next Basic character
AF4C–AF4D	SUB token?
AF4E–AF4F	Jump if it's a SUB token
AF50–AF51	TO token?
AF52–AF53	Jump if it isn't a TO token
AF54–AF55	Decrement the line-number counter
AF56–AF57	Jump if the line number hasn't been located
AF58–AF59	Get the Basic character
AF5A–AF5C	Join the GO code
AF5D–AF5E	Bump the ESP to the next character
AF5F–AF60	Evaluate the line number
AF61–AF62	Next character a comma?
AF63–AF64	Loop if it's a comma
AF65–AF66	Get the token and return

AF67–AF88 ASCII to Binary (Unsigned 16-Bit)

AF67–AF68	Zero X
AF69–AF6A	Save it as the current result
AF6B–AF6C	Jump if the character isn't numeric
AF6D–AF6E	A = binary value of the digit
AF6F–AF70	Save it
AF71–AF72	D = current result
AF73–AF74	Total too large?
AF75–AF76	Jump if it's too large
AF77–AF78	D = D*2
AF79–AF7A	D = D*4
AF7B–AF7C	D = D*5
AF7D–AF7E	D = D*10
AF7F–AF80	Add the value of the digit into B
AF81–AF82	Adjust D for a carry
AF83–AF84	Save the new result
AF85–AF86	Get the next character
AF87–AF88	Loop until done

AF89–AFCE Let Routine

AF89–AF8B	X = VARPTR
AF8C–AF8D	Save it as the current VARPTR
AF8E–AF8F	B = equal token
AF90–AF92	Check the syntax
AF93–AF94	A = current NTF
AF95–AF96	Save the current NTF
AF97–AF99	Evaluate the expression
AF9A–AF9B	Get the old NTF
AF9C	Set carry according to the old NTF
AF9D–AF9F	Check for a TM error
AFA0–AFA3	Jump if it's numeric
AFA4–AFA5	X = string VARPTR
AFA6–AFA7	D = start of the string-space pointer
AFA8–AFA9	String in string space?
AFAA–AFAC	Jump if the string is in string space
AFAD–AFAE	String in the program
AFAF–AFB0	Jump if the string is in the program
AFB1–AFB2	B = string length
AFB3–AFB5	Open up string space
AFB6–AFB7	X = string VARPTR
AFB8–AFBA	Move the string into string space
AFBB–AFBD	X = dummy VARPTR
AFBE–AFBF	Save the string VARPTR
AFC0–AFC2	Reset the temporary string area
AFC3–AFC4	U = string VARPTR
AFC5–AFC6	X = LET VARPTR
AFC7–AFC8	A = string length and Y = string address
AFC9–AFCA	Save the string length
AFCB–AFCD	Save the string address
AFCE	Return

AFCF–AFD5 Color Basic ?REDO Message

AFD6–B0E7 Color Basic INPUT and READ Commands

AFD6–AFD7	B = FD error code
AFD8–AFD9	Current device = keyboard?

Listing continued

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In the ABC program, all 26 letters spring up in color to the familiar ABC tune. Then, colorful detailed pictures depicting each individual letter of the alphabet appear one by one. Your child's fascination will mount as he or she correctly presses the letter on the keyboard and is rewarded with a musical tune before the next detailed picture is drawn line by line onto the screen: AIRPLANE for A, BUS for B, CLOWN for C and so on to ZEBRA for Z. Truly a must program for the preschool to first grade age group!

CoCo 16K ECB . . . . . Tape: $19.95 Disk: $25.95

CRISS–CROSS MATH

As the program begins, your child is presented with a nine square playing board. It is your choice as to which square you choose. After a choice is made, a MATH PROBLEM appears in the square. You score your first X by answering the problem correctly. If your answer is incorrect, the square clears and your opponent is allowed his choice of squares. The game is over when three squares vertically, horizontally, or diagonally are won by the same player. When playing against the computer, every answer you get wrong is won by the computer. Multi-level ADDITION AND SUBTRACTION program.

CoCo 16K . . . . . Tape: $12.95

FRACTIONS

SIDE ONE: Fraction Lessons, explains fractions with the aid of graphics. Child studies the different ways fractions can be represented. Lessons include:

IMPROPER FRACTIONS
MIXED FRACTIONS
PROPER FRACTIONS

Many educators have praised the use of motion and color to display the fractional equivalents.

SIDE TWO: Fraction practice, offers a random computer generated quiz.

Atari 16k . . . . . Tape: $19.95
CoCo 16k . . . . . Tape: $19.95

JOYSTICK DRAW

Joystick Draw is the simple way to explore your artistic talents! Program operation is easy enough for a child to use, but effective enough that TCE uses it to design many sophisticated high-resolution graphic screens. Joystick Draw's design allows you or your child to save those masterpieces for future revisions or for use in other programs (instructions included). Your child will spend many hours enjoying this program and at the same time improving his or her eye hand coordination! You will find Joystick Draw to be an easy way to design those more sophisticated graphics for your own programs!

CoCo 16 ECB . . . . . Tape: $16.95

SPELL BOMBER

As captain of your ship, you must destroy the enemy bomber by spelling the mystery word. In this exciting and educational game the bomber gets closer with each inaccurate letter. You have only EIGHT tries to guess the mystery word or your ship will be bombed! If you guess the word correctly, GENERAL QUARTERS will sound and your ship will fire a missile to destroy the bomber, Three levels are available: EASY, MEDIUM, and HARD. Challenging for all ages!

Atari 16K . . . . . Tape: $18.95
CoCo 16k ECB . . . . . Tape: $18.95 Disk: $22.95
Vic 20 13k . . . . . Tape: $18.95

SPELLING BEE

The word is pronounced vocally and it is up to you to type in the correct spelling. If wrong, the computer will be your friend and flash the word on the screen for just an instant. OK! Try typing the word in again. STILL WRONG! The computer wants success and allows you to see the word again this time a little longer. If you just can't spell the word, the computer realizes you need to learn to spell the word and leaves the word on the screen for you to copy. Try your best and the computer has a surprise for your reward!

SPELLING BEE I . . . GRADE 1 & 2
SPELLING BEE II . . GRADE 3 & 4
SPELLING BEE III . . . GRADE 5 & 6
SPELLING BEE IV . . . GRADE 7 & 8

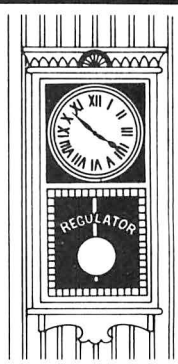
CoCo 16k ECB . . . . . TAPE: $16.95 Each

TC–INVENTORY

Many insurance companies offer a discount for policy holders which have complete inventories on file. TC – Inventory is designed to help you organize, maintain, and compile the personal belongings of your home. Program is user friendly and menu driven. TC – Inventory allows input for location of item, price of item, serial number of item, date of purchase, and a text written description of the item. Don't put off recording your personal belongings until its too late. Requires printer for hard copy.

CoCo 32k ECB . . . . . Tape: $16.95

TEACHING CLOCK



Torn between teaching time on a digital or a conventional (face and hands) clock? Well, this program combines the two using high resolution graphics and prompts! Your child will learn to tell time with the aid of a specially designed CLOCK! Child enters the time, if wrong, the center of the clock displays a graphic aid. If the child is correct a musical reward is heard. Program offers three levels: hours, quarter hours, and five minute intervals.

Apple 48k . . . . . Disk: $19.95
Atari 32k . . . . . Tape: $16.95
CoCo 16k ECB . . . . Disk: $19.95 Tape: $16.95

MasterCard

Additional Educational Software available for Color Computer, TDP 100, Atari ®, Apple ®, Commodore 64 ®, and VIC 20 ®.

VISA

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P.O. Box 2477 Gaithersburg, Maryland 20879 (301) 963-3848

See List of Advertisers on page 131

Listing continued

AFDA–AFDB	Jump if it's the keyboard
AFDC–AFDE	Jump to the error routine
AFDF–AFE0	A = READ/INPUT flag
AFE1–AFE2	Jump if INPUT
AFE3–AFE4	X = READ line number
AFE5–AFE6	Save it as the current Basic line number
AFE7–AFE9	Display SN error message
AFEA–AFEC	X = ?REDO message pointer
AFED–AFEF	Display the message
AFF0–AFF1	X = last ESP
AFF2–AFF3	Save it as the current ESP
AFF4	Return
AFF5–AFF6	B = ID error code
AFF7–AFF8	X = current Basic line number
AFF9–AFFA	Command mode?
AFFB–AFFC	Display ID error message if it's the command mode
AFFD–AFFE	Get the input
AFFF–B000	Current device = keyboard
B001	Return
B002–B003	Next character = number sign?
B004–B006	Jump if it isn't a number sign
B007–B008	Set the current device
B009–B00B	File OPEN?
B00C–B00E	Check the syntax
B00F–B010	Next character = quotation mark?
B011–B012	Jump if it isn't a quotation mark
B013–B015	Build a string entry
B016–B017	B = semicolon
B018–B01A	Check the syntax
B01B–B01D	Display the prompting message
B01E–B020	X = start of the input buffer
B021–B022	Flag the end of the input
B023–B024	Current device = keyboard?
B025–B026	Jump if it isn't the keyboard
B027–B028	Get the keyboard input
B029–B02A	B = comma
B02B–B02C	Save it in the buffer
B02D–B02E	Jump
B02F–B031	Display a question mark
B032–B034	Display a space
B035–B037	Get the keyboard input
B038–B039	Jump if no break
B03A–B03B	Clean up the stack
B03C–B03E	Jump
B03F–B040	B = IE error code
B041–B042	EOF?
B043–B044	Jump if EOF
B045	Return
B046–B047	X = current READ pointer
B048–B049	A = READ code
B049	A = INPUT code
B04A–B04B	Set the READ/INPUT flag
B04C–B04D	Save the input pointer
B04E–B050	Locate the variable
B051–B052	Save the VARPTR
B053–B054	X = current ESP
B055–B056	Save the ESP
B057–B058	X = input pointer
B059–B05A	A = input character
B05B–B05C	Jump if it isn't the end of the input
B05D–B05E	A = READ/INPUT flag
B05F–B060	Jump if READ
B061–B063	Call the Extended Color Basic link
B064–B066	Display a question mark
B067–B068	Get the keyboard input
B069–B06A	Save the input pointer as the current ESP
B06B–B06C	Get the next character
B06D–B06E	B = current NTF
B06F–B070	Jump if it's numeric
B071–B072	X = input pointer
B073–B074	String delimiter = input character
B075–B076	Quotation mark?
B077–B078	Jump if it's a quotation mark
B079–B07A	Decrement the input pointer
B07B	Zero A
B07C–B07D	Save it as the string delimiter
B07E–B080	Check the current device
B081–B082	Current device = cassette?
B083–B084	Jump if it's the cassette
B085–B086	A = colon
B087–B088	Save it as the string delimiter
B089–B08A	A = comma
B08B–B08C	Save it as the string delimiter
B08D–B08F	Build a string entry
B090–B092	Update the input pointer
B093–B095	Variable = string
B096–B097	Jump
B098–B09A	Do ASCII to binary
B09B–B09D	Variable = FPAC1
B09E–B09F	Get the next input character
B0A0–B0A1	Jump if it's the end of the input
B0A2–B0A3	Comma?
B0A4–B0A7	Jump if it isn't a comma
B0A8–B0A9	X = updated input pointer
B0AA–B0AB	Save it
B0AC–B0AD	X = last ESP
B0AE–B0AF	Save it as the current ESP
B0B0–B0B1	Get the next character
B0B2–B0B3	Jump if it's the end of the Basic statement
B0B4–B0B6	Check the syntax
B0B7–B0B8	Loop
B0B9–B0BA	Save the READ pointer as the ESP
B0BB–B0BD	Bump it to the end of the statement
B0BE–B0BF	Bump the READ pointer
B0C0	Check the READ character
B0C1–B0C2	Jump if it's a colon
B0C3–B0C4	B = OD error code
B0C5–B0C6	U = next Basic line pointer
B0C7–B0C8	Jump if it's the end of the program
B0C9–B0CA	D = Basic line number
B0CB–B0CC	Save it as the READ line number
B0CD–B0CE	A = next READ character
B0CF–B0D0	DATA token?
B0D1–B0D2	Loop if it isn't a DATA token
B0D3–B0D4	Jump
B0D5–B0D6	X = input pointer
B0D7–B0D8	B = READ/INPUT flag
B0D9–B0DC	Jump if READ
B0DD–B0DE	A = next input character
B0DF–B0E0	Jump if it's the end of the input
B0E1–B0E3	X = ?EXTRA IGNORED message pointer
B0E4–B0E6	Display the message
B0E7	Return

B0E8–B0F7 Color Basic ?EXTRA IGNORED Message

B0F8–B140 Color Basic NEXT Command

B0F8–B0F9	Jump if it's not the end of the Basic statement
B0FA–B0FB	X = default NEXT VARPTR
B0FC–B0FD	Jump
B0FE–B100	X = NEXT VARPTR
B101–B102	Save it
B103–B105	Scan the stack
B106–B107	Jump if the FOR frame was found
B108–B109	B = NF error code
B10A–B10B	Display NF error message
B10C–B10D	Reset the stack pointer
B10E–B10F	Bump the stack memory pointer

Listing continued

Listing continued

B110–B112	FPAC1 = STEP value
B113–B114	A = sign of the STEP value
B115–B116	Save it
B117–B118	X = NEXT VARPTR
B119–B11B	FPAC1 = STEP value plus variable's value
B11C–B11E	Variable = FPAC1
B11F–B120	X = TO value pointer
B121–B123	Compare it to FPAC1
B12A–B12B	FOR done?
B126–B127	Jump if it's done
B128–B129	X = NEXT line number
B12A–B12B	Save it as the current Basic line number
B12C–B12E	X = NEXT ESP
B12F–B130	Save it as the current ESP
B131–B133	Jump to the interpreter
B134–B136	Remove the FOR frame from the stack
B137–B138	Get the next character
B139–B13A	Comma?
B13B–B13C	Jump if it isn't a comma
B13D–B13E	Bump the ESP to the next character
B13F–B140	Loop until the NEXT is done

B141–B155 Evaluate-Expression Routine

B141–B142	Evaluate the expression
B143–B144	Clear carry for a numeric result
B145–B147	Ignore
B146–B147	Set carry for a string result
B148–B149	Set zero according to NTF
B14A–B14B	Jump if testing for a string
B14C–B14D	Return if the result is numeric
B14E–B150	Ignore
B14F–B150	Return if the result is a string
B151–B152	B = TM error code
B153–B155	Display TM error message

B156–B34A Main Evaluate-Expression Routine

B156–B157	Decrement the ESP
B158	A = dummy precedence value
B159–B15B	Ignore
B15A–B15B	Save the token
B15C–B15D	Save the precedence value
B15E–B15F	B = number of words for memory check
B160–B162	Do memory check
B163–B165	Evaluate the next character
B166–B167	Clear the <=> flag
B168–B169	Get the next character
B16A–B16B	Adjust it for <=>
B16C–B16D	Jump if it's less than a > token
B16E–B16F	Greater than a < token?
B170–B171	Jump if it's greater than a < token
B172–B173	Equal token?
B174	Multiply the token by two
B175–B176	Combine it with the last token
B177–B178	Illegal use of <=>?
B179–B17A	Display SN error message if it's an illegal use of <=>
B17B–B17C	Save the new <=> flag
B17D–B17E	Bump the ESP to the next character
B17F–B180	Loop
B181–B182	<=> used?
B183–B184	Jump if <=> used
B185–B188	Jump if the token is out of range
B189–B18A	Token = plus sign to OR?
B18B–B18C	Jump if the token is < plus sign
B18D–B18E	Combine the NTF with the token
B18F–B192	Jump if string plus sign
B193–B194	Adjust the token
B195–B196	Save it
B197	A = token*2

Listing continued

↙ See List of Advertisers on page 131

Listing continued

B198–B199	A = token*3
B19A–B19C	X = function-table pointer
B19D–B19E	Point to the proper function
B19F–B1A0	Get the last precedence value
B1A1–B1A2	Last precedence value > current precedence value?
B1A3–B1A4	Jump if the last precedence value > the current precedence value
B1A5–B1A6	Check for a TM error
B1A7–B1A8	Save the last precedence value
B1A9–B1AA	Do the function
B1AB–B1AC	X = <=> flag
B1AD–B1AE	Get the last precedence value
B1AF–B1B0	Jump if not <=>
B1B1	Dummy precedence value?
B1B2–B1B5	Jump if it's a dummy precedence value
B1B6–B1B7	Jump
B1B8–B1B9	Set carry according to NTF
B1BA	Put it in B
B1BB–B1BC	Decrement the ESP
B1BD–B1BF	X = function-table pointer
B1C0–B1C1	Save the new <=> flag
B1C2–B1C3	NTF = numeric
B1C4–B1C5	Do the function
B1C6–B1C7	X = current ESP
B1C8–B1CA	Jump
B1CB	Precedence value for <=>
B1CC–B1CD	Jump address for <=>
B1CE–B1CF	Last precedence value > current precedence value?
B1D0–B1D1	Jump if the last precedence value > the current precedence value
B1D2–B1D3	Jump
B1D4–B1D5	D = current-function address
B1D6–B1D7	Save it
B1D8–B1D9	Do the function
B1DA–B1DB	B = dummy token
B1DC–B1DE	Loop
B1DF–B1E1	Display SN error message
B1E2–B1E3	B = (SF1)
B1E4–B1E5	A = current precedence value
B1E6–B1E7	Y = function address
B1E8–B1E9	Save (SF1)
B1EA–B1EB	B = (EXP1)
B1EC–B1ED	X = (MSB1) and (NMSB1)
B1EE–B1EF	U = (NNMSB1) and (LSB1)
B1F0–B1F1	Save the value
B1F2–B1F3	Do the function
B1F4–B1F5	Zero X
B1F6–B1F7	A = precedence value
B1F8–B1F9	Jump if it's a dummy precedence value
B1FA–B1FB	<=> precedence value?
B1FC–B1FD	Jump if it's a <=> precedence value
B1FE–B200	Check for a TM error
B201–B202	Save the <=> flag
B203–B204	Get the precedence value
B205–B206	NOT precedence value?
B207–B208	Jump if it's a NOT precedence value
B209–B20A	Minus precedence value
B20B–B20C	Jump if it's a minus precedence value
B20D	Shift the precedence value
B20E–B20F	Save it
B210–B211	Get the floating-point value
B212–B213	Save (EXP2)
B214–B215	Save (MSB2) and (NMSB2)
B216–B217	Save (NNMSB2) and (LSB2)
B218–B219	Get (SF2)
B21A–B21B	Save it
B21C–B21D	Combine (SF1) and (SF2)
B21E–B21F	Save it
B220–B221	B = (EXP1)
B222	Return
B223–B225	Call the Extended Color Basic link
B226–B227	NTF = numeric
B228–B229	Get the next character
B22A–B22B	Jump if it's nonnumeric
B22C–B22E	Jump if it's numeric
B22F–B231	Alphabetic?
B232–B233	Jump if it's alphabetic
B234–B235	Decimal point?
B236–B237	Jump if it's a decimal point
B238–B239	Minus token?
B23A–B23B	Jump if it's a minus token
B23C–B23D	Plus token?
B23E–B23F	Jump if it's a plus token
B240–B241	Quotation mark?
B242–B243	Jump if it isn't a quotation mark
B244–B245	X = current ESP
B246–B248	Build a string entry
B249–B24A	X = string ending address
B24B–B24C	Save it as the current ESP
B24D	Return
B24E–B24F	NOT token?
B250–B251	Jump if it isn't a NOT token
B252–B253	A = NOT precedence value
B254–B256	Evaluate the expression
B257–B259	D = integer result
B25A	Invert the MSB
B25B	Invert the LSB
B25C–B25E	Save it as the current result
B25F	Bump the character
B260–B261	Jump if it's a function prebyte
B262–B263	Check the syntax
B264–B266	Evaluate the expression
B267–B268	B = right parenthesis
B269–B26B	Ignore
B26A–B26B	B = left parenthesis
B26C–B26E	Ignore
B26D–B26E	B = comma
B26F–B272	Character in B = ESP character?
B273–B274	Display SN error message if they don't match
B275–B276	Bump the ESP to the next character
B277–B278	B = SN error code
B279–B27B	Display SN error message
B27C–B27D	A = negation precedence value
B27E–B280	Evaluate the expression
B281–B283	Negate the current result
B284–B286	Evaluate the variable
B287–B288	Save the VARPTR
B289–B28A	A = current NTF
B28B–B28C	Jump if it's a string
B28D–B28F	FPAC1 = variable's value
B290–B291	Bump the ESP to the next character
B292–B293	B = token
B294	B = token*2
B295–B296	Bump the ESP to the next character
B297–B298	Color Basic token?
B299–B29A	Jump if it's a Color Basic token
B29B–B29E	Jump to the Extended Color Basic Functions link
B29F–B2A0	Save the token offset
B2A1–B2A2	Token < LEFT$?
B2A3–B2A4	Jump if the token < LEFT$
B2A5–B2A6	Token > = INKEY$?
B2A7–B2A8	Jump if the token >= INKEY$
B2A9–B2AA	Check the syntax
B2AB–B2AC	A = token
B2AD–B2AE	Token >= POINT?
B2AF–B2B0	Jump if the token >= POINT
B2B1–B2B3	Evaluate the expression
B2B4–B2B5	Check the syntax
B2B6–B2B8	Check for a TM error
B2B9–B2BA	A = token

Listing continued

Listing continued

B2BB–B2BC	U = string VARPTR
B2BD–B2BE	Save the token and the string VARPTR
B2BF–B2C1	Evaluate the expression
B2C2–B2C3	A = token
B2C4–B2C5	Save the token and the 8-bit value
B2C6–B2C8	Ignore
B2C7–B2C8	Check the syntax
B2C9–B2CA	Get the token offset
B2CB–B2CD	X = functions jump table
B2CE	Pointer to the proper jump address
B2CF–B2D0	Do the function
B2D1–B2D3	Check for a TM error
B2D4–B2D5	A = OR flag
B2D5	A = AND flag
B2D6–B2D7	Save the AND/OR flag
B2D8–B2DA	Convert the current result to an integer
B2DB–B2DC	Save the first value
B2DD–B2DF	Move FPAC2 to FPAC1
B2E0–B2E2	Convert the second value to an integer
B2E3–B2E4	OR?
B2E5–B2E6	Jump if OR
B2E7–B2E8	A = MSB2 AND MSB1
B2E9–B2EA	B = LSB2 AND LSB1
B2EB–B2EC	Jump
B2ED–B2EE	A = MSB2 OR MSB1
B2EF–B2F0	B = LSB2 OR LSB1
B2F1–B2F3	Save D as the current result
B2F4–B2F6	Check NTF
B2F7–B2F8	Jump if it's a string
B2F9–B2FA	A = (SF2)
B2FB–B2FC	Mask it for the sign
B2FD–B2FE	Combine the sign with (MSB2)
B2FF–B300	Save it
B301–B303	X = FPAC2 pointer
B304–B306	Compare FPAC2 to FPAC1
B307–B308	Save the result in FPAC1
B309–B30A	NTF = numeric
B30B–B30C	Adjust < = > value
B30D–B30F	Clean up string space
B310–B311	Save string1 length
B312–B313	Save string1 address
B314–B315	X = string2 VARPTR
B316–B318	Clean up string space
B319–B31A	A = string1 length
B31B–B31C	Save string2 length
B31D–B31E	String1 length = string2 length?
B31F–B320	Jump if they are equal
B321–B322	A = 1
B323–B324	Jump if string1 length > string2 length
B325–B326	Save string1 length
B327	A = −1
B328–B329	Save the string-comparison flag
B32A–B32B	U = string1 length
B32C	Bump string1 length
B32D	String1 done?
B32E–B32F	Jump if string1 isn't done
B330–B331	B = comparison flag
B332–B333	Jump
B334–B335	A = next string2 character
B336–B337	String2 character = string1 character?
B338–B339	Jump if they match
B33A–B33B	B = −1
B33C–B33D	Jump if string1 character < string2 character
B33E	B = 1
B33F–B340	Bump the comparison value
B341	Shift the comparison value
B342–B343	Mask it for true/false
B344–B345	Jump if false
B346–B347	B = −1
B348–B34A	Save B as the current result ■

✓ See List of Advertisers on page 131

The Educated Guest

Assembly Language In Educational Programming

by Dr. Charles H. Santee

This month's column explores the use of Assembly language in educational programming. Every four months or so, I hope to include an Assembly-language application for you to review and use. Even if you are not interested in becoming an Assembly-language programmer, at the end of this article I will ask you for program ideas to get "other guys" to work on.

Now, before I continue, consider the pros and cons of Assembly language versus Basic.

Why Assembly Language?

The main argument for using Assembly language is its speed. In writing educational software speed is one of the most important considerations. Research shows that a quick presentation with learner involvement is the most effective means of instruction.

Through Assembly language the programmer has at his disposal the full potential of the computer. The programs are more memory efficient and allow for comprehensive coverage of content. The programmer has full control of key functions and can control the use and purpose of special keys such as break or clear. Assembly-language programs are also more difficult for students to tamper with. You could use Assembly language in the following ways:

- An educational program might require a foreground and background task. For example, you might want a software clock running while the student performs educational tasks. You can call the clock when you need to time a particular response.
- It is often desirable to mix graphics with text to provide a particular display. You can use the Basic DRAW statements, but a machine-language implementation is much faster.
- You might want to add music with more than one voice to enhance an educational program.
- You might need an Assembly-language implementation to control external devices. For example, you might need to control light and appliance modules in an environmental-control program for a handicapped student.

Learning Assembly language helps you become a better Basic programmer. You learn to make use of the undocumented routines and how to POKE and PEEK those special effects. Or, think of it as a new educational adventure.

The Case Against Assembly Language

It takes time to develop an Assembly-language program. It can take as much as 10 times as long as for a Basic program. Educators with limited time need a faster solution.

Assembly-language programmers often use ROM routines that can change from one version of ROM to the next. Assembly language can limit the equipment used for a particular program.

Relocatable or position-independent code does not solve the problem since you cannot assume that the educator has the skill and resources needed to move the code when required. Many cassette-based programs do not work with disk systems without relocating or changing the code. Assembly-language programs are more difficult to convert from one type of computer to another.

Converting a program from Color Computer Basic to Apple Basic is tough enough, but try converting an assembled program from 6809 to 6502. The screen memory map of the Apple is a nightmare!

There is a much wider audience for the Basic program and there are more educators who have the skills to change a Basic program to meet individual student needs.

There are many routines, programs, and languages that can help overcome the shortcomings of Basic without the headache of writing in machine- or Assembly-code. Compiled versions of Basic and Basic-language compilers are becoming more common. So are routines that let you add clocks, four-voice music, and graphics with text to Basic programs. Alternative languages such as Forth let you perform some of those less traditional applications such as accessing the real world outside the computer.

Tackling the Task

First, you need a few tools. Unless you are willing to POKE each value of a machine code into memory (and fully understand conversions from binary, decimal, and hexadecimal), you should have an editor/assembler. I purchased the EDTASM+ ROM pack from Radio Shack (cat. no. 26-3250), and have since patched this version to disk. Radio Shack now puts out a disk version.

I recommend that you purchase a few good books as guides. *TRS-80 Color Computer Assembly-Language Programming,* by William Barden Jr. (Radio Shack cat. no. 62-2077) is helpful, as is *Assembly-Language Graphics for the TRS-80 Color Computer,* by Don and Kurt Inman (Reston Publishing Co.). Be aware that each of these books uses a different editor/assembler. For a more comprehensive and more difficult treatment of the subject I recommend Lance Leventhal's *6809 Assembly-Language Programming* (Osborne/McGraw-Hill).

The Program Listing this month will help you learn Assembly language. It is not, as such, an educational program, but it lets you take an Assembly-language program and convert it to one in independent Basic (a sort of reverse-Basic compiler). You can write short Assembly routines to mix with Basic for certain effects.

Your first task is to write a short Assembly-language program and com-

pile it onto disk or cassette. When writing an Assembly-language program use an ORG address of 3F00 hex (16128) or greater to protect the Basic program. Be sure to note the first and last locations of the assembled program and where it starts. Load and run my program (MTOBSAVE).

When the program starts, input the starting location of the assembled program when it is loaded into memory. Indicate the program's starting location, the last location it uses, and the name you used to compile it. Then, input the name you will use to save the program. MTOBSAVE then loads in the assembled program, converts the assembled code into POKE values needed for a Basic program, and saves the program back to disk or cassette as a complete Basic program.

You can now load and run the resulting program as you would any Basic program and see your assembled program implemented through Basic.

As a beginner you will want to write and test short Assembly routines, but they are of little use unless you can mix them with Basic commands to handle more complex tasks. MTOBSAVE helps you mix the Assembly routine with a Basic program.

There is a short routine on page 49 of *Assembly Language Graphics* that inverts the video text screen from black-on-green letters to green-on-black. Assemble this program to disk or cassette and use MTOBSAVE to create a Basic program. Next, edit the Basic program to include more complex Basic functions before using the Assembly routine. You might use Basic to create the instructional display you would like and call the Invert routine (X = USR0(0)) to emphasize the material.

A Trick in Basic

MTOBSAVE uses the CLEAR statement in an unusual way. The program first calls for the starting location of the Assembly code. That value is POKEd into memory. I use the location in a CLEAR statement and call back the value saved with a PEEK statement so the value can be used later.

You can also use this technique if you have a program that does a lot of string or variable manipulation. In the middle of the program, much of this becomes excess garbage you want to get rid of.

POKE any values you want to save into a protected area of memory, and use the CLEAR command to wipe out the garbage. Use PEEK to call back your protected values and you have a clean slate with unwanted variables initialized to null or zero. See if you can figure out how to use PRINT and the VARPTR command to save and retrieve strings before and after a CLEAR.

Program Suggestions For the Other Guy

In an upcoming issue I will share my first Assembly-language program. In the meantime tell me what you would like to see the experts do with Assembly language to improve the quality of educational programs. If you have assembled a masterpiece or even a quickie let me share it with our readers.

I close with suggestions for writers of commercial programs.

- I would like to see more programs that make use of the speed and alternatives available through Assembly language.
- I would like to see more programs that tell in hours, minutes and seconds when a response began and ended (not just the duration).
- I would like to see animation that gives a child better understanding of how something works.
- If a program is written in Assembly language, it should be position independent.
- I would prefer that the program automatically adjust to the system on which it is used. A teacher or parent shouldn't have to relocate a program if disk is used instead of cassette, or if 32K is used instead of 16K.
- If the program will not adjust automatically, then include different versions for different systems.
- Make the program flexible enough so that the teacher or parent does not need to know Assembly language to alter content for the child.

If you have other suggestions, let me hear them and I will discuss them in future columns.

Here is one final challenge for those of you with advanced programming skills. I would like to see a comprehensive article on writing programs (in both Basic and Assembly language), that will adjust to different system requirements.

The program might have a preloader that senses the amount of memory (PEEK (39–40)) and if the disk controller is connected (PEEK (188)). The preloader loads in the main program at a location offset to the specific system requirements. It senses if a printer is attached and provides a user test to determine which baud rate will be used by the program. ■

Contact Charles Santee with any questions or responses c/o HOT CoCo, *80 Pine St., Peterborough, NH 03458.*

```
10 '***** MTOBSAVE ***** ASSEMBL
Y TO BASIC LANGUAGE PROGRAM ****
*
20 INPUT "FIRST ADDRESS";SA$:SA=
VAL(SA$):S1=INT(SA/256):S2=SA-IN
T(SA/256)*256:CLS:POKE &H500,S1:
POKE &H501,S2
30 CLEAR 1000,SA-1:SA=PEEK(&H500
)*256+PEEK(&H501)-1:SA$=STR$(SA)
40 INPUT "START ADDRESS";BG$:BG=
VAL(BG$):INPUT "END ADDRESS";ED$
:ED=VAL(ED$)
50 DIM A$(30)
60 INPUT"MACHINE FILE";NM$
70 IF PEEK(188) = 14 THEN LOADM
NM$:GOTO 80
75 CLOADM NM$
80 C=0
90 FOR A=SA+1 TO ED
100 B=PEEK(A):B$=HEX$(B):IF LEN(
B$)<2 THEN B$="0"+B$
110 C$(C)=C$(C)+B$:IF LEN(C$(C))
>200 THEN C=C+1
120 NEXT
130 A$(0)="10 CLEAR 1000,"+SA$
140 FOR A=0 TO C:LN$=STR$(A+11):
A$(A+1)=LN$+" C$("+RIGHT$(STR$(A
+1),1)+")="+CHR$(34)+C$(A)+CHR$(
34):NEXT
150 LN$=STR$(A+11):A$(A+1)=LN$+"
 FOR A = 1 TO "+STR$(A)
160 LN$=STR$(A+12):A$(A+2)=LN$+"
 FOR B=1 TO INT(LEN(C$(A))/2)"
170 LN$=STR$(A+13):A$(A+3)=LN$+"
 L="+SA$+"+B"
180 LN$=STR$(A+14):A$(A+4)=LN$+"
 V$=MID$(C$(A),B*2-1,2)"
190 LN$=STR$(A+15):A$(A+5)=LN$+"
 V=VAL("+CHR$(34)+"&H"+CHR$(34)+
"+V$)"
200 LN$=STR$(A+16):A$(A+6)=LN$+"
 POKE L,V"
210 LN$=STR$(A+17):A$(A+7)=LN$+"
 NEXT B:NEXT A"
220 LN$=STR$(A+18):A$(A+8)=LN$+"
 DEFUSR0="+BG$
230 LN$=STR$(A+19):A$(A+9)=LN$+"
 X=USR0(0)"
240 INPUT"BASIC FILE NAME";BF$
250 IF PEEK(188)=6 THEN 330
260 BF$=BF$+"/BAS"
270 OPEN"O",#1,BF$
280 FOR B=1 TO A+11
290 PRINT#1,A$(B)
300 NEXT B
310 CLOSE#1
320 END
330 OPEN"O",#-1,BF$
340 FOR B=1 TO A+11
350 PRINT#-1,A$(B)
360 NEXT B
370 CLOSE#-1
380 END
```

Program Listing. MTOBSAVE

Reader's Forum

Two New Uses for RENUM

I've found two new uses for the Color Computer RENUM command that I hope will be helpful.

After buying a disk drive, I found myself editing programs to fit into the slightly reduced available memory. Not having a program-compressor utility, I started removing REMs manually, and soon found that the program called the REM lines as well as the first line after the remark. I had to change all lines that called the REM line to the next line number used.

Here's a different method. It is slow for long programs, but it is easier and faster than the manual method. First, type RENUM and hit enter. Next, remove a remark line, type RENUM and hit enter. Remove one line at a time.

The RENUM subroutine moves the lines after the one erased up, and all calls to the removed line call the next line instead. Program Listings 1 and 2 show a test of this technique, before and after.

If the program is long, the RENUM command takes longer, but the technique is useful, until you find a utility program to replace it.

Another use for the RENUM command is to find the lines that call any given line. In Listing 1, RENUM the program. Retype line 50 using any line number from 41–49 or 51–59 and delete line 50. RENUM the program again and it should be identical to the original program, but the computer shows:

```
UL 50 IN 20
UL 50 IN 90
```

So line 50 is called by lines 20 and 90.

Again, there are utilities that do this more easily and faster but if you do not have them, these techniques help.

Dwight A. Spitzer
Mio, MI

```
10 CLS
20 GOSUB 50
30 PRINT "THE END"
40 END
50 REM -- DELAY SUBROUTINE
60 FOR DE=1 TO 500
70 NEXT DE
80 RETURN
90 GOTO 50
100 GOTO 60
```

Program Listing 1. Before RENUM

```
10 CLS
20 GOSUB 50
30 PRINT "THE END"
40 END
50 FOR DE=1 TO 500
60 NEXT DE
70 RETURN
80 GOTO 50
90 GOTO 50
```

Program Listing 2. After RENUM

The Fourth Color Set

Much has been written about mixing or overlapping PMODEs 3 and 4 to get a black, red, blue, and white color set. This is done by executing PMODE4:SCREEN1,1:PMODE3. However, I have seen no mention of the fourth color set, which contains dark green, medium green, gray green, and light green. This color set is accessed by PMODE4,1:SCREEN1,0:PMODE3,1 when mixing modes.

A better way of accessing the two extra color sets is by executing a PMODE3:SCREEN1 followed by a POKE 65314,248 for the black, red, blue, white color set, or a POKE65314,240 for the four shades of green color set.

One advantage of this method is that it is easy to switch between these color sets and also between the two normal color sets. To switch to a different color set you execute the POKE that corresponds with that color set. To get color set 0, do a POKE65314,192. For color set 1, do a POKE 65314,200.

A second advantage is that by using the POKEs you can get the extra colors from PMODE1. This is not possible by switching modes. To get the extra colors for PMODE1 use

```
10 PMODE4,1:SCREEN1,1:PCLS
20 FOR X= 1 TO 255
30 CIRCLE(128,96),40,7
40 POKE 178,X
50 LINE(20,20)-(60,60),PSET,BF
60 PAINT(128,78),,7
70 REM PAINT MUST HAVE BOTH COMM
AS INCLUDED AFTER THE RIGHT PARE
NTHESIS WITH NOTHING BETWEEN THE
M
80 PCLS:NEXT X
```

Program Listing 3. The Fourth Color Set

the same POKEs as with PMODE3. Switching color sets is also easy from PMODE1, again using the same POKEs for each color set as used for PMODE3.

Keith Campbell
Salem, VA

64K for CoCo 2

Upgrading the CoCo 2 to 64K is a simple procedure. First, open the case by removing seven screws, one of which is located under the "opening case will void warranty" label. There are eight 16K RAMs located directly under the top of the keyboard. Removing the keyboard will make replacing the RAMs easier. Carefully pull the keyboard cable out of the connector on the circuit board. Then carefully remove the eight RAMs: U14 through U21. Replace these with 4164, 200ns RAMs.

Between U6 and U7 is a solder pad labeled W1. There are several solder pads in that area, so be sure you are on the one nearest the W1. A jumper must be formed between W1 and the pad directly above it.

On my board, there are two pads directly above W1: Solder the jumper to them. After installing the jumper, replace the cable for the keyboard. You should check your work, making sure the ICs are installed in the right direction. Use a small cordless solder gun, and be sure you have no static charge in your body when working with the ICs. You now have 64K in the CoCo 2.

Verne R. Winter, Jr.
Des Moines, IA

RF Interference From the Keyboard

It seems the calculator style-keyboard is a major cause of RF interference on the Color Computer. When I removed the keyboard, the screen on my monitor was perfectly clean, so I knew the keyboard was most likely the culprit.

To correct the problem I cut out a piece of aluminum foil to the shape of the backside of the keyboard, along with a small tab to attach to the top of the RF shielding cover on the motherboard (Fig. 1).

Next, I taped the aluminum foil to the back of the keyboard and inserted the keyboard back into the socket. Then I attached the tab to the RF cover with a small piece of tape and checked to make sure the connections were good. The interference on the monitor was reduced significantly.

Jack Shaffer
Oakwood, IL

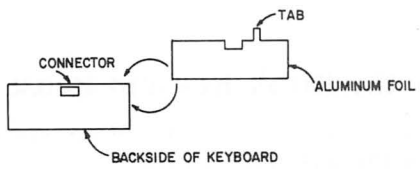

Fig. 1. RF Shield for the Keyboard

Cursor and Prompt for 64K

For all the Color Computer fans who are tired of watching a flashing colored box as a cursor—how about getting a nice big OK on the screen when your favorite program has just bombed?

```
I/O ERROR
OK
```

I have come up with a solution if your CoCo has been modified for 64K RAM operation. Otherwise you are unable to perform this patch because it takes place in what is normally ROM. This patch can be either a direct command or can be inserted into a Basic program.

Direct Method: Once you are in the 64K RAM mode, POKE in the following:

- To change the prompt to [+ +] POKE &HABEE, &H2B: POKE &HABEF, &H2B and press enter.
- To change the cursor to a steady cyan box POKE &HA1A6, &H80 and press enter.

Program Method: Use the following program with 64K RAM program ready in your drive or tape deck.

```
10 LOADM"64K RAM": EXEC: 'For disk operation
15 'CLOADM"64K RAM": EXEC: 'For tape operation
20 POKE &HABEE, &H2B: POKE &HABEF, &H2B
30 POKE &HA1A6, &H80
40 NEW
```

If you prefer some other prompt, try any other ASCII value instead of &H2B (+ +). As for the cursor, the only other value worth trying would be &HC0. It gives a flashing blue cursor.

Edgar Poulin
Sherbrooke, Quebec, Canada

Disable Extended Basic

While trying to write programs that were compatible with non-Extended Color Computers on my Extended machine, I decided that the best way to be certain I didn't use Extended functions or commands was to disable my Extended Basic ROM.

After some experimenting and looking at memory maps, I have found that if you type POKE298,0:POKE 303,0 the computer no longer recognizes Extended Basic words. In order to restore your Extended Basic, just type POKE 298,25:POKE303,14 or do a cold start. The reset button does not restore the Extended Basic.

Kevin Derby
Lubbock, TX

Tape EDTASM+ To Disk

If you have a 32K CoCo and bought the EDTASM+ cartridge before adding disks, you can capture the program for use with the disk system. You must be a cheapskate like I am since it will still use cassettes for its own files. Code assembled in memory can be transferred to disk with SAVEM. The following procedure yields a version that assembles into high RAM.

First bring up the system with the EDTASM+ cartridge. Do PCLEAR 1. Type in and run the following Basic program:

```
10 CLEAR 100, 5632
21 FOR X=5632 TO 15871
30 POKE X,PEEK(43520+X)
40 NEXT X
50 POKE 5633,62
```

Then do CSAVEM "EDTASM+",&H3DFF,&H1600.

You can later transfer it to disk with appropriate CLOADM and SAVEM commands when running with the disk cartridge.

The final POKE in the Basic program relocates the work area above the new location of the code. It yields about 16K bytes for work area and assembled code. The EDTASM+ code itself appears to be completely relocatable.

Charles P. Werner
San Jose, CA

```
20 REM *PUT MAIN PROGRAM TO SET
UP TEXT HERE (30-240)*
30 REM SAMPLE PROGRAM
40 CLS:PRINT"    ******SAMPLE DUM
P******"
50 PRINT "PUT ANY TEXT HERE"
60 PRINT"THE PRINTER WILL GIVE Y
OU A PRINTOUT OF EXACTLY";
70 PRINT"WHAT IS ON THE SCREEN A
T THE TIME THE SUBROUTINE IS RUN
."
80 PRINT:PRINT"****************
**********"
90 PRINT "TEXT-SCREEN DUMPT TO P
RINTER":PRINT"WRITTEN BY ANDREW
C. HALTER
100 PRINT:PRINT"***************
**********"
110 PRINT:PRINT"    ***PRESS ANY
KEY TO DUMP***"
120 A$=INKEY$:IF A$="" THEN GOTO
120
130 GOSUB 150
140 GOTO 20
150 FOR I=1024 TO 1535
160 X=PEEK(I)
170 X$=CHR$(X)
180 IF X>=0 AND X<32 THEN X$=CHR
$(X+96):GOTO 200
190 IF X>95 AND X<128 THEN X$=CH
R$(X-64):GOTO 200
200 IF I/32=INT(I/32) THEN PRINT
#-2
210 PRINT#-2,X$;
220 NEXT I
230 PRINT#-2
240 RETURN
```

Program Listing 4. Text-Dump Routine

```
1 IF PEEK (16057)<>50 THEN CLEA
R 200,16048:FOR I=33465 TO 3356
6:POKE I-17408,PEEK(I):NEXT ELS
E 5
2 FOR I=0TO 2:POKE 16061+I,18:N
EXT:I=16158
3 POKE I,38:POKE I+1,3:POKE I+2
,126:POKE I+3,131:POKE I+4,34:P
OKE I+5,126
4 POKE I+6,164:POKE I+7,76
5 POKE 411,62:RUN 10
10 REM ** YOUR PROGRAM BEGINS H
ERE **
```

Program Listing 5. Break Disable

What's the Value of Pi?

My beautiful new CoCo disappointed me at first by its reluctance to tell me the value of Pi, and its unwillingness to express angles in degrees except when nudged by the converter 57.29577951. The entry ATN(1)*4, I soon found, gave the value of Pi. I was able to display the sines of angles from 0 to 90 degrees in steps of 10 degrees with the following routine:

```
10 X=ATN(1)*2
20 FOR A=0 TO X STEP X/9
30 B=SIN(A)
40 PRINT A*90/X,B
50 NEXT A
60 END
```

Keith Robertson
Australia

POKE, PEEK and ASCII

You have probably noticed that when you POKE text or graphics characters on the text screen (1024 to 1535) the POKE and PEEK values for characters are not always the same as the ASCII numbers. This gets frustrating when you want to examine the text screen using PEEK. Table 1 shows how you can find what number to POKE to produce the desired ASCII and graphics characters.

Program Listing 4 is a short routine to produce a text-screen dump of any text screen.

Andrew C. Halter
Valencia, PA

Disable the Break Key and Pause Control

Program Listing 5 disables the break key and pauses control for 16K and 32K machines.

Timothy Wehner
Yale, MI

HOT CoCo

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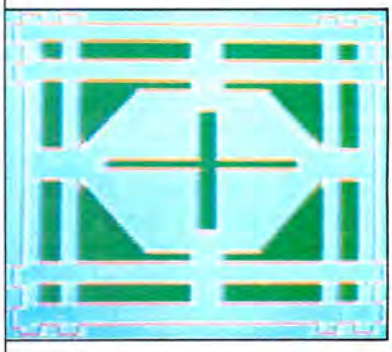

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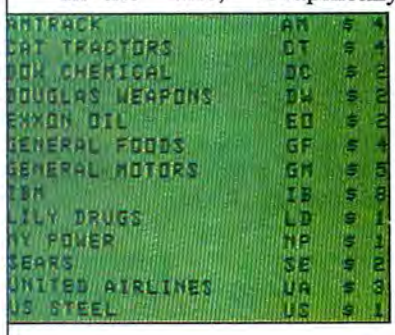

Be sure to join us for informative reviews, features, hardware tips, the regular columns, and much more.

Doctor ASCII

by Richard E. Esposito

Got a problem with your Color Computer? Ask Doctor ASCII to solve it. Write to Doctor ASCII, HOT CoCo, *Pine St., Peterborough, NH 03458.*

Q. Radio Shack advertising is lacking in regards to their new OS-9 software package. I have an E board converted to 64K using Frank Hogg's directions and a Radio Shack disk system. Will the OS-9 package run on my system as is? Radio Shack has a different drive system for sale with the newer CoCo. Are there significant differences that won't let OS-9 run on the older CoCos?

Gerald Casey
Prince Rupert, BC

A. OS-9 will run on any 64K CoCo, old or new. As far as the drives are concerned, see the next letter.

Q. I bought a Color Computer 2 with Extended Basic and 16K RAM. Can you tell me what kind of board I have? How can I tell one type from another? Are there any major component differences (other than the keyboard) between current and immediate past production models? I've heard that some computer companies have continued to offer established computer models, yet have done major downgrades on internal or assembly techniques. Has this happened to CoCo?

George Cross
San Antonio, TX

A. You have a new board that was designed to fit into the smaller CoCo 2 case. On older CoCos, the board-identification letter appeared on the PC board just below the ROM-pack port along with a board number with the computer facing you. The most recent version of CoCo prior to the CoCo 2 had a number only and this is the one that is commonly referred to as the F board. Using that logic, I guess that would give you a G board.

The power supply in the CoCo 2 is different from the one used in previous CoCos. It does not supply 12 volts. Because of this, Radio Shack has come out with a new disk controller that gets its 12-volt supply from the disk-drive power supply. The two major differences are that an older CoCo disk controller will not work without modifying its PC board, and you cannot use 4116 dynamic RAMs to piggyback your memory to 32K. If you want to piggyback your memory to 32K on a CoCo 2, you must use the newer 2118 16K RAMs that need only +5 volts. If you decide to upgrade to 64K, the operation on a CoCo 2 is easier than ever and uses standard 4164 dynamic RAMs.

I would not call the CoCo 2 a downgrade because it is functionally equivalent to the original. It was redesigned to take advantage of the latest technology. An advantage of the CoCo 2 is that it eliminates the possibility of frying your chips when 12 volts gets into a circuit designed for 5 if someone should accidentally plug in or unplug a ROM pack with the power on.

Q. In your January 1984 column, you referenced a Basic merge program for tape. *HOT CoCo* in the June 1983 issue also ran a Basic merge program, which works for both tape and disk and does not require that you save the program first in ASCII format as the disk MERGE command does.

Robert P. Bussell
Lexington Park, MD

A. Sorry to have overlooked your program, especially since it was published in this magazine. I try to keep this column unbiased and I will make references to a helpful article even if it is published in a competing magazine. Those of you in need of a merge program should take note that Bob's program, although written in Assembly language, is accompanied by a Basic POKE routine so that you can enter his program even if you do not own an assembler.

Q. I have a 64K CoCo with a disk drive. I have some Basic programs that run fine without the disk controller plugged in, but give errors like OM ERROR—LINE 10 with the disk drive connected. Is there a way to run these programs from disk?

John P. Stowe
San Francisco, CA

A. With the disk plugged in, you have 2K less RAM available for your Basic programs. If the program does not use graphics, you can PCLEAR 0 by typing POKE25,14: POKE&HE00,0:NEW before loading it to clear an additional 6K of RAM that is reserved for the graphics screen. Another alternative is a program called 64K that is marketed by Spectrum Projects (93-15 86th Drive, Woodhaven, NY 11421) for $9.95. It relocates the Extended Basic ROM's code above the Disk Basic ROM's code giving you an additional 8K for your Basic programs.

Q. I am the happy recipient of one of the early versions of Telewriter given to educational institutions last summer. I have been using the program successfully on my older model 16K Color Computer, which has been upgraded to 64K. However, it will not work properly on a late version 32K nor on the new 16K CoCo 2.

The problem is a sluggishness of the keyboard. Two letters in succession only print one of them, and the break key and arrows take several strikes before they register. The problem is less noticeable if the shift key is held down, but that interferes with the proper use of the program.

Has there been a change in the later models of the CoCo to account for this or is there a software problem with Telewriter?

Regarding the question about using mimeograph stencils on the dot-matrix printer (*HOT CoCo*, January 1984, p.

134), A.B. Dick sells a light-weight stencil (#2060) for this purpose. Printing is done with the ribbon in place so the head should not clog. The stencil is very thin so it requires careful handling on the mimeograph machine to avoid tearing.

Buford V. Frye, Ed.D.
Sylvan School
Snow Camp, NC

A. The problem is with the 1.2 version of the Basic ROM. Its keyboard strobe routine has caused problems for many. I know of CoCo users who have upgraded from the 1.1 to the 1.2 and because of this problem, put the 1.1 back in. On a 64K machine with the 1.2, you can put it into 64K mode and then load in a tape or disk version of the 1.1 ROM before EXECing Telewriter. To do this, add the following statements to the 64K program that appeared on p. 137 of the November 1983 Doctor ASCII column.

```
100 CLOADM"BASIC1-1"
110 CLOADM"TELEWRIT"
120 EXEC
```

The programs should be put on one tape with the Basic program appearing first followed by the 1.1 code followed by Telewriter. The addresses needed for the CSAVEMs to put the programs on tape are &HA000,&HBFFF for BASIC1-1 and &H1E28,&H3767,&H1E28 for TELEWRIT. You could put 1.1 ROMs into your machines if you can find them, or you could burn EPROMs of them from your 64K machine's 1.1.

Thanks for the info on the stencils.

Q. I upgraded my 32K CoCo to 64K, but I only have access to addresses 49152–65279 through PEEK and POKE commands. That area of RAM is not used with Basic unless directly accessed with PEEK and POKE. Have I done things right?

John W. Phillips
Burlington, IA

A. What you say is correct. To be sure, run the memory-test program that appeared in the March 1984 Doctor ASCII (p. 136) column.

Q. You said in the article "Disk Utilities" (*HOT CoCo*, September 1983, p. 138) that you could not get the Microtext cartridge to work from disk with the Romfix program. I have been having a problem with the Mega-Bug cartridge. I would like to know if you have solved the problem and if so, the solution.

I have also tried the program with tape changing the SAVEM to CSAVEM. Pinball and Polaris work this way. I was wondering if the machine-language saving addresses in line 380 should be changed for tape.

Brian Moore
Foxboro, Ontario

A. Mega-Bug and a few other ROM packs have machine-language instructions that write to addresses that are normally in ROM. When the program is run in its native ROM, these instructions are ignored because read-only memory cannot be written to. When one of these programs is run in RAM, it eats itself. This is done to protect the programs from pirates, but it is a nuisance for those with a legitimate reason for copying, such as putting their programs on disk. To circumvent this strategy, one needs to disassemble the code and possibly change those instructions to NOPs ($12s).

The addresses are extracted from the original tape. The other program Romend is useful in making sure that the proper addresses are used. They are the same whether you are saving to tape or disk.

Q. I need some technical information concerning my CoCo and the SCM TP-1 printer. This printer has right-margin sets. However, I cannot communicate between the computer and the printer. The following is a quotation from the manual:

> A right margin may be set by transmitting forward or backspace characters to the printer to position the print point at the desired position and transmitting an ASCII "DC3" character (hex 13) to set the right margin. The printer will acknowledge the receipt of the new margin setting with an audible beep. The ASCII "CAN" character (hex 18) is the margin release character.

Either the Radio Shack manual does not cover this subject or I do not understand it.

Albert M. Huntley
Windsor, VT

A. Characters are sent to the printer using the PRINT#-2, statement. Characters that cannot be typed in from the keyboard such as an ASCII "DC3", an ASCII "CAN", and backspace can be generated using the CHR$ function. The following example statements should help get you started:

```
PRINT#-2,CHR$(&H03)+CHR$(&H03)+CHR$(03)+CHR$(&H13)
```

will backspace the print point three spaces (hex 03) and then set the right margin at that point.

```
PRINT#-2,"HELLO"+CHR$(&H18)
```

will print HELLO and then generate a margin release on your printer.

Q. I have a 32K E board CoCo that I modified to 64K with the jumpers. The machine used to work with the double-speed POKE 65495,0 and the triple-speed POKE 65497,0, but since the modification, it won't run at these speeds. The cursor just disappears and the machine hangs up.

Do I need to remove some capacitors or is this normal after the change?

Larry Hoeme
Liberal, KS

A. If you also added a disk drive, you need to remove C85. If that is not the case, be certain that you made the proper connections. Figure 2 in last July's "64K Modification" (*HOT CoCo*, p. 46) should have been numbered counterclockwise from the notch. I do not know of anyone else who has had problems with the speedup who has done the modification correctly.

Q. I have an F board CoCo (8709285) with 16K Extended Basic (eight 4116 chips). I want to upgrade to 64K and can get easy access to 4164 chips. I understand that the three jumpers located under the top cover shield are to be moved from the 16K to the 64K positions and a jumper is to be added to the 64K terminals located next to U17. What else must be done? I cannot locate past issues of *HOT CoCo* dealing with the modifications.

Tony Rapson
Tulsa, OK

A. Remove the eight capacitors C58, C60, C62, C64, C66, C68, C70, and C72. They are located under the metal shield with the RAM chips near the bottom of the PC board with the computer facing you. The removal can be done with a pair of wire-cutting pliers. Be careful not to disturb the row of capacitors just below them. Replace your eight 4116 chips (they might have different numbers but are labelled U21–U28 on the board) with 4164 dynamic RAM chips, and you are done.

Q. I have an E board CoCo with a disk drive and an Anderson-Jacobson modem. I edit a small magazine that is published in New York. I would like to communicate copy to my word-processing bureau, which uses NBI equipment. However, I am not certain I have all the prerequisites to do it. I would like to transmit text files from the drive (I am using Disk Color Scripsit) via the modem to the bureau.

Disk Color Scripsit allows files to be retrieved in a non-standard mode, which eliminates the apparent problem of carriage returns at the other end. What I envision is addressing the modem (and the bureau) as if it were a printer and transmit the files in ASCII. Since I cannot plug in something like Videotex, remove it, and then plug in the disk controller while the unit is powered, I wonder if I can fool the system into thinking the modem/receiver is a printer.

E. E. Fricks
Clementon, NJ

A. Radio Shack's Disk Color Scripsit and Videotex are, in my opinion, not the worst programs of their kind, but there is better software available and the tone of your letter hints that you are unaware of the alternatives. As far as full-featured word processing goes, if you try Telewriter-64 (Cognitec, 704 N. Nob St., Del Mar, CA 92014, $59.95) or VIP Writer (Softlaw, 9072 Lyndale Ave. So., Minneapolis, MN 55420, $59.95), you will never go back to Disk Color Scripsit. Even without their more sophisticated features, their 51 by 24 displays of upper- and lowercase characters alone would make them superior.

As far as smart-terminal programs are concerned, Videotex is far from the leader in its class. At the head of the class or very close to it is a program called Colorcom/E (Eigen Systems, P.O. Box 180006, Austin, TX 78718, $49.95). This program, among other things, lets you load text into a memory buffer from disk for transmission to another CoCo or other computer without disconnecting the disk controller. Its latest disk version also supports a 51 by 24 display.

Q. Everyone tells me that RAM is better than ROM. If that is so, why do we need any ROM at all?

Cheryl Brewster
Pocatello, ID

A. ROM is read-only memory. You can read from it, but you cannot write to it. It is permanently programmed when you purchase it. RAM is random-access memory although read-write memory would be a better name for it. The reason you need some ROM is that a microprocessor is always executing some machine-language instructions.

In the CoCo, the first thing that the microprocessor does on power-up is to look at the contents of memory addresses 65534 and 65535. Each contains an 8-bit binary number. Together they make up a 16-bit binary number. Upon determining this number, the computer starts executing a series of instructions that begin at that point (or address) in memory. (The possible addresses in the CoCo range from 0 to 65535.) This series of instructions is usually referred to as a startup, or "bootstrap," routine.

If this startup routine were in RAM, the computer would begin executing random instructions and you would not be able to control it. The reason for this is that RAM is never empty. Each unit of RAM is known as a byte. Each byte consists of 8 bits, and each bit is either a one or zero. A bit cannot take on any other value, so every byte of RAM contains some value on power-up.

Early computers did not contain ROM. Instead, they had what is known as a front panel, which consisted of a set

of toggle switches and usually some indicator lights to go along with them. Many people uninitiated to computer technology still associate a computer with a panel of these blinking lights. The startup procedure with these computers was to enter a small bootstrap program with the toggle switches. The procedure consisted of entering 1 byte at a time by setting the eight toggle switches to either the on (one) position or the off (zero) position and then pressing an enter button, which programmed a byte and moved on to the next byte.

If a mistake was made with just 1 bit, it required that the whole procedure start anew. To minimize the length of a toggled in program, it usually consisted of a bare-bones program that did nothing more than cause a longer, more useful program to be read in from tape.

The use of ROM eliminates this lengthy procedure, but it exacts the penalty of dedicating some of the 65,536 bytes of memory in the address space to particular programs. The SAM chip in the CoCo has the ability to swap the ROM out and replace it with RAM after a program of instructions has been placed in RAM. This gives you the benefit of booting up with ROM and still having an all-RAM machine except for only 256 bytes at the top of memory for interrupt vectors and input/output. This RAM/ROM swap capability is what allows the CoCo to use advanced operating systems such as FLEX and OS-9.

Q. Enclosed is a program I wrote to help my neighbor in math. However, the way it's written now she has to figure out her answer on a piece of paper and then enter it (line 1050) in the correct order. How can I get the numbers to appear on the screen from right to left under the appropriate columns, the way one would do it on paper, and then enter the program when enter is pressed? This way one could work out the answer right on the screen, scratch-pad style, and not need pencil and paper. Also, how can I get the program to continue on the Y/N prompt (line 1060) without having to press enter?

Lenny Riforgiato
Miami Beach, FL

A. I have edited your program, marking the beginning of each deleted line with "REM delete" and the end of each added line with ":REM new". Line 1 fixes the program so that it does not start with the same problem set whenever the program is run from a newly powered-up state.

GOSUB statements were used throughout where GOTOs should have been used. A GOSUB should only be used when a corresponding RETURN statement is going to be used in a subroutine. GOSUB initially works like a GOTO. When a RETURN statement is encountered, the computer returns to the statement that follows the GOSUB that sent it.

I have eliminated the INPUT in line 1060 as per your request and replaced it with a use of the INKEY$ function. I have added your scratch-pad type input by using character manipulation, PRINTUSING, and character-to-number conversion. Most of these additions are in the vicinity of your line 1050. There are a few other changes, but they are relatively minor. All are marked in the Program Listing. ■

```
1 T=0: X=RND(-TIMER): REM new
10 CLS
15 PRINT:PRINT
20 PRINT"      SUBTRACTION EXERCI
SES "
25 FOR DLY=1 TO 1000:NEXT
28 CLS:PRINT:PRINT:PRINT:PRINT
30 PRINT"PAIRS OF NUMBERS WILL A
PPEAR ON THE SCREEN ONE PAIR AT
A TIME."
40 PRINT" YOU ARE TO SUBTRACT TH
E LOWER  FROM THE HIGHER. IF YOU
 ARE       WRONG, THE COMPUTER W
ILL TELL YOU, AND GIVE YOU ONE C
HANCE TO CORRECT YOUR MISTAKE. I
F YOU     TYPE THE WRONG NUMBER B
EFORE YOUHIT ENTER, USE THE LEFT
 ARROW TO BACK UP."
50 PRINT@480,"  PRESS <ENTER> WH
EN READY            CONTINUE"
60 A$=INKEY$
61 IF A$<>CHR$(13) THEN 60: REM
new
65 REM delete IF A$=""THEN GOTO
60
70 REM delete IF A$=CHR$(13) THE
N GOSUB 1000
1000 CLS:A=RND(1000)
1010 B=RND(1000)
1020 IF A<B THEN GOTO 1000
1030 REM delete PRINT@204,A
1035 PRINT@96,"":PRINTUSING"
      ####";A: REM new
1040 REM delete PRINT@236,B
1041 PRINTUSING"         - ####";
B: REM new
1042 REM delete IF B<100 THEN PR
INT@237,B
1044 REM delete IF B<10 THEN PRI
NT @238,B
1045 PRINT@197,"     -----":REM n
ew
1050 REM delete INPUT X
1051 A$="     "+"?": REM new
1052 PRINT@233,A$: DG=5 : REM ne
w
1053 D$=INKEY$:IF D$="" OR ASC(D
$+" ")=9 AND DG=5 THEN 1053: REM
 new
1054 IF ASC(D$)<>13 AND ASC(D$)<
>9 THEN MID$(A$,DG,1)=D$: MID$(A
$,DG-1,1)="?":PRINT@233,A$: DG=D
G-1 ELSE IF ASC(D$)<>13 AND ASC(
D$)=9 THEN MID$(A$,DG,1)=" ":MID
$(A$,DG+1,1)="?":DG=DG+1:PRINT@2
33,A$ ELSE GOTO 1058: REM new
1057 IF DG>1 THEN GOTO 1053: REM
 new
1058 X=VAL(RIGHT$(A$,5-DG)): REM
 new
1060 REM delete IFX=(A-B) THEN P
RINT@268,A-B "IS CORRECT. TRY
              ANOTHER? (Y/N)":IN
PUT N$
1061 IFX=(A-B) THEN PRINT@266,A-
B "IS CORRECT. TRY
   ANOTHER? (Y/N) ? ";: REM new
1062 N$=INKEY$: IF N$="" THEN 10
62
1063 PRINT N$: REM delete IF X<>
(A-B) THEN PRINT@268 "INCORRECT.
.TRY AGAIN": REM delete  GOTO108
0
1064 IF X<>(A-B) AND T=0 THEN PR
INT@268,"INCORRECT..TRY AGAIN":T
=1:GOTO1051 ELSE IF X<>(A-B) AND
 T=1 THEN Y=X: GOTO 1090: REM ne
w
1065 IF N$="Y"THEN GOTO 1000
1070 REM delete IF N$="N" THEN G
OSUB 2500
1071 IF N$="N" THEN GOTO 2500:RE
M new
1080 REM delete INPUT Y
1090 REM delete IF Y=(A-B) THEN
GOSUB 2000
1091 IF Y=(A-B) THEN GOTO 2000:
REM new
1100 REM delete IF Y<>(A-B) THEN
 GOSUB 3000
1101 IF Y<>(A-B) THEN GOTO 3000:
 REM new
1110 REM delete RETURN
1120 GOTO1000
2000 CLS:PRINT@224,"  THAT'S BET
TER. HERE'S ANOTHER": FOR DLY =
1 TO 800:NEXT:GOTO1000
2500 CLS:PRINT"WHADDYA MEAN, NO?
 YOU TRY AGAIN OR I'LL ZAP YOU B
EFORE YOU CAN  GET TO THE DOOR..
.AND REMEMBER, I'M A COMPUTER...
THERE'S NO       ESCAPE, HEH HEH
HEH....!!!  NOW YOU JUST HIT THA
T <ENTER> KEY, BUBBA!"
2510 R$=INKEY$: IF R$="" THEN 25
10
2520 REM delete IF R$=CHR$(13) T
HEN GOSUB 1000
2521 IF R$=CHR$(13) THEN GOTO 10
00 ELSE CLS:PRINT"BYE": END: REM
 new
3000 PRINT@322,"SORRY WRONG AGAI
N.  THE ANSWER IS" (A-B)
3001 T=0: REM new
3005 PRINT@386,"PRESS <ENTER> TO
 CONTINUE"
3010 F$=INKEY$
3020 IFF$=""THEN 3005
3030 IF F$=CHR$(13) THEN GOTO100
0
```

Program Listing

Re:FLEX

COOKING WITH STYLOGRAPH

by Scott Norman

I've been doing a lot of word processing with Stylograph lately (Great Plains Computer Co., Box 916, Idaho Falls, ID 83402). It supports both Frank Hogg Labs' and Data-Comp's versions of FLEX, and there's also an OS-9 version that I haven't seen yet.

I like it; Stylo, as it's known to its fans, can do almost everything but cook, yet even in the early going I never felt that sense of drowning in control keys that I remember from my first encounters with WordStar. Maybe I've just become hardened by too many late-night encounters with new software, but I really think that Stylo is a more rational program.

There are some rough spots, but nothing too serious. The biggest problem is that Stylo is incompatible with certain printers.

Stylo doesn't overwhelm you with menus. Author Robert Bundy offers a simple main menu, a few prompting messages (mostly to guard against losing a file), and some assistance screens that you can call up if necessary. These, plus the manual and its color-coded chart of keyboard functions, suffice.

There are three operating modes: Supervisor, Escape, and Insert. Supervisor controls printing, the saving and loading of text files, and the passing of commands to FLEX. (It is a simple matter to temporarily leave the word processor, execute FLEX utility commands, and return.)

You edit text with the Escape and Insert modes. Use Insert for text entry, but exit to Escape mode to scan through the material once it is in the machine.

Then you have a dozen keys on the right side of the keyboard to control scrolling and cursor movement for proofreading. The left side controls deletion; S, W, and X delete a single character, word, or line, respectively, when used with the clear key (which acts as control for many Stylo operations) in either Insert or Escape modes. The left-arrow key also performs the backspace-and-erase task in Insert.

The idea of a separate mode for wandering through the text seemed awfully strange to me at first. I've been spoiled by Telewriter's straightforward use of the arrow keys, I guess. At least Stylo's choice of cursor control keys is sensible; I, J, L, and the comma govern the four basic movements, and they form a diamond on the keyboard.

Escape also has another function: It serves as a pathway whenever you switch between the other two modes. You perform all such transitions with single keystrokes, which probably helped me get used to the frequent Escape/Insert/Escape switching required by my style of editing on the fly.

The video displays for the Insert and Escape modes are similar in appearance: just a dashed ruler line at the top of the screen, followed by the text (49-by-24 high-resolution format).

Only one visual clue indicates which of the two modes is in effect—in Insert, a second dashed line extends from the cursor position to the right margin. The text you enter overwrites this. I like this better than having a lot of status lines cluttering up the display.

Of course, if you really want a report on such things as remaining memory, current format parameters, and the names of input and output files, control/P brings up a list from either Insert or Escape.

Insert is an appropriate name for the text-entry mode. Stylo assumes that, if you move the cursor into the middle of some existing text and start to type, you want to insert your new material into the old—not to overwrite it. This is obviously the best way to operate, since it coincides with my own prejudices.

There is a single-character overwrite option, however. Using it involves getting into Escape mode and typing in the numeral one and then the desired character. I'm not sure it's worth the trouble.

Stylo has a full complement of commands for duplicating, moving, saving, deleting, and otherwise manipulating arbitrary blocks of text. All are controlled by a marker: a pair of right-brackets (}}), generated by holding down the clear key while pressing the period.

The marker always occurs at the end of the target block. You then move the cursor to the beginning and enter the appropriate clear/letter command.

You must enter 32 of Stylograph's print-formatting commands as imbedded commands in a text file. Naturally, they get stored and retrieved with the text, too.

This is in contrast to many word processors that require you to fill in figures for line spacing, margins, and other parameters on a separate format menu each time you print a file.

Formatting commands each begin with a comma, and are generally easy to remember, as in the following examples:

- ,1m 10 sets the left margin at 10 spaces;

- ,11 60 specifies a line length of 60 characters;
- ,rj 3 right-justifies the following three lines;
- ,ju sets up flush left and right margins;
- ,hd begins the definition of a page header;
- ,ft begins the definition of a page footer;
- ,, terminates either definition; and
- ,pc defines the delimiter for nonprinting control strings.

Some of the commands, like those for setting line length, centering, and justification, take effect on the video screen as soon as you enter them from the keyboard. This is called dynamic screen formatting and is one of Stylograph's most attractive features.

It's nice to be able to check the appearance of headers and footers, and to make certain that indented material has the appearance you want. I do wish that multiple line spacing would show up, though.

I recommend composing, proofreading, and correcting text using the 49-character default line length. Then you can return to the top of the text to insert the actual line length just before you print your file.

If you set up the final configuration any sooner, you must scroll back and forth while proofing—and Stylo's scrolling action is slow.

Like most FLEX applications software, you must install Stylo on your system. If you want a stand-alone word processor, you must prepare a new system disk containing FLEX, any desired utilities, Stylo, and the assistance files. Then you must inform the word processor of the terminal and printer to be used.

This terminology is actually a carryover from multi-user business systems; the only terminals the Color Computer edition supports are the Data-Comp and Frank Hogg versions of FLEX itself. At present, there are no provisions for using Color Computer Stylo with an external video terminal.

You use a routine called STYFIX, furnished on the Stylo disk, for this part of the installation. If you want to use Mail-Merge (the separate program that handles chain printing of text files as well as form-letter applications), you should install it at the same time. It has its own installation utility, MMFIX.

When you give the new system disk the command RUN "FLEX", the operating system asks for the date and then sets up and calls the word processor. The whole process takes about 25 seconds after you've entered the date.

The installation process sounds straightforward, and the mechanical aspects are. Some problems can arise, though, which brings me to those incompatibility issues.

I have mentioned that Stylo uses the clear key to create control commands for text deletion. It also uses some of the other control commands to designate special printing treatment, or character modification: clear/B for boldface, clear/U for underlining, and so on.

These commands seem much easier to remember than the sequences employed by many other word processors. Unfortunately, they will not work with all printers. Epsons apparently accept the commands, while my Prowriter does not. It cannot properly interpret some of the codes generated by Stylo's "intelligent" printer driver routines; Roger Snyder, president of Great Plains Computer, says it's too smart for its own good.

"Speaking of file handling, Stylo automatically makes a back-up copy... of any text file that you read from disk and later restore with the same name."

The problems seem to be with backspacing, necessary for underlining and boldface printing, and with the routine for flush-left and -right margins. Even though the Prowriter uses the conventional command code 08 for a backspace, something gets fouled up in the driver translation.

That's why I had to designate the Prowriter as device #40 in my own installation procedure, even though that number actually invokes the device driver for less capable TTY printers without backspace capability. At least this makes the justification routines work properly.

Other printers evidently have problems with some of the character modification commands also, and this is not peculiar to the Color Computer edition of Stylograph, either—"big machine" users also have to be wary.

A configurable printer interface software module that will address the problem is under test, but for the present you simply can't use the abbreviated character-modification commands with some machines. Until then, I imbed the required ASCII control codes for underlining, boldface, and so on in the text, thereby passing them directly to the printer.

The only complication is that Stylo does not allow you to set up an entire code sequence ahead of time. Instead, you have to define a printer-control character with the ,pc formatting command and use it to enclose any nonprinting codes you want to send to the printer.

Here's how I do boldface printing. Suppose the plus sign is to be my printer-control character (that means it can't be used for anything else in the text). Somewhere at the top of my text I put the formatting command:

```
,pc +
```

Then I have to begin each stretch of boldface text with the sequence:

```
+27,33+
```

and end it with:

```
+27,34+
```

which are the Prowriter's control sequences.

While this method always seems to work, it is inconvenient. A partial solution is to just mark all the places where you'll need character modification when you first compose your text, then use Stylo's find-and-replace function to go back and insert all the necessary codes. This requires several passes through the text: one to turn a given feature on and one to turn it off.

Stylo only allows you to define one printer control character, too, so you'll have to skip at least half of the markers on your first pass. Still, this may be less disruptive than stopping to look up each code sequence while composing text.

Despite the fact that there can be a lot of activity on the screen whenever wordwrap adjusts the material, it seems impossible to lose text by continuing to type. I suspect that you just can't beat Stylo's text buffer.

It's also nearly impossible to lose text through accidental deletion. Every command that might jeopardize an open file draws a two-stage "Are you sure?" prompt. This can get a little tiresome—like Mom constantly reminding you to wear your rubbers—but all will be forgiven the first time it saves an evening's work.

Speaking of file handling, Stylo automatically makes a back-up copy (with extension .BAK) of any text file that you read from disk and later restore with the same name. The .TXT file will always be the very latest version, the .BAK file its immediate predecessor.

WordStar has a similar feature, but Stylograph has the advantage of being able to print a test file without first storing it. This comes in handy for short, informal pieces that might not deserve permanent storage.

It can also save your neck when you have an important file in RAM and insufficient space on your working disk; at least you can get hardcopy from Stylograph.

One point about the size of files: Stylo only leaves about 21K of RAM free for text, so Mail-Merge quickly becomes a necessity, if only for its chain-printing capability. I can't say much about the program in this month's column, except to point out that it's a snap to use.

Unfortunately, it takes a little cash. At the end of 1983, Stylo was selling for $150–$200, Mail-Merge for $75–$145. The price might depend on which version of FLEX is involved, but of course your friendly vendor will have to be the final word on that.

All in all, Stylo is comparatively simple to learn and to use, with good documentation and a host of "big system" features. It is quite capable of serving as the heart of a complete text-manipulation system. You can expect to hear more about it in future editions of Re:FLEX. ■

Write Scott Norman c/o HOT CoCo, *Pine St., Peterborough, NH 03458.*

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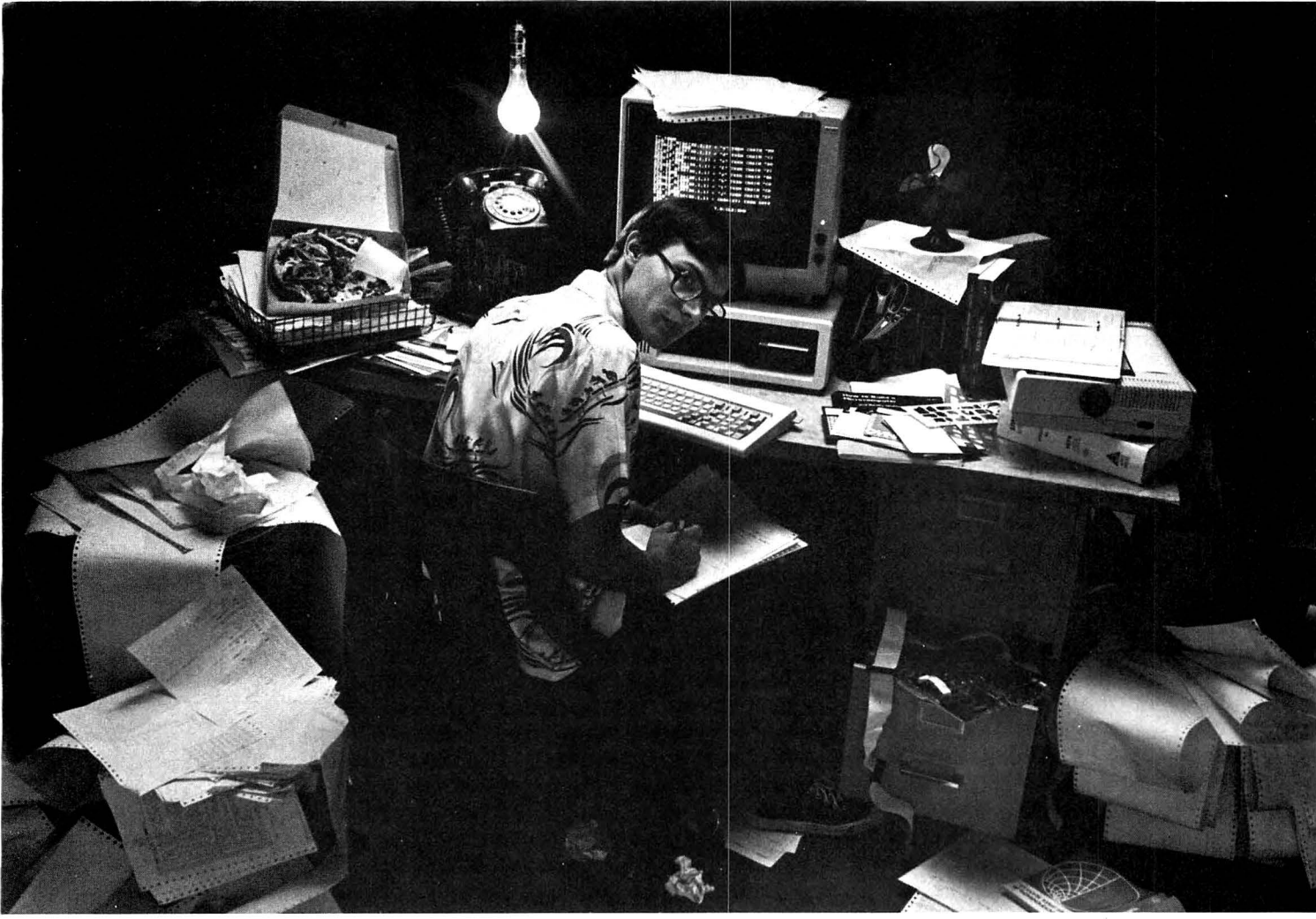

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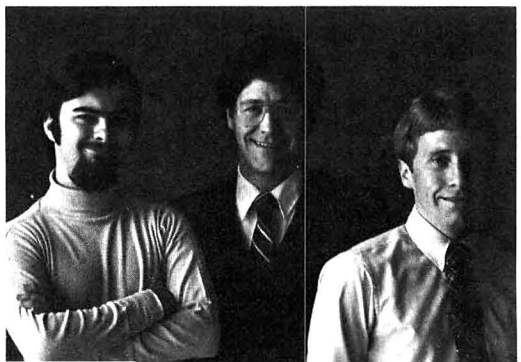
I/O WARE is looking for innovative programs for the home and small business markets: word processing, graphic arts, finance, planning, home budgeting, "how-to", etc. Programs that will run on the Commodore 64 (Disk or Tape); IBM PC and PC Jr. (Disk); Apple II (Disk); TRS-80 I, III, IV (Disk), and Color Computer (Disk or Tape). You'll receive our decision in 30 days. If you have what we're looking for we'll immediately send you an advance of *at least* $250.

And that's just the beginning. I/O WARE can give you the kind of exposure (and royalties) you've been dreaming of.

We'll put a cash advance in your pocket.



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Duane Manseau, Jim Eastman, Tom Cullity
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See your name up in bytes.
Every program needs professional documentation, packaging, distribution, and promotion. That's our job. We'll transform your program into a polished, and successful software package.

I/O WARE is part of the team of computer experts publishing the leading computer magazines in the country. Which means your program will have access to major national advertising, direct mail, and hundreds of retail outlets across the country.

So hit us with your best shot—today.
Because we're putting together a very strong line of software. Fast. And there's a good chance you could be a part of the team. Just call Tom Cullity at our software hotline, 603/924-9897, and let us know what you have up your sleeve.

I/O ware

I/O WARE INC.
Peterborough, NH 03458
Attention: Tom Cullity

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↙ See List of Advertisers on page 131

PRODUCT NEWS

edited by Cynthia Smith

The information used in the Product News section is supplied through manufacturers' press releases. *HOT CoCo* has not tested or reviewed these products and cannot guarantee any manufacturer's claim.

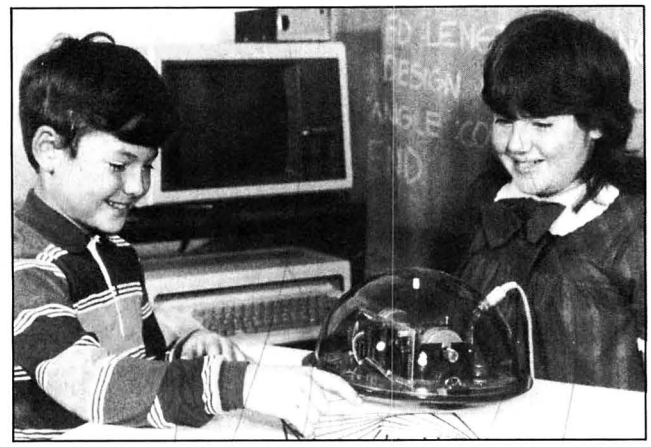
Tasmanian Turtle Tot

The Tasman Turtle has a new baby brother. Built in Australia by Flexible Systems of Hobart, Tasmania, preproduction Turtle Tots were demonstrated at the Comdex Las Vegas and Canadian Computer shows. Turtle Tot can move, draw, turn, blink its eyes, and feel its surroundings with touch sensors. With an optional speech package, Turtle Tots can even talk.

Turtle Tot is controlled via an RS-232 interface and comes fully assembled and tested with instructions and a 10-color pen set.

It sells for $299. For more information about Turtle Tots write Harvard Associates Inc., 260 Beacon St., Somerville, MA 02143, or call 617-492-0660.

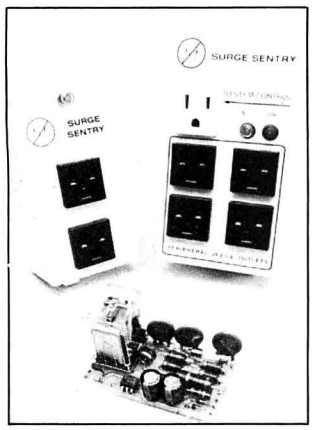
Reader Service ✓ 550



The affordable robot: Turtle Tot from Tasmania.

Protection From Killers

RKS Industries has introduced an advanced level of surge protection for computers, VCRs, component television systems, and other sensitive home electronics devices. The Surge Sentry product line contains a new three-stage, three-way common mode design that shields the user's personal computer and other equipment from high-speed power spikes and large voltage surges.



Surge Sentry Protects your computer from power spikes.

The new common mode unit combines a high-speed component that captures fast transients, and high-power devices that will dissipate a wide range of spikes and surges. Surge Sentry detects power spikes in less than 5 picoseconds (5 trillionths of a second).

Large voltage surges entering the Surge Sentry are captured and passed through the RKS engineered, multistage power-handling components that weaken and absorb the current, finally shunting it to a power dissipator. Only normal voltage reaches your equipment.

Surge Sentry products have been tested to the IEEE Standard 587, and UL 1449, and are UL listed.

Contact RKS toll-free at 800-892-1342, or in California at 408-438-5760. Or write RKS, 4865 Scotts Valley Drive, Scotts Valley, CA 95006.

Reader Service ✓ 551

Free Catalog

A 24-page, full-color catalog of Computer Supplies and Accessories is now available from Mattick Business Forms. This new catalog offers over 1,000 products from brand-name manufacturers, and includes disks, filing and storage accessories, magnetic tape, computer forms and labels, data binders, and binder filing supplies, ribbons and print wheels, maintenance needs, and furniture.

For a free copy, write Mattick Business Forms Inc., 333 W. Hintz Road, Box P, Wheeling, IL 60090, or phone 1-800-MAT-TICK.

Reader Service ✓ 557

Enhanced Graphics Firmware

Privac Inc. has announced enhanced graphics software, optimized for speed and features to reside in firmware on Electro-Screen BT-1, an SS-50 and SS-64 Bus graphics board.

The Electro-Screen BT-1 is a plug-in board with its own onboard 6809 microprocessor, and provides a bit-mapped 512-by-580 resolution graphics display and 84-by-48-line text display with flexible text and graphics integration, composite and TTL level video output and an eight-channel, 8-bit A/D converter.

The new, enhanced version 2.0 software provides for fast, 19.2K-baud equivalent character throughput and includes a complete 2-D graphics package with scaling, rotation in 1-degree increments, and translation, as well as extensive graphics primitive drawing set including circles, arbitrarily bounded object flood, outlined rectangles, solid rectangles, and variable sized auto-clipping viewports.

Other features include TV-950 graphics character emulation, TV-912 terminal emulation, and text qualities such as overstrike, underline, line wrap, reverse video, and an 84-character text line. BT-1 version 2.0 software also has double height or double width character options as well as the ability to upload multiple character fonts and switch among them while accepting a line of characters.

FLEX and OS-9 level I and II drivers as well as many sample demo graphics programs and tutorials are included in the manual. Complete instructions are provided for interfacing BT-1 to non-SS-50 computers through a parallel port.

Price for the BT-1 graphics board with the enhanced version 2.0 software is $795. BT-1 with version 1.0 is $595. A version 2.0 upgrade EPROM set for older BT-1s is $195. For more information, contact George Wheelock at Privac Inc., 3711 S. George Mason Drive, Falls Church, VA 22041. 703-671-3900.

Reader Service ✓ 559

Award-Winning Educational Software

Sunburst Communications Inc. has a new line of educational software featuring five programs for ages seven through adult. These programs are designed to use the computer's interactive abilities, color graphics, and animation to enhance learning and encourage the development of thinking skills and problem-solving techniques.

Memory Castle, The Pond, The Factory, Teasers by Tobbs, and M-ss-ng L-nks are award-winning programs packaged in vinyl albums, complete with a comprehensive program guide. Suggested retail price for each program is $39.95. Contact Sunburst Communications Inc., Pleasantville, NY 10570. 800-431-6616.

Reader Service ✓ 553

PRODUCT NEWS

A Classic For the CoCo

Colortech Systems has released a new game called CoCo-Bingo. It allows an unlimited number of players, features color graphics and sound, and is disk compatible. CoCo-Bingo includes ball count and pause feature, and comes complete with bingo cards and chips.

The game sells for $12.95 (16K Extended Color Basic cassette). Include $1.50 for shipping, and Ohio residents add 6.5 percent sales tax. Contact Colortech Systems, 17401 Dartmouth Ave., Cleveland, OH 44111. 216-476-0543.

Reader Service ✓ 552

Screen With A View, Please

Clean your CRT screens, micrographic equipment, and optical components with Data Vu Cleaning Mist. It will safely remove surface contaminants like fingerprint smudges, dust, and smoke particles, and it contains no silicon or harsh abrasives. Data Vu dries quickly and leaves no streaks.

Packaged in 12 2-ounce bottles per carton, each bottle has its own fingertip mist sprayer and stores conveniently in a desk drawer. Data Vu sells for $3.75 per bottle from Eye Communication Systems Inc., 117 Hill St., Hartland, WI 53029. 414-367-3080.

Reader Service ✓ 556

Spray Cleaner for a Clearer View.

Touch-N-Turn eliminates eye-strain and neck fatigue.

Touch-N-Turn

Put your computer terminals, monitors, or portable TVs on the Touch-N-Turn, a swivel and tilt stand, and help eliminate eye-strain and neck fatigue. You can tilt your monitor or TV back or forward, and swivel it left or right.

The Touch-N-Turn is strong enough to hold heavy monitors, and you need no tools or experience to install it. It comes in putty or walnut, and sells for $59.95 (12-by-12 inches), $64.95 (16-by-16 inches), and $69.95 (16-by-20 inches). Contact Aztec Electronics, 12345 Westminster Ave., Santa Ana, CA 92703. 714-554-1730.

Reader Service ✓ 554

Free Adventure Game

You can receive a free copy of Flight from Grimdar from The CoCo Freeware Clearing House. Just send a blank tape or disk and postage-paid return mailer, and mention CoCo Freeware Program #101. Contact CoCo Freeware Clearing House, P.O. Box 1084, Morgantown, WV 27507. 304-599-4493

Reader Service ✓ 558

Communicate!

You'll get a combination of the Database/Mailer 2.0 and Letter Writer 2.0 with CC-DBM2/LW2. Use the Database/Mailer to create from 68 to 454 records per file with full file-handling capability. The Letter Writer will create from a single fast letter to thousands of form letters.

Both tape and disk versions are available including a non-Extended version for the 16K and 32K systems. The entire package sells for $49.95 plus $3 shipping. Contact EVS Engineering Co., 9528 Suite 35, Miramar Road, San Diego, CA 92126. 619-695-1385.

Reader Service ✓ 555

64 Column/ Model I/III Emulator

Here is an answer if you want to get more characters on the screen (64 by 16) or if you want to run Model I/III Basic software on the Color Computer. The 64 Column/Model I/III Emulator allows Model I/III SET, RESET, POINT, PRINT@, CHR$, and CLS commands to work as they do on a Model I/III by using the PMODE 4 screen and rewriting the ROM routines and placing them in RAM.

This program does not add the DEFDBL, DEFSNG, DEFINT, or fix the other differences in the languages, but lets you type or load a Model I/III Basic program in on the CoCo without changing graphics statements. (Note: some software might require special Color Computer loaders such as Spectral Associates' Magic Box, or can be directly downloaded using a package like Colorcom/E). The 64 Column/Model I/III Emulator requires 64K and sells for $19.95.

The program emulates the black-and-white monitor of a Model I/III. Some TVs can produce a color flair or sparkle around hi-res characters. To maximize the display quality you might turn the color down or off completely on the set, or type SCREEN,0 to change the screen color.

Contact Spectrum Projects, 93-15 86th Drive, Woodhaven, NY 11421.

Reader Service ✓ 563

BBS Directory

The *National CBBS Directory* is now available to all computer users who communicate over the telephone. This directory contains over 1,000 computer bulletin-board telephone numbers organized in numeric sequence, plus a key field that identifies information such as the BBS type, its baud rate, operating hours, and special comments about each BBS.

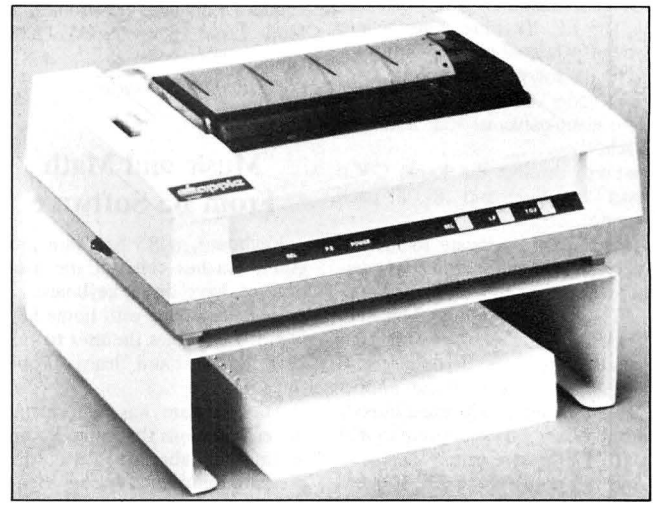
Many of the bulletin boards contain programs that you can download into your system at no charge to you. It provides you with a comprehensive list of national BBS telephone numbers, and will be promptly shipped to you.

Send $2 postpaid to Thomas Wnorowski, 3352 Chelsea Circle, Ann Arbor, MI 48104. (SYSOPS: send information for next printing of the Directory.)

Reader Service ✓ 562

Bretford Accessories

Elevate your printers with these new printer stands from Bretford Manufacturing Inc. The model



Mini Printer Stand from Bretford Manufacturing Inc.

WSPS-1 elevates a printer with a 9½-inch paper feed and accommodates a continuous flow of paper. The WSPS-2 mini printer stand is for a larger mini printer with a 15-inch paper capability. Both units feature a slot to accommodate the appropriate bottom-feed printers.

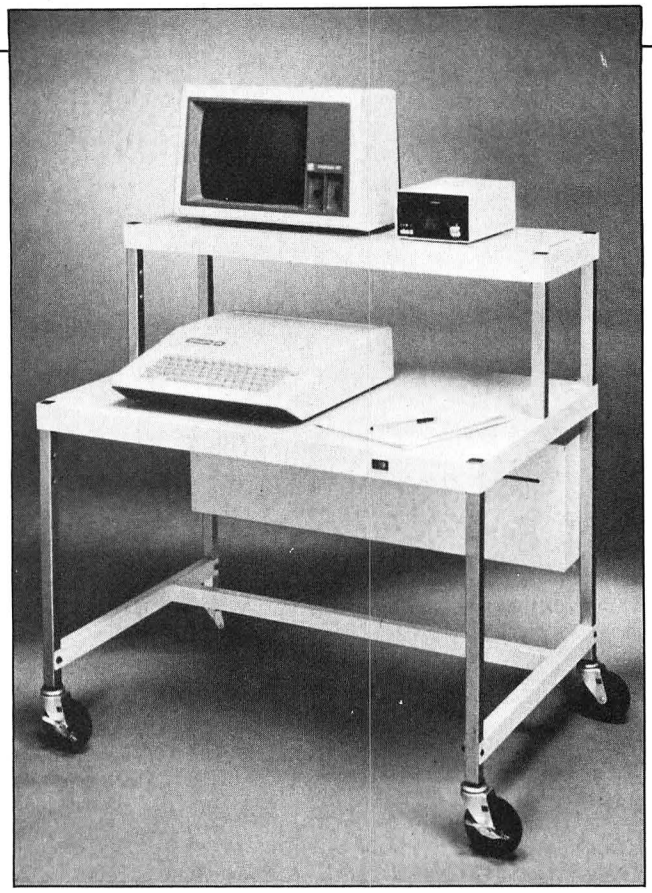
Both units are made of solid steel and have a baked enamel finish in putty beige. For more information contact Bretford Manufacturing Inc., 9715 Soreng Ave., Schiller Park, IL 60176. 312-678-2545.

Also from Bretford is an adjustable computer table with a single switch that turns an entire computer system on and off. The EC-15 has an adjustable top shelf and adjustable work surface to accommodate a variety of microcomputer systems and users.

The neon-lighted switch is located on the front of the work surface for easy location, and its connectors are housed in a protective channel under the work surface. There is also a grounded outlet at the rear of the channel.

The EC-15 features heavy-gauge steel construction with 1-inch square tubular steel legs on 4-inch casters, two with locking brakes. Its high-impact enamel finish is putty beige.

Reader Service ✓ 561



Bretford's Computer Table, the EC-15.

Modular Interfacing Boards

Now you can interface to your Color Computer using the EE 100 Series Modular Interfacing Boards. You can start with the EE 101 and breadboard your own applications circuit, or combine the EE 101 and 102 for a complete dual 8-bit bidirectional parallel port with four handshaking lines.

The EE 101 plugs directly into your CoCo's 40-pin port and provides the following functions:

- Decodes addresses FF40–FF5F into eight banks of four addresses each.
- Feeds through the 40-pin CoCo port for disk and ROM pack control.
- Feeds out a separate 16-line bus that can be used for your own interfacing projects.

The EE 102 is a dual 8-bit bidirectional parallel port with four handshaking lines. It connects to the EE 101 via a 16-line jumper cable and can be addressed directly from a Basic program using POKE and PEEK statements.

In addition to the EE 101 and 102, Enhanced Electronics also offers two types of power switching boards:

- The EE 103 provides four 60V 3-amp MOSFET transistors.
- The EE 104 puts four 60V 0.4-amp MOSFET transistors at your disposal. Connecting the EE 103 or EE 104 with port lines from the EE 102 lets you switch DC loads under Basic language control with only a few simple POKE statements. All EE 100 boards offer PC board construction and terminal strips for positive hookups.

Prices are as follows: EE 101, $60; EE 102, $70; EE 103, $48; EE 104, $33. Personal check or money order accepted; send $2 for COD. Contact Enhanced Electronics, 26 Hope Lane, Hicksville, NY 11801. 516-681-7293.

Reader Service ✓ 567

Music and Math From B5 Software

Keyboard, a B5 Software program, teaches children the location of keys on a keyboard. A graphic keyboard with home keys identified enables the user to find keys quickly and learn proper fingering.

The program has four menu-driven selections that build lessons around alphabet and letter drill presentations. Each lesson gives a graphics reward.

Keyboard is available in 16K or 32K versions with an optional Keyboard Phonic Drill data tape. The program requires Extended Basic and sells for $19.95 (16K cassette), $24.95 (32K cassette), $26.95 (32K disk), $8.95 (data tape). Contact B5 Software, 1024 Bainbridge Place, Columbus, OH 43228.

Also available from B5 Software is Skipcounting, a program designed to help elementary children understand math by counting. For each lesson the user is able to select the beginning and ending numbers from 0–9,999,999, and the number to count by (any number from 1–10, or 15, 20, 25, 50, 100, or 1,000). Students can also count backwards for further challenge. Lessons end with a counting song and a graphics reward. Skipcounting requires Extended Basic and sells for $16.95 (16K cassette) or $18.95 (32K disk).

Reader Service ✓ 566

Random Basic For OS-9

Computerware has announced Random Basic for the Color Computer and OS-9. Now the CoCo user has access to a wide range of business and programming products that are already written in Random Basic on other operating systems.

With Random Basic all OS-9 commands are directly accessible. It has 9 or 11 digits of precision using BCD arithmetic, and its file-handling capabilities include ISAM random, and sequential file structures.

Existing programs are transportable between operating systems. Output formatting is easy with PRINT USING, automatic pagination, left- and right-justification, columnization, and decimal point alignment. Programming is fast, and it is self-documenting with extended variable names.

Contact Computerware, Box 668, 4403 Manchester Ave., Suite 102, Encinitas, CA 92024. 619-436-3512.

Reader Service ✓ 565

Data-base Update

The *Omni Online Database Directory*, edited by Mike Edelhart and Owen Davies, is a guide to more than 1,000 selected data bases in 50 different fields. It analyzes and evaluates data bases for content and use, and provides users' comments, access information, suppliers' addresses and telephone numbers, costs, a computer glossary, and in-depth discussions of such key vendors as The Source, Compu-Store, Dialog, and BRS.

In addition, information for novice and veteran database users alike covers areas such as choosing a modem and setting it up, selecting the right software, and choosing the best vendor to fit one's needs.

It sells for $19.95 hardcover and $10.95 paperback. Contact Diane McNulty, Associate Director of Publicity, MacMillan Publishing Company, 866 Third Ave., New York, NY 10022. 212-702-4212.

Reader Service ✓ 560

Jargon Demystified

Today's computers have spawned a language all their own. If you don't know a disk from a data base, or a bubble sort from a breakpoint, try *The Computer Dictionary*.

This state-of-the-art dictionary defines computer terms, as well as newly coined computerisms such as *zeroing*, *bit map*, and *firmware*, all in alphabetical order. Look for *The Computer Dictionary* in your book store, or contact Running Press Book Publishers, 125 South 22nd St., Philadelphia, PA 19103. 215-567-5080.

Reader Service ✓ 564

of the hill!

It's a jungle out there, but the latest news on the Color Computer grapevine is that, above the swirling mists of confusion, more and more people are discovering **the Rainbow.**®

Now in its third year, **the Rainbow** has become the standard by which all other Color Computer magazines are compared. And no wonder! **The Rainbow** towers above the crowd, now offering more than 300 pages each month, including more than two dozen type-in-and-run program listings, a host of articles and in excess of 30 hardware and software product reviews.

We lead the pack in Color Computer publications and are devoted *exclusively* to the TRS-80® Color, TDP-100 and Dragon-32. We made our climb to the top by continually offering the best and the most by such well-known authors and

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All systems feature the **GIMIX CLASSY CHASSIS**; with a ferro-resonant constant voltage power supply, gold plated bus connectors, and plenty of capacity for future expansion.

Static **RAM** and double-density **DMA** floppy disk controllers are used exclusively in all systems.

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Systems are assembled using burned-in and tested boards, and all disk drives are tested and aligned by **GIMIX**.

You can add additional components to any system when ordering, or expand it in the future by adding **RAM, I/O**, etc.

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All **OS-9/FLEX** systems allow you to software select either operating system.

Also included is the **GMXBUG** monitor and, in systems with 128K or more of RAM, **GMX-VDISK** for **FLEX**.

All **GIMIX OS-9** systems include **Microware's Editor, Assembler, Debugger, Basic09,** and **Runb**; and the GMX versions of **RMS** and **DO** for **OS-9**.

All **GIMIX** versions of **OS-9** can read and write RS color computer format OS-9 disks, as well as the Microware/GIMIX standard format.

New and exclusive with **OS-9 GMX III** systems is the **GMX OS-9 Support ROM**, a monitor for **OS-9** that includes memory diagnostics and allows the system to boot directly from either hard disk or floppy.

A wide variety of languages and other software is available for use with either **OS-9** or **FLEX**.

OS-9 GMX III/FLEX SYSTEMS (#79)

The **#79** super system now includes (in addition to the above): the **GMX 6809 CPU III**, a **256K CMOS Static RAM Board (#72)**, and a **3-port Intelligent Serial I/O Processor (#11)**.

The **GMX 6809 CPU III** can perform high-speed DMA transfers from memory to memory and uses memory attributes and illegal instruction trapping to protect the system and users from program crashes. If a user program crashes, only that user is affected; other users are unaware of the problem.

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OS-9 GMX I / FLEX SYSTEMS #49

The **#49** systems include 64KB static RAM, #05 CPU, #43 2 port serial board.

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with dual 80 track DSDD drives **$4198.49**
with **#88** dual 8'' DSDD drive system **$5698.49**
with **#90** 19MB Winchester subsystem and one 80 track **$6898.49**

OS-9 GMX II / FLEX SYSTEMS #39

The **#39** systems include 128KB static RAM, #05 CPU, #43 2 port serial board.

with dual 40 track DSDD drives **$4498.39**
with dual 80 track DSDD drives **$4698.39**
with **#88** dual 8'' DSDD drive system **$6198.39**
with **#90** 19MB Winchester subsystem and one 80 track **$7398.39**

GIMIX DOES NOT GUARANTEE PERFORMANCE OF ANY GIMIX SYSTEMS, BOARDS OR SOFTWARE WHEN USED WITH OTHER MANUFACTURERS PRODUCT.

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GIMIX, Inc. reserves the right to change pricing, terms, and products specifications at any time without further notice.

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Contact GIMIX for price and availability of UniFLEX and UniFLEX GMXIII Systems.

NOTE on all drive systems: Dual 40 track drives have about 700KB of formatted capacity; dual 80's about 1,400KB; dual 8'' about 2,000KB. The

Want to expand your system to a megabyte of Static RAM and 15 users?

Simply add additional memory and I/O boards. Your **GIMIX** system can grow with your needs. Contact us for a complete list of available boards and options.

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#67 64KB STATIC RAM board **$478.67**
#11 3 port intelligent serial I/O board **$498.11**
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#42 2 port parallel I/O board **$88.42**
#95 cable sets (1 needed per port), specify board **$24.95**

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GIMIX will allow you up to $1100.00 credit toward the purchase of any GIMIX system when you trade-in your working Color Computer, peripherals, and original software. The trade-in value is limited to 110% of the RADIO SHACK™ list price at the time your order is placed. You pay the freight. This offer is good only in the Continental U.S.; is limited to the first 100 orders; and expires on 9/30/84. Only one trade-in per customer.

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THE COLOR ACCOUNTANT

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The checkbook maintenance program is the key to the entire package. Once your checkbook is balanced, the checkbook summary file will automatically update the home budget analysis, net worth, and income/expense statements. You can then graph any file, record bills and appointments, make decisions, print a mailing list, analyze various accounts or stocks, and even calculate taxes.

All programs are menu-driven and allow add/change/delete. Each file and statement can be listed to screen or printer, and saved to cassette or diskette. **THE COLOR ACCOUNTANT** also comes with 40 pages of documentation that leads you step-by-step through the entire package. The TRS-80 COLOR Ext. Basic requires 16K for this package.

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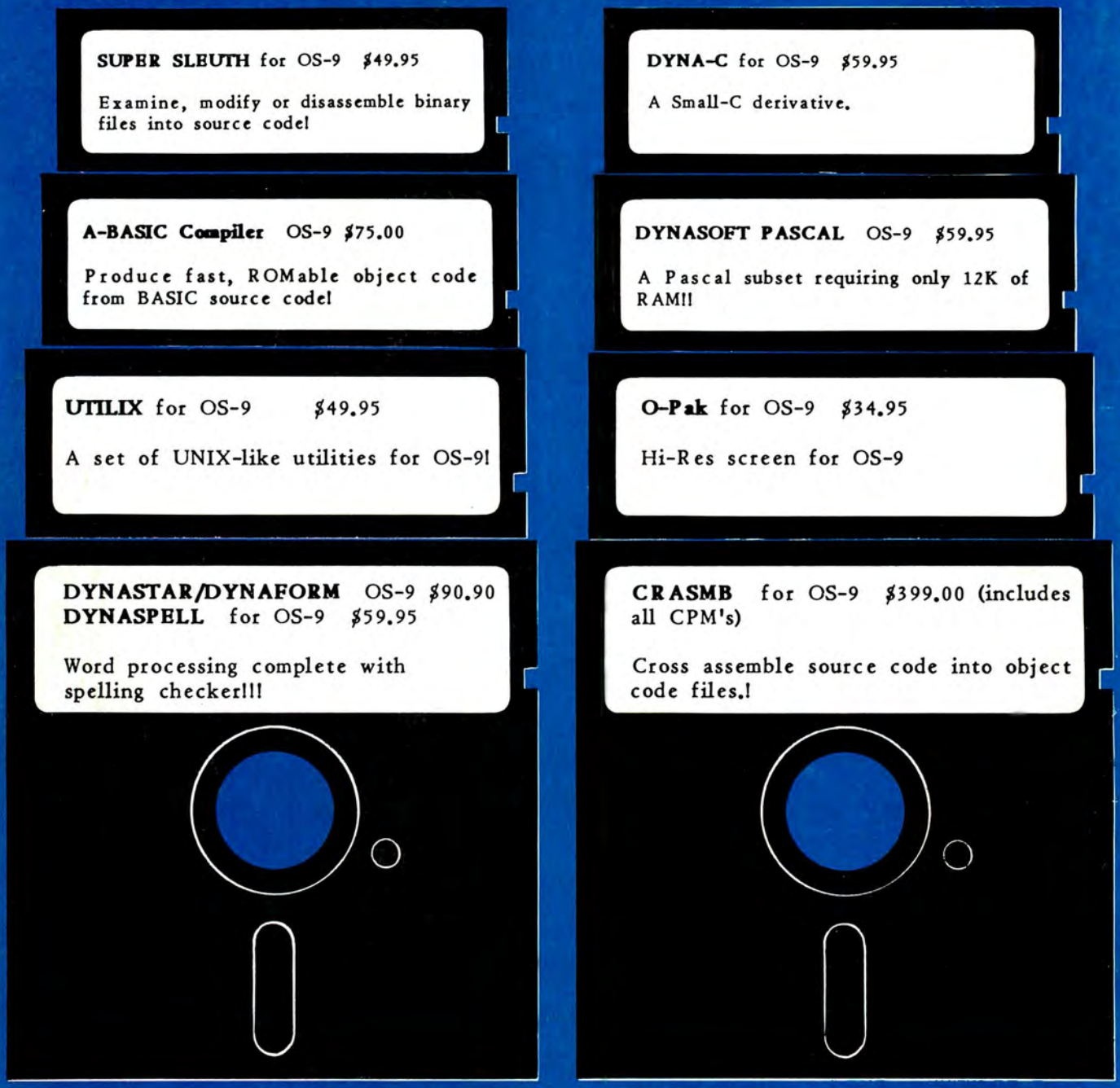

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