

Education
Issue

HOT

CoCo[®]

A WAYNE GREEN PUBLICATION
December 1983 USA \$2.95

THE MAGAZINE FOR TRS-80 COLOR COMPUTER[®], MC-10[®], TDP-100[™] AND DRAGON[™] USERS.

Make Your Children Smarter...

... With Help from Your Color Computer

**Build a
Better Vocabulary**

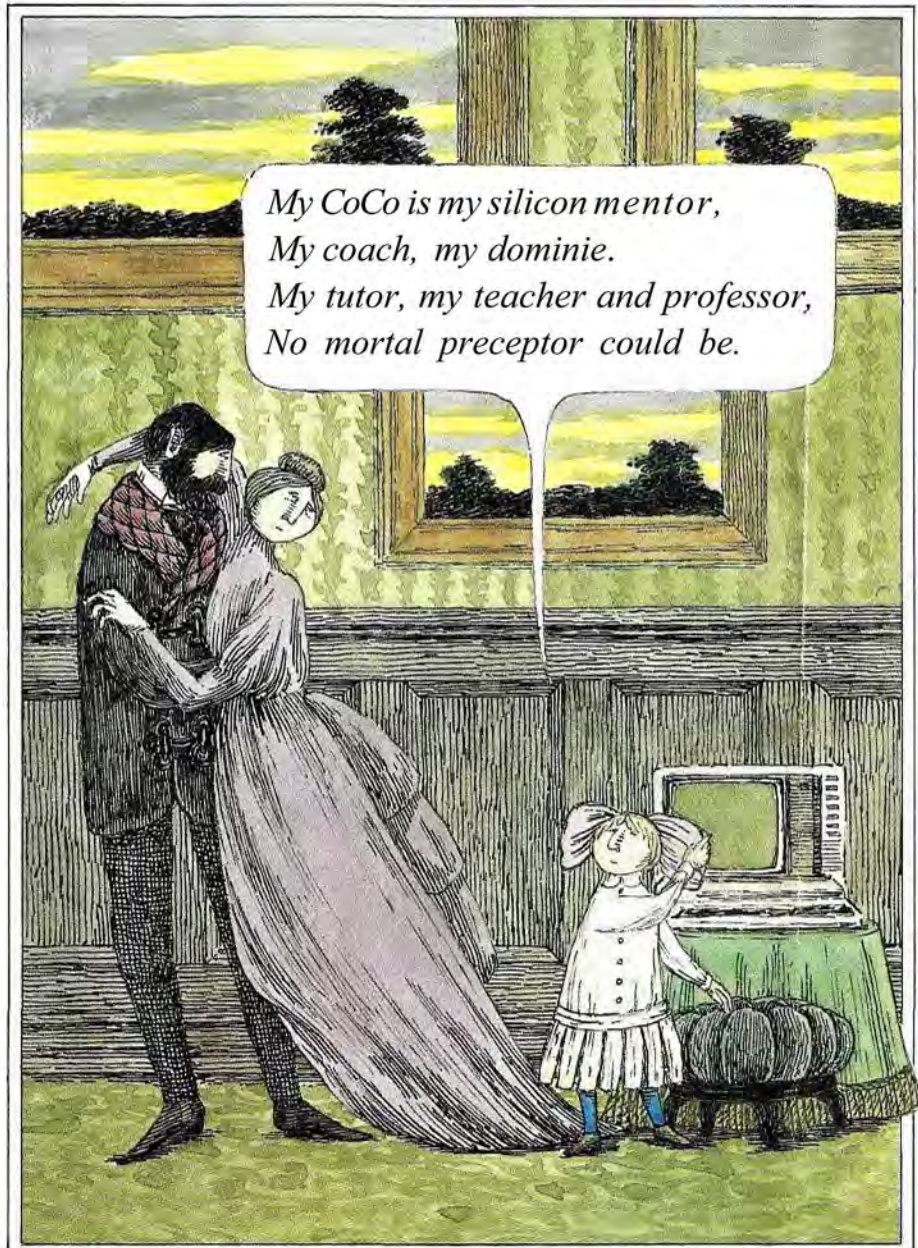
**If Einstein
Had Had a CoCo...**

**How to Write
Educational Software**

**Do You Know
The Capitals
Of the World?**

**New Feature:
The Educated Guest**

*PLUS: In-Depth Reviews
Of the 64K CoCo
And the Dragon by Tano*



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All

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so it never loses its
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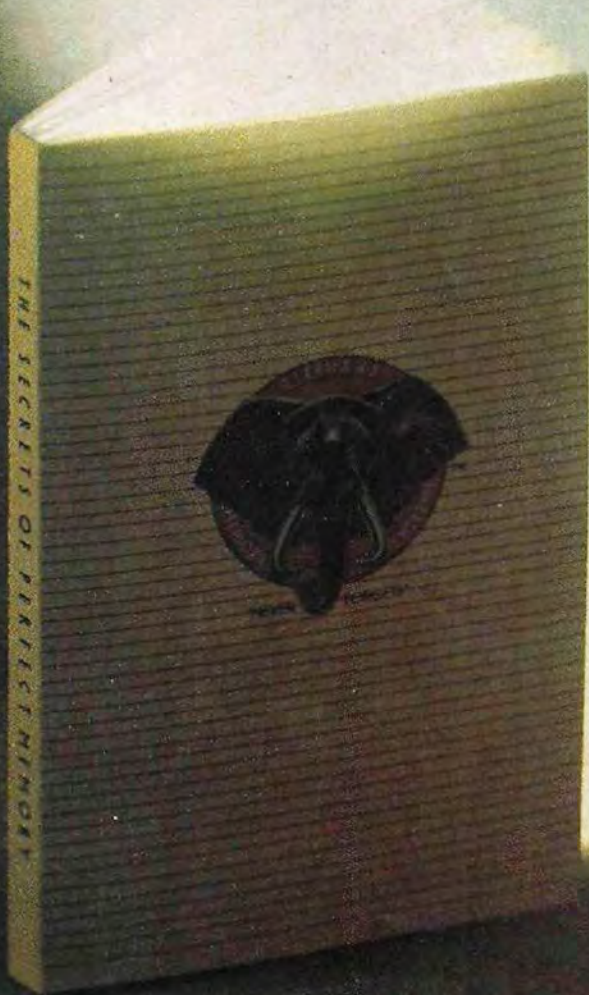
How fingerprints can
actually damage disks.
Unretouched Kirlian
photographs of UFOs
(Unidentified Floppy
Objects)! The incredible
importance of making
copies: the Department
of Redundancy Depart-
ment- and what goes on
when it goes on! Power-
ful secret methods that
scientists claim can ac-
tually prevent computer
amnesia! All this, and
much more...

In short, it's an 80-
page plain-English,
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guide to the care and
feeding of flexible disks.

For The Book, ask your
nearest computer store
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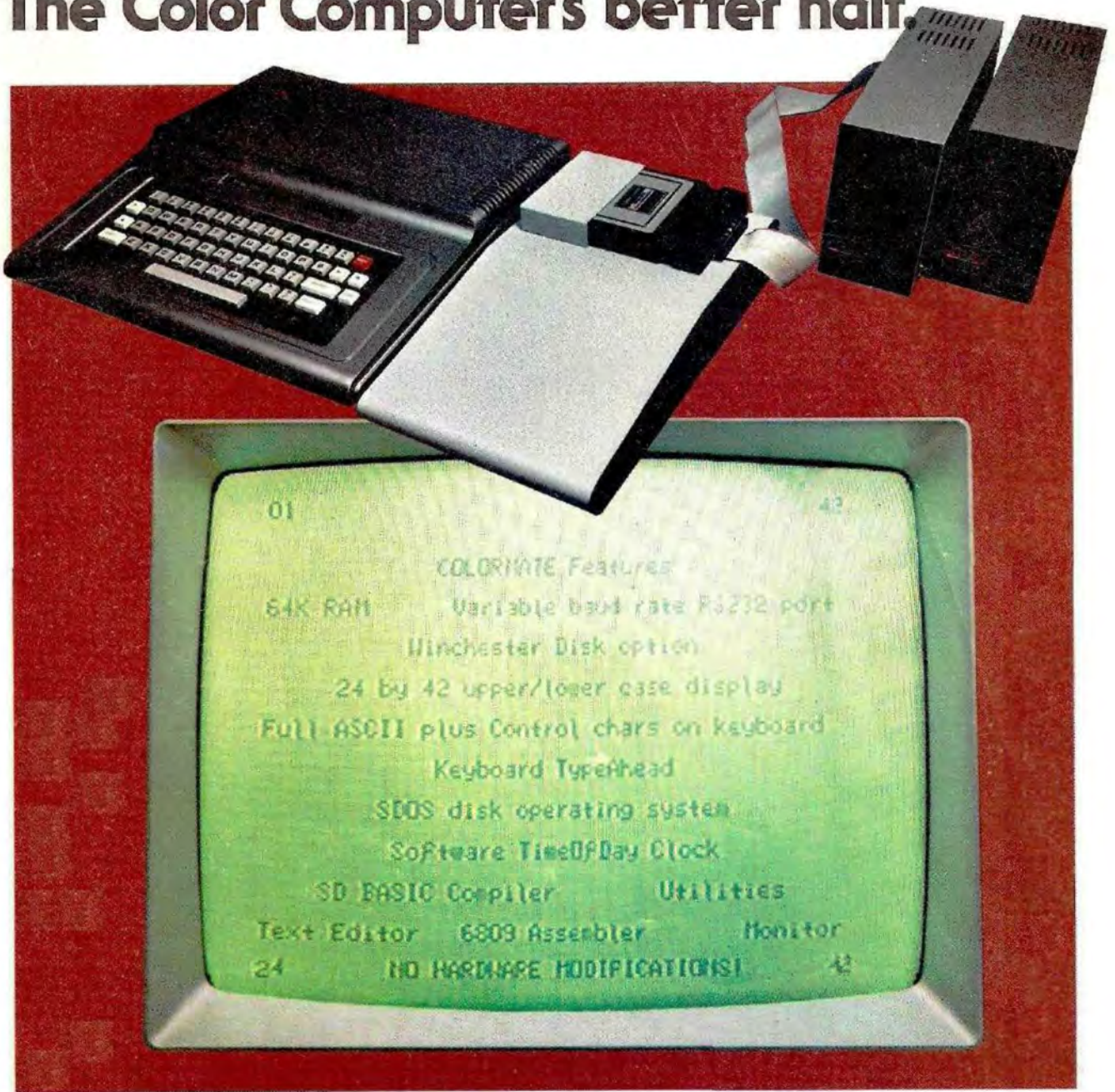
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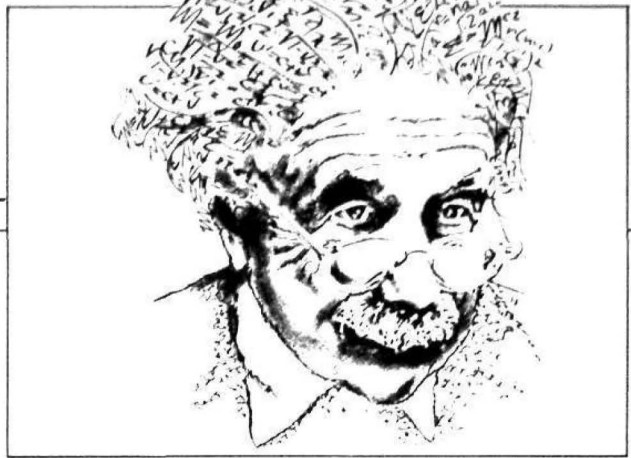


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HOT CoCo



ARTICLES

Writing Educational Software _____ 44

What are the elements of creating your own learning tools?
F.J. Raeske

Einstein's Tutorial _____ 50

The Theory of Relativity looks easy on your CoCo.
Michael L. Johnson

Hear Here! _____ 62

Improve your childrens' spelling with this talking tutor.
Tom W. Jones

The Twelve Days of Christmas _____ 68

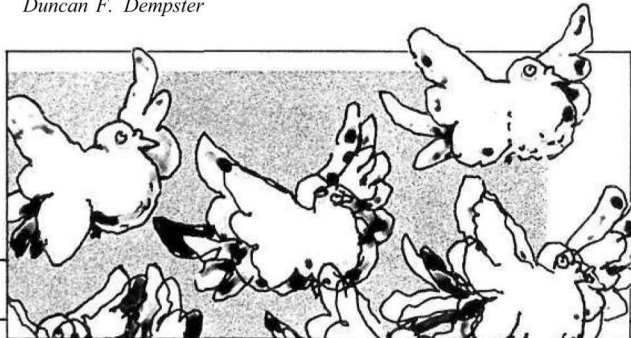
Here's some Christmas cheer with graphics and music.
Ellen and George Aftamonow

Two Titans from Tano and Tandy _____ 74

How do the 64K CoCo and the Dragon-64 by Tano compare?
Guier S. Wright

A Capital Suggestion _____ 81

You might know the states' capitals, but how about the world's?
Duncan F. Dempster



Colorful Cryptology—Part IV _____ 88

Crack the code in this article and win a prize.
Karl Andreassen

Making the Grade _____ 92

Teachers will appreciate this time-saving, grade-figuring program.
Norman Garrett

Muff Duff _____ 98

There's no need to be a dull conversationalist with this program.
Michael D. Polito

Checksum _____ 104

This utility is an easy way to check typed-in listings.
Howard Batie

Landscape Defense _____ 106

Play this arcade game with unusual sound techniques.
James W. Wood

Cover art by Edward Gorey. Poem by M.E. Nadeau, with apologies to all true poets.

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DEPARTMENTS

Digressions _____ 6

Your' CoCo is making a name for itself in education.
Cynthia Smith

Feedback _____ 8

Elmer's Arcade _____ 12

Help Santa deliver presents to the children.
Richard Ramella

Reviews _____ 19

Essential Mathematics, Early Games, Talking Speller, Baseball Math, Elite Calc, and more.
edited by Mark E. Reynolds

The Basic Beat _____ 38

Learn a new way to create graphics and how to incorporate recorded sound into your programs.
James W. Wood

The Educated Guest _____ 118

Is Logo education's sacred cow?

Reader's Forum _____ 124

Doctor ASCII _____ 128

Richard Esposito, Ralph Ramhoff

Graphically Speaking _____ 134

Graphing Polar Equations
Delmar Searles

Product News _____ 140

edited by Cynthia Smith

Vol. 1 No. 7 December 1983

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VICE PRESIDENT/GENERAL
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VICE PRESIDENT/FINANCE
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EDITORIAL MANAGER
Jeff DeTray
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SALES
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CIRCULATION
603-924-9471
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Ginnie Boudrieau
1-800-343-0728
ADVERTISING, 603-924-7138
Advertising Sales Manager: Ed Borezo
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DIGRESSIONS

YOUR COLOR COMPUTER: A GROWING EDUCATIONAL INFLUENCE

For several months now students and teachers have been back at work mastering basic competencies, exploring the Fine Arts, sweating it out in gym class, and studying their way through piles of homework and preparation. Right along with them—everywhere except the locker room—is the Color Computer.

Education is certainly the fastest growing frontier for microcomputing. School districts are spending increasing amounts of time and money on machines and software to improve the quality of instruction and answer the outcry for computer literacy that parents and community members are raising. Since so many schools and households are finding the CoCo valuable in teaching and learning, this issue of *HOT CoCo* is devoted to just that.

In a recent *HOT CoCo* survey, we discovered that a large portion of our readers are students from the ages of 13-19, and a surprising amount of them use the CoCo for educational purposes. What you'll find in this issue is a combination of features, games, and reviews designed for teaching, learning, and using your CoCo. There is, as usual, something for everyone.

Our Educated Guests

Joining us this month with a new column specifically for CoCo education is Dr. Charles Santee. Every month his column, called The Educated Guest, will feature discussions of software, educational issues, programs and programming techniques designed for home or school use of the CoCo as an educational tool.

To quote Dr. Santee, "An educational column should be a mix of information, entertainment, and controversy." He invites (and incites) his readers to challenge his theories and write to him in care of *HOT CoCo* (80 Pine St., Peterborough, NH 03458) with comments, challenges, and ideas. You

DIGRESSIONS

will want to watch for his upcoming features, especially his approach to Logo, which he says is "rapidly becoming the sacred cow of education." We think you will find his humor and approach to education just the thing to make the Color Computer an even better learning tool.

Speaking of humor, you probably noticed our unusual cover art; has this sweet Victorian miss been lured from the bosom of mother-dear and father-dear by the wiles of a VDT? World-famous artist, author, and illustrator Edward Gorey has provided us with just the right shades of paradox and subtlety on our cover.

You probably know Gorey best for his macabre books *The Loathsome Couple*, *The Hapless Child*, *Amphigorey*, *The Epileptic Bicycle*, and for his set designs of the Broadway production of *Dracula*. His somewhat sinister blend of old and new is especially appropriate as the computer begins to replace the chalkboard in so many of our nation's schools.

Featured This Month

Between our guest artist and our Educated Guest are a number of features for teaching and learning. A common cry in teacher workshops across the country is "Give us more software!" and you *HOT CoCo* readers are the logical people to meet this challenge. Read the Raeske article entitled "Writing Educational Programs" and try your hand at creating some programs to make learning more fun for some struggling student. Raeske offers plenty of inspiration and some practical tips on the subject.

Are you a student (or do you live with one) in need of some study helps to liven up those hours of dreary assignments? Put your Color Computer to work beyond gaming and let it test and drill you.

To be truly effective, a learning program needs to offer positive reinforcement, simultaneous sight and sound stimulation, repetition, review, visual erasing of errors, and a fresh, eye-catching approach. Michael Polito's "Muff Duff" is a user-modifiable vocabulary builder that takes the tedium out of word drill. "Here Here!," a spelling program by Tom W. Jones, can be used in the classroom or at home for solid, independent learning. Then you can really get down to work on the theory of relativity with "Einstein's Tutorial."

If you're one of our teacher-readers who would like a little more time to explore the CoCo, watch football, or do some skiing, check out the grading program called "Making the Grade." We have it on authority from some former teachers that this program is a merciful time saver and useful teaching aid. You'll also want to pay careful attention to our Review section for user reports on some of the more popular educational software on the market.

This month Mark Reynolds has gathered reviews of the hottest educational software from CoCo reviewers John Steiner, James Wood, and the father-daughter team of Scott and Beth Norman. It is especially interesting to read Beth's student's-eye view of the "Talking Speller" program.

You will find Baseball Math by Edugames, Old McDonald's Farm Vowels by Superior Graphics, Micro School Programs, Essential Mathematics, Early Games by Counter Point Software, and several other important pieces of software including Elite Calc.

Ready to lighten up a little? (It is the Christmas season after all.) Read Elmer's Arcade for a game especially for Christmas, and to boost your holiday spirits, try the program called "The Twelve Days of Christmas." This sound-graphics feature does some surprising things to the traditional song. You'll want it ready to run when friends and neighbors drop by for wassail and fruitcake!

Even if you are not directly involved in education as a parent, teacher, or student, we guarantee you will feel the CoCo's growing influence on the learning process. Use the items in this issue to learn what is ahead, and what is the latest, and to explore an area where Color Computing has only begun to make its mark.—*Cynthia Smith* ■

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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.

HOT CoCo formats its program listings to run 64 characters wide. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering Assembly listings.

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.

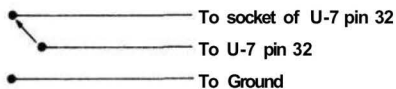
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Feedback

The More Difficult (If Not Impossible) Method

I enjoyed the article "Inverted Video Modification" (*HOT CoCo*, September 1983, p. 94). However, implementing the lowercase display is difficult, if not impossible, since step 4 tells me to connect U29 pin 16 to U29 pin 3. U29 is a quad-inverted NOR gate, 74LS02, with only 14 pins. Where should I connect that pin 3?

I also found that you should use a single-pull, double-throw switch and a two-conductor shielded cable to allow you to switch screen modes, or induced signals will produce havoc on your screen.



This gave me trouble-free video and a lot more contrast.

*M.T. Heer
High Point, NC*

Improving "The More Difficult Method"

Thanks to John Skora for his article "Inverted Video Modification" (*HOT CoCo*, September 1983, p. 94).

Many readers have probably realized by now that there is an error in the description of "The More Difficult Method." I confirmed this error in a phone conversation with Mr. Skora.

Step 4 refers to pin 16 of IC U29. U29 is only a 14-pin chip. Actually, you should omit step 4 entirely and alter step 3 so that it calls for only bending up pins 1 and 2 of U29. In addition, on my computer with the E board, I had to bend the pins 180 degrees rather than the suggested 90 degrees, because at 90 degrees they would short out against the frame of the RF shield.

The article also refers to a switch that can give you a choice between regular and inverted video. You should use a single-pole, double-throw switch with the center connection going to

pin 32 of U7, one leg going to pin 1 of U29, and the other leg going to hole 32 of the U7 socket.

*Hilton N. Wasserman
Little Neck, NY*

Getting Easier All the Time

The problem in the article "Inverted Video Modification" (*HOT CoCo*, September 1983, p. 94), is that Mr. Skora listed the wrong pins on U29 (74LS02). To do the modification, make the following changes:

Lift pin 32 of IC U7 (MC6847).

Connect pins 2,3 of IC U29 to pin 2 of IC U7.
Connect pin 1 of IC U29 to lifted pin 32 of IC U7.
(IC U29 is a 74LS02, quad-inverted NOR gate—only two of the NORs are used.)

On my unit, IC U29 was soldered in place, but I didn't have to remove the IC and lift the pins. I checked the bottom of the board and saw that the three pins were not connected to anything, so I soldered directly to the top of the pins.

This modification makes the print much easier to read. I wish someone had thought of this sooner.

*Larry Barnes
Elk Grove, IL*

What I'd Like to See Is...

Your new magazine has helped me develop my Color Computer. It's a good source of information on hardware and software manufacturers, and I've built two projects from your articles. The latest one was the "CMI" (*HOT CoCo*, September 1983, p. 82).

Now I'd like to see an EPROM programmer project, and instructions for building a PC board extender/socket combination with a switch on pin 7 so I don't have to keep taping the fool contact.

I'd also like to see two special issues of *HOT CoCo*: one on ham radio communications, and one on ROM packs (i.e., how to build a 2716 programmer or extender modules).

*David J. Johnstone WBICOB
Torrington, CT*

"Displaying Moving Graphics" on Disk

David Meredith's program ("Displaying Moving Graphics," *HOT CoCo*, August 1983, p. 108) is one of the finest graphics displays I have seen for the CoCo. There is one problem, however: It will not work on a disk system unless you make the following changes:

Basic Program Changes

Line

150 Change CLOADM to LOADM
1230 Change CLOADM to LOADM
1430 Change CSAVEM to SAVEM
1630 Change TAPE to DISK
1640 Change TAPE to DISK

Machine-Language Program Changes

Line

1150 Change \$600 to \$E00
1610 Change #600 to #E00
1650 Change \$FFCB to \$FFCA
1660 Change \$FFCD to \$FFCC
1670 Change \$FFCE to \$FFCF
1710 Change #600 to #E00
1760 Change \$FFCA to \$FFCB
1810 Change #600 to #E00

*Tony Sharp
Griffin, GA*

Thanks Dennis

I bought my CoCo for business applications and have spent a lot of money trying to find good business-oriented software. I began to think that the program that would answer my needs didn't exist.

Finally I purchased Dennis Derringer's Pro-Color-File and Pro-Color-Forms. These are serious data-management and form-control programs that I have been able to use for all my needs.

Besides getting a quality program, I'm also completely impressed with the support I've gotten from Mr. Derringer personally. When I couldn't understand exactly how to use the program in a particular way, I phoned him. In a few minutes he had explained exactly what I should do.

Some software companies only

Feedback

want to sell their product and then forget about the customer. It's great when you find a manufacturer that cares.

*Paul L. Kush
Yorba Linda, CA*

HOT CoCo Down Under

HOT CoCo really hits the spot here down under, especially since there's a dearth of material for the Color Computer in Australia. I'd especially like to see a series of articles on machine-language programming using a universally available editor/assembler (i.e., EDTASM+).

Hardware construction projects would fill a gap here also, since Tandy (Australia) seems to be the poor relation, and we can't get much of the hardware that's available to you.

I'd also like to see a ham column, because the CoCo is gaining ground among hams here. And of course, good, bug-free programs are sorely needed as an invaluable teaching aid.

*Colin D. Stevenson VK2WA
P.O. Box 109, Mt. Druitt
New South Wales, 2770
Australia*

That series on Assembly for beginners will appear soon.—eds.

Meet Me in Vancouver

The Vancouver Color Computer Club meets the third Tuesday of every month at 7:30 p.m. at Microtel Pacific Research, 8999 Nelson Way (off Gagliardi), in Burnaby, B.C. We have a general meeting, a hardware special-interest-group meeting, and a steering-committee meeting, each of which is open to all members and prospective members.

Dues are \$15/yr., which entitles you to group purchase participation, use of the software library, use of the hardware lending service, and a voting voice in the club.

We now have over 50 members and invite as many people as possible to join in our goal of exploring and sharing microcomputer information.

*Ronn O'Connor
333 Boyne St.
New Westminster, B.C. V3M5J9
526-3865 (Ronn O'Connor)
987-4004 (Bob Ostle)*

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

Meet Me in LA

The Los Angeles/Wilshire Color Computer User's Group has been going since April 1983 to serve as a non-profit, casual forum for the CoCo user.

For more information, contact the L.A.W.C.C.U.G., c/o Norm Wolfe, President, 269 S. Lafayette Park Place, Los Angeles, CA 90057, or phone 213-389-3334.

*Erik Hoover
Los Angeles, CA*

Meet Me in Lexington

I enjoy your magazine and appreciate your commitment to the CoCo, and to CoCo user's groups in particular. I'm starting a group in the Lexington, KY, area, and *HOT CoCo* is about the only means of contacting prospective members.

Interested people should contact me at 3401 Tisdale Drive, Lexington, KY 40503, or phone 606-223-5772.

Scott Sehlhorst

Meet Me in Glendale Heights

A couple of us, in cooperation with KCR Data Co., are interested in starting a Color Computer club/user's group in the Glendale Heights, IL, area. Anyone interested can write to me, Keith Gerue, c/o KCR Data Co., P.O. Box 1140, Glendale Heights, IL 60139 or call 668-0629.

Keith R. Gerue

The Rest Of Orange Trap

HOT CoCo inadvertently left out these lines from James Wood's Orange Trap program listing (November, p. 126).

```
358 C-PEEK(P):IF C-255THENGOTO37
OELSEPOKEP,C+16
360 ML=ML+1:GOTO280
370 ML=14383:N=0:P-1089:C-159:FO
RT=1TO1500:NEXTT:CLS
380 PRINT"(P)LAY NEW GAME":PRINT
:PRINT"(I)NSTANT REPLAY":PRINT:P
RINT"(S)TORE LAST GAME ON TAPE":
PRINT:PRINT"(E)NTER GAME PROM TA
PE"
390 Z$=INKEY$
400 IFZ$="P"THEN160
410 IFZ$="I"THEN260
420 IFZ$="S"THEN450
430 IFZ$="E"THEN490
440 GOTO390
450 CLS:PRINT"PREPARE RECORDER T
O STORE DATA.":PRINT"PRESS PLAY
AND RECORD.":PRINT"PUSH ENTER WH
EN READY."
460 IF PEEK(338)<>191THEN460
470 CSAVEM"CRUNDATA",14383,16383
,0
480 CLS:PRINT"RECORDING DONE":G
OTO370
490 CLS:PRINT"PREPARE RECORDER T
O ENTER DATA.":PRINT"PUSH PLAY."
:PRINT"PUSH ENTER WHEN READY."
500 PRINT:PRINT:PRINT"AFTER DATA
ENTERED. ANSWER QUESTION
WITH (I). "
510 IF PEEK(338)<>191THEN510
520 CLOADM:GOTO370
530 CLS0:FORA=65TO385STEP64:PRIN
T@A,A$;:PRINT@A+32,E$;:NEXTA:PRI
NT@449,A$;
540 X=143:FORA=94TO318STEP32:PRI
NT@A,CHR$(X);:X=X+16:NEXTA
550 PRINT@0," MOVES"
560 RETURN
```

Program Listing. Orange Trap

Hunting Atari Racing Clones

I love the graphics capabilities of my CoCo and am looking for a 3-D, high-resolution racing game that can compare to "Turbo" or "Pole Position" from Atari. Can anyone out there help?

*Scott Aronie
7 Percheron Road
Chelmsford, MA 01824*

The Data Forum

The Data Forum is an information exchange for computer users. Those with user privileges can obtain previously unpublished facts on the TRS-80 Color Computer and the Models III and 4. We hope to expand our data base to include information useful to all computer users.

Though there is no charge for The Data Forum, we do screen potential users. Therefore, you must apply for an access code by calling our communications line.

We hope that the Data Forum can act as a conduit through which useful

Feedback

and timely information can pass freely from one user to another. Not only can you gain information from our data base, but you can also add anything of your own that might be helpful to others.

*Stephan L. Anderson, Editor/Sysop
The Data forum
20993 Foothill Boulevard, Suite 718
Hayward, CA 94541
415-276-6322*

SN Error in "The Game of Towers"

A printer's error slipped into my program "The Game of Towers" in the October *HOT CoCo*, p. 93.

Statement 1530 should read as follows:

```
1530 IF DD(NE)=1 THEN RZ=RZ+1:  
A=T1(NE): B=T2(NE): GOSUB 1610 ELSE  
GOSUB 1480
```

This corrected line is a must in the recursive routine, otherwise you get a syntax error.

*Rodrigue Dugal
40 Des Chenes Ouest #3
Quebec, Quebec
GIL 1K3*

Printing 3-D Graphics

In Delmar Searls' article on 3-D graphics ("Graphically Speaking," *HOT CoCo*, June 1983, p. 126), he mentions that the height/width ratio between the screen and the Line Printer VII is off, I have a DMP-400 Print-

er, and Program Listing 1 should work on the VII. It produces a very close height/width ratio.

I line 50 sets the printer in the compressed mode. Line 80 CHR\$(18) selects graphics mode, and CHR\$(10) selects full line feed. Line 120 reads the PPOINT and prints what is on the screen. If (he color code is more than one, then the printer prints CHR\$(143) twice. CHR\$(143) prints the top four dots. CHR\$(128) prints a blank space.

In line 150, CHR\$(30) returns to print mode, (27) and (30) are half reverse, (27) and (51) are 1/36th forward line feed, (27) and (50) are 1/12th forward line feed, and CHR\$(18) returns to graphics mode. Line 180 is print-head positioning.

The program goes back and forth between graphic and print modes because the printer will not recognize all line feeds in the graphics mode.

It takes about 45 minutes to read the screen and print the graphics.

*Bruce C. Miller
Granite Falls, WA*

Another Corner Of the Snob Market

Although I don't prefer to call the people I have in mind "snobs," William Sill's letter, "Cornering the Snob Market," in the September issue of *HOT CoCo* (Feedback, p. 13) confirms something I've observed for some time.

I'm a semiretired engineer with 43 years experience in electronics and

electrical, mechanical, and hydraulics design. My field is full of problems to be solved by mathematical and logical analysis. Over the years I have used pencil arithmetic, logarithms, slide rules, mechanical and electronic calculators, and now a Color Computer.

I sure wish I'd had the CoCo years ago! Many times I had to shortcut designs simply because there wasn't the time to perform the calculations necessary to explore the alternatives.

Most engineering data appears in older books and magazines as graphs or tables. This data has to be converted into equations to be used in a computer. But few of these converted equations have been published, and to do so requires a knowledge of math and programming.

Many engineers, however, don't have the programming expertise to create these conversions. And many engineering problems involve repetitious calculations and involved formulas—boring and error-prone chores, but duck soup for a computer when the proper tool (a program) is at hand.

I have yet to find a computer magazine that fills this particular gap. People like me need a technical publication, in that it addresses the problems of technical men, but nontechnical from a programming standpoint. We need to know how to use the computer and all its support hardware and software to do our jobs with maximum efficiency, without getting bogged down in programming theory.

*G. Herbert Gill
Joptin, MO*

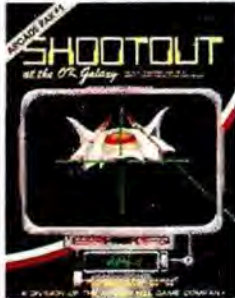
```
50 PRINT #-2, CHR$(27);CHR$(23);  
60 PMODE 3,1  
70 SCREEN 1,0  
75 CLOADM  
80 PRINT #-2, CHR$(18);CHR$(10);  
90 FOR H = 0 TO 192  
100 GOSUB 180  
110 FOR W = 0 TO 256  
120 IF PPOINT(W,H)>1 THEN PRINT  
#-2, CHR$(143);CHR$(143);ELSE PRI  
NT #-2, CHR$(128);CHR$(128);  
130 NEXT W  
140 PRINT #-2, ""  
150 PRINT #-2, CHR$(30);CHR$(27);  
CHR$(30);CHR$(27);CHR$(51);CHR$(  
27);CHR$(50);CHR$(18);  
160 NEXT H
```

```
170 END  
180 PRINT #-2, CHR$(27);CHR$(16);  
CHR$(0);CHR$(200);  
190 RETURN  
200 '*****  
210 ' TO LOAD AND PRINT FORM TAP  
E USE PROGRAM AS IS  
220 '*****  
230 'TO PRINT ONLY FROM SCREEN,  
AFTER YOU HAVE  
240 'YOUR PICTURE, DO NOT SHUT D  
OWN THE COMPUTER  
250 'PRESS BREAK  
260 'LOAD THIS PROGRAM  
270 'DELETE LINE 75 AND RUN  
280 '*****  
290 ' "COPY 400"
```

Program Listing 1.

eeny meeny miney mo

FIVE HOT GAMES FOR YOUR HOT CoCo



ARCADE



WARGAME



SCIENCE FICTION



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Shootout Screen

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VC Screen

SHOOTOUT (at the OK Galaxy)

30 ALIEN WARSHIPS HAVE ENTERED YOUR PATROL ZONE. OK, shields up?, energy level . . . check, azimuth set? Yup. This may sound like the latest summer space movie thriller but in fact it's the preparations YOU will make when playing Avalon Hill's new **arcade** strategy game SHOOTOUT AT THE OK GALAXY. Over 2 years in the making, SHOOTOUT is purely graphical combining arcade excitement with just the right touch of strategy.

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ELMER'S

ARCADE

YULE
DROP



Robert Dukette



by Richard Ramella



Christmas Eve. The air was aswirl with snow—big wet flakes that could make you scream if they fell on your bare neck. I drove slowly down the snowcovered street because one of my tire chains had broken and was slapping the fender. I sang fa, la, la, la, la, through clenched teeth.

There was a light in Elmer's joint—not a big light, just a yellow glow that silhouetted a familiar form hunched over one of the old-fashioned arcade machines. It was Elmer.

I slid my junkmobile to a stop with the aid of a snowbank, got out, and rapped on the arcade's glass door. Maybe there was egnog ahead.

Without turning, Elmer waved me away, so I rapped harder. He turned with a little candle of a smile that said, "Oh it's you," and let me in.

"Merry Christmas, Elmer!"

"Says you!"

My work was cut out for me. I handed him a dime. "Here, boy, take this to the butcher and fetch back the biggest Christmas goose you can find." When he didn't respond, I told him, "That's from *A Christmas Carol*, Elmer. You were supposed to laugh."

"Ha ha," he said carefully.

"Hmm, your emotions aren't in tune with the festive occasion."

"Astute observation, kid." He turned away to feed another nickel into *Paradise*, his favorite pinball game. The glass scoreboard illustrated the South Sea Island theme complete with a playboy yachtsman with a pencil thin mustache, surrounded by a bevy of beauties. It was as far away from

Christmas as you could get.

"Christmas," said Elmer as he played the game, "is hardly a happy time for me. It reminds me of... sad years."

I said nothing but gave an encouraging smile.

Elmer sighed. "We were very poor when I was a child. The Christmas I was seven, my dad was out of work.

System Requirements

16K RAM

Extended Color Basic

Elmer's Arcade

He told me and my nine sisters we wouldn't be getting presents because Santa had to fly very fast to cover the entire world in one night, and sometimes, when Santa drops presents from the sleigh, they miss the chimney. And if they miss, well, you get nothing."

I listened with great sympathy, but with a growing sense of discomfort, for Elmer's sad tale began to take shape in my mind as a computer game. A sleigh. Dropping presents. Chimneys. Kids. I felt very guilty. Trying to hide my excitement was

nearly impossible.

I wasn't very successful in hiding my feelings. Elmer looked at me sharply. "You louse, I know what you're thinking. I'm baring my soul and you're using it as a scenario in a stupid computer game! Admit it."

"Elmer..." I began, but I couldn't finish.

He pounded his fist on the side of pinball Paradise. "You're not even human. Why don't you just crawl in among the rims and rungs—"

"RAMs and ROMs," I corrected.

"—whatever! Crawl in among

them and stay there!"

"I apologize, Elmer. I feel terrible, but I can't help the way my mind works."

He glowered at me for a long time. Then he chuckled. "I was just feeding you a line. I had a great childhood, actually, one sister, well-to-do parents, spoiled rotten, the whole thing."

"Then why? Why put me through the wringer like that?"

"It was just my way of giving you a little Christmas gift. Remember, the game was my idea, not yours."

I smiled, realizing I could write the

Program Listing. Yule Drop

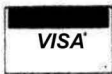
```
120 CLS0
130 DIM BB(86)
140 DATA 204,4,197,2,193,4,185,4
,176,3,185,3,193,3,176,4,185,2,1
93,2,197,2,185,2,193,4,185,2,176
,4,170,4,176,6
150 DATA 185,4,193,2,197,2,185,3
,193,3,197,3,204,3,185,4,193,2,1
97,2,204,4,210,2,216,2,218,4,216
,4,210,4,204,6
160 DATA 210,3,210,3,210,3,210,3
,204,6,197,2,193,6,185,6,176,10
170 FOR A=1 TO 86
180 READ BB(A)
190 NEXT A
200 Z=(RND(5)*6)-6
210 L(1)=417+Z
220 E=L(1)
230 L(2)=449+Z
240 Y$=CHR$(128)+CHR$(229)+CHR$(
231)+CHR$(235)+CHR$(234)+CHR$(12
8)
250 Z$=CHR$(128)+CHR$(128)+CHR$(
238)+CHR$(237)+CHR$(128)
260 FOR X=0 TO 62
270 IF X=0 OR X=62 THEN FOR K=25
TO 30: SET(X,K,8): NEXT
280 SET(X,24,8)
290 SET(X,31,8)
300 NEXT X
310 FOR X=6 TO 60 STEP 12
320 FOR Z=X TO X+3
330 RESET(Z,24)
340 NEXT Z
350 NEXT X
360 PRINT @ L(1),Y$;
370 PRINT @ L(2),Z$;
380 P=3.14159
390 C=RND(5)
400 A1=-C*P
410 A2=C*P
420 N=360
430 R=RND(6)
440 X=(A2-A1)/N
450 F=255/(A2-A1)
460 FOR I=A1 TO A2 STEP X
470 IF H>62 THEN H=H-1
480 IF G<>1 GOTO 490 ELSE SET(H,
J,8): IF J=25 AND POINT(H,J+1)=7
OR POINT(H-1,J+1)=7 OR POINT(H+
1,J+1)=7 GOSUB 830: GOTO 390
490 IF G=1 GOTO 500 ELSE IF X<0
AND INKEY$<>" " GOSUB 610: SET(H,
J,8)
500 IF POINT(H,J+1)=8 GOSUB 650:
GOTO 390
510 X=I*F
520 Y=R*SIN(I)
530 RESET(B,V)
540 SET((X+129),(10+Y),3)
550 B=X+129
560 V=Y+10
570 IF X+129>62 GOTO 390
580 IF G=1 THEN RESET(H,J): H=H+
.5: J=J+1
590 NEXT I
600 GOTO 390
610 G=1
620 H=X+129
630 J=INT(Y+10)
640 RETURN
650 IF J=30 THEN D=448+(H/2)-2 E
LSE IF J=23 THEN D=320+(H/2)-2
660 PRINT @ D,"SPLAT";
670 RESET(H,J)
680 IF J<>30 THEN 690 ELSE IF PO
INT(H-1,31)=6 OR POINT(H+1,31)=6
THEN SET(H,31,6)
690 G=0
700 SOUND 1,5
710 PRINT @ D,STRING$(6,128);
720 H=0
730 J=0
740 QQ=QQ+1
750 PRINT @ 0,"SPLAT";QQ;" LOSE
20 POINTS"
```

Listing continued



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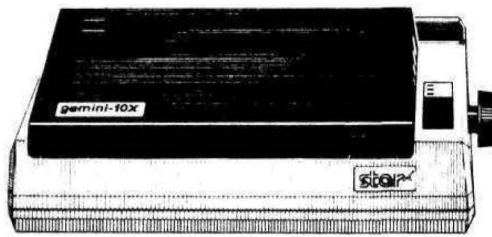
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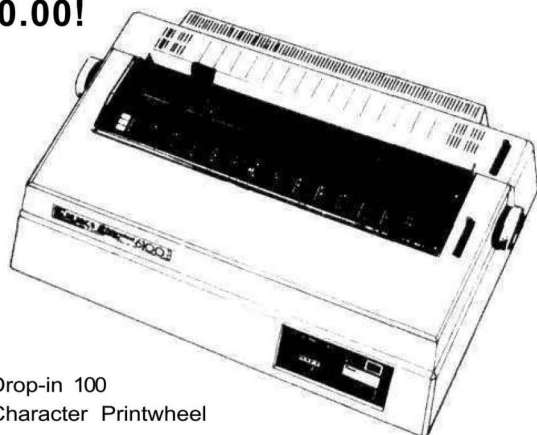
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Elmer's Arcade

Listing continued

```

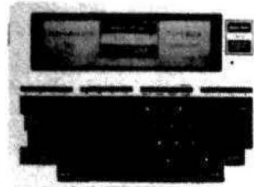
760 PRINT "SCORE:"S*S-(QQ*20);
770 FOR T=1 TO 750
780 NEXT T
790 PRINT @ 0,STRING$(64,128);
800 FOR T=1 TO 100
810 NEXT T
820 IF QQ<5 THEN PRINT @ 0,STRIN
G$(32,128);: RR=1: GOSUB 940: RE
TURN ELSE PRINT @ 32,"GO BACK TO
NORTH POLE.":: GOTO 820
830 S=S+1
840 PRINT 1 0,"GIFT"S;"- SCORE:"
S*S-(QQ*20);
850 TT=RND(38)*2+1
860 FOR SS=TT TO TT+9 STEP 2
870 SOUND BB(SS),RND(4)+1
880 GOSUB 1460
890 NEXT SS
900 RR=1
910 FOR T=1 TO 50
920 NEXT T
930 PRINT @ 0,STRING$(30,128);
940 G=0
950 RESET(H,J)
960 Z=(RND(5)*6)-6
970 KM=(L(2)-449)*2+2
980 L(1)=417+Z
990 IF RR=0 GOTO 1000 ELSE IF J=
25 AND POINT(KM,31)=8 THEN FOR J
J=KM TO KM+10: SET(JJ,31,6): NEX
T: LL=LL+1: RR=0
1000 H=0
1010 J=0
1020 IF LL=5 GOTO 1140
1030 L(2)=449+Z
1040 IF L(1)=E GOTO 1110
1050 IF L(1)>E THEN FOR A=E TO L
(1) ELSE FOR A=E TO L(1) STEP -1
1060 PRINT @ A,Y$;
1070 PRINT | A+32,Z$;
1080 FOR T=1 TO 10
1090 NEXT T
1100 NEXT A
1110 E=L(1)
1120 G=0
1130 RETURN
1140 PRINT @ 0," ALL LITTLE ELME
RS OF THE WORLD GET GIFTS."
1150 SC=S*S-(QQ*20)
1160 PRINT
1170 PRINT @;"GIFTS X BONUS"S="
S*S
1180 PRINT "MINUS 20 X"QQ"SPLAT"
;
1190 IF QQ>1 THEN PRINT "S "; EL
SE PRINT " ";
1200 PRINT "EQUALS..."
1210 PRINT
1220 PRINT "SCORE:"SC
1230 FOR B=1 TO 2

```

Listing continued

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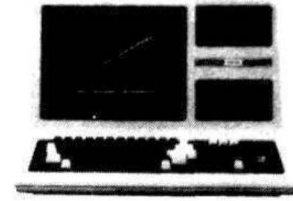
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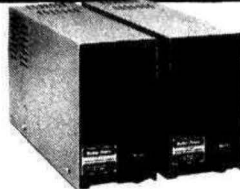
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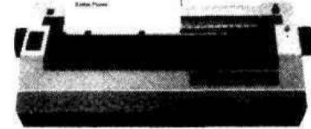
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Listing continued

```
1240 FOR A=1 TO 33 STEP 2
1250 SOUND BB(A),BB(A+1)
1260 GOSUB 1460
1270 NEXT A
1280 GOSUB 1460
1290 NEXT B
1300 FOR A=35 TO 67 STEP 2
1310 SOUND BB(A),BB(A+1)
1320 GOSUB 1460
1330 NEXT A
1340 GOSUB 1460
1350 FOR A=1 TO 15 STEP 2
1360 SOUND BB(A),BB(A+1)
1370 GOSUB 1460
1380 NEXT A
1390 FOR A=69 TO 85 STEP 2
1400 SOUND BB(A),BB(A+1)
1410 GOSUB 1460
1420 NEXT A
1430 FOR T=1 TO 500
1440 NEXT T
1450 GOTO 1230
1460 FOR HH=1 TO 5
1470 NEXT HH
1480 RETURN
1490 END
```

game without guilt now. "You're right, Elmer. I'll give you full credit for Yule Drop. I'll include a credit: Based on a lie by Elmer."

"Yule Drop," he said. "Presents falling down the chimney and all?"

"At the very least, Elmer."

"Merry Christmas," he said, producing a quart of eggnog from nowhere.

"Happy landings, my arcadian friend!"

Yule Drop is for children of all ages. It's similar to the bombardier genre of arcade game, but I have blunted the destructive fantasy by transforming the bombs into Christmas presents and the target into a child waiting to catch them.

As the game starts, a orange rectangle is drawn along the bottom of the screen. It represents five rooms, each with a chimney, the hole in the ceiling. In the house is drawn my idea of what Elmer looked like as a child: squat, fat, and magenta. Then play starts. You are Santa Claus, and your sleigh is the blue pixel which makes its way eastward across the sky above the house. It travels in random sine-wave paths.

The immediate object is to tap any key, releasing the orange Christmas gift so it falls down a chimney and is caught by the waiting Elmer. Elmer

tends to move among rooms between turns.

If a dropped gift hits the roof or the floor, that's a splat. If you get five splats you lose, and even if you eventually win the game, each splat subtracts 20 points from your score.

You score by dropping a gift so Elmer catches it. Your final score is the number of gifts delivered multiplied by that same number and reduced by your splats. Example: You deliver 10 gifts with only two splats, so your score is 10 times 10 (100) reduced by two splats times 20 (40), for a total of 60.

When Elmer catches a gift, the floor beneath him turns from orange to green, if it isn't already green. The game ends successfully when the entire floor is green. Good yule drops into already green areas simply increase the score.

If you have trouble keying in Yule Drop, send the offending program listing or a description of error messages and lines occurring, and I'll answer quickly. Include a self-addressed stamped envelope (Canadians 30 cents and a self-addressed envelope). I'm Richard Ramella, 1493 Mt. View Ave., Chico, CA 95926. I can't help if you have changed the program in any way, so save enhancements until we get it running correctly. •

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REVIEWS

CONTENTS

Elite Calc	19
Early Games for Young Children	26
Old MacDonald's Farm	28
Essential Mathematics	29
Talking Speller	30
Baseball Math	32
Graphic Math Adventure	32
Prereader	34

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Elite Calc
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by **Scott L. Norman**

I'm not very good at writing suspense stories, so let me start this review with the punch line: Bruce Cook's Elite Calc is a very fine program indeed—potentially one of the great Color Computer programs.

To my knowledge, it is currently (early August, 1983) the best spreadsheet using the standard Radio Shack operating system. It doesn't sacrifice much capability in doing so, either. In fact, I think it compares very favorably with two professional-caliber programs: DynaCalc, the powerful FLEX-based spreadsheet, and SuperCalc, which runs on CP/M machines. In a spreadsheet each location, or cell, can contain a number, a text entry, or a formula to calculate something based on the values of other cells. Much of the appeal of these programs stems from their ability to quickly recompute everything whenever you change a single variable.

Elite Calc does this, of course, and provides more relational and logical

functions than most of its competitors. You can use Basic's familiar IF... THEN... ELSE construct in formulas, to cite just one example.

Since I think that Elite Calc is fully capable of handling business-caliber problems, I think it only fair to make occasional comparisons to other programs of similar power. Even though there's more to life than memory size, Elite Calc leaves 20,677 bytes of RAM available in a 32K computer.

This is quite enough for serious work, but owners of 64K CoCos can do better still. At least some of the utilities that enable the 64K RAM mode to copy Basic to RAM will allow Elite Calc to run with a corresponding increase in capacity. I have used Micro Technical Products' PLUS32 to gain a new-sheet capacity of 28,869 bytes, about 29 percent more than the 22,396 offered by Dyna Calc.

I also tried Spectrum Projects' 40K, but there appears to be a memory conflict that keeps the spreadsheet from working properly with this utility.

SuperCalc also gives me about 28K in my 64K Osborne 1, but gains some of this capacity through disk-resident commands. The need to wait while the required subroutines are brought into RAM slows down many common operations. In contrast, Elite Calc offers a comparable workspace while retaining high speed through the use of many calls to routines in the Extended Color Basic ROMs.

What do these blank-RAM figures mean in terms of usable worksheet size? First, you must realize that although 64K spreadsheet programs typically set up row and column identifiers for a 255-by-255 sheet when you first turn them on, a much smaller area is actually available once you begin to enter data and formulas.

Elite Calc reserves a certain amount of space for the framework (number of rows and columns) of a worksheet, and additional space for the entry in each cell. The amount of memory an entry requires depends on whether it is text, a number, or a formula.

Without going into the details of the memory-allocation algorithms, I'll note that squarish matrices use less storage than long, thin ones with the same number of cells. For example, a one-column worksheet 100 rows deep needs 808 bytes just to define its structure, while a 10-by-10 sheet only needs 484 bytes. The differences become even more pronounced for larger worksheets.

The result is that Elite Calc can handle problems of very reasonable size. Elite Software's John Waclo has reported using a 14-row, 140-column sheet, and that certainly falls into the "long and thin" category. Of course, the reason for having those 255 rows and columns in the initial blank sheet is to allow you to set up this sort of workspace if the problem requires it.

The Details

The video display is typical of spreadsheet programs. It shows a portion of the worksheet itself, row and column indices, and an area for commands and status messages. Elite Calc uses Color Basic's standard text format, 32 characters by 16 lines. This, coupled with the use of fewer prompting lines than other spread-

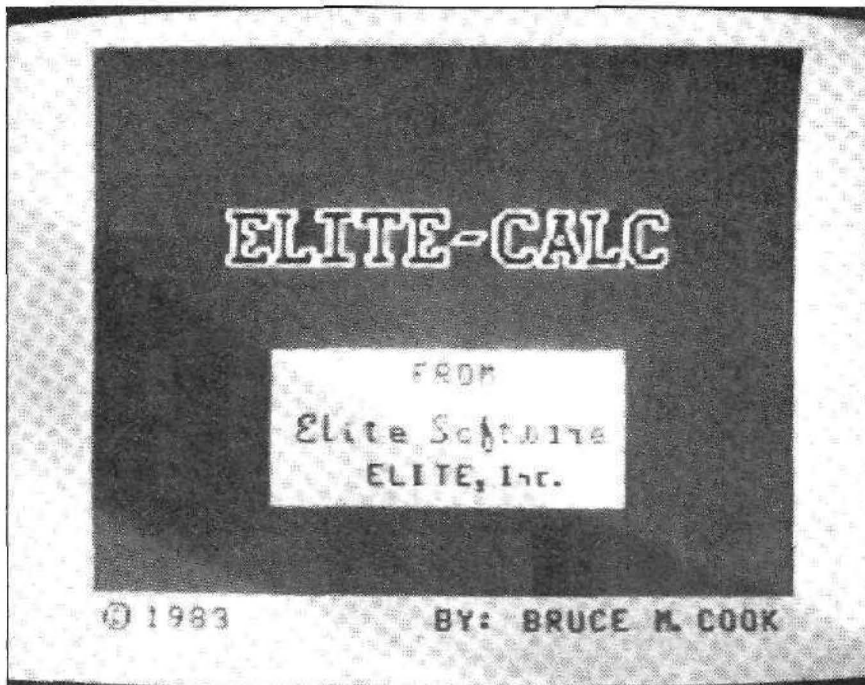


Photo 1. Elite Calc's Opening Screen Display

sheets, gives an uncluttered look. Of course, this limits the amount of data it can display at any time.

You can use the four arrow keys or a jump instruction to move the cursor to a new cell. Like all of Elite Calc's 20 primary commands, the JUMP com-

mand consists of the single letter J followed by additional data. In this case, the data is the column and row coordinates of the target cell, in the familiar letter/number format: B15 is the 15th cell in the second column, AB3 the third cell in the 27th column, and

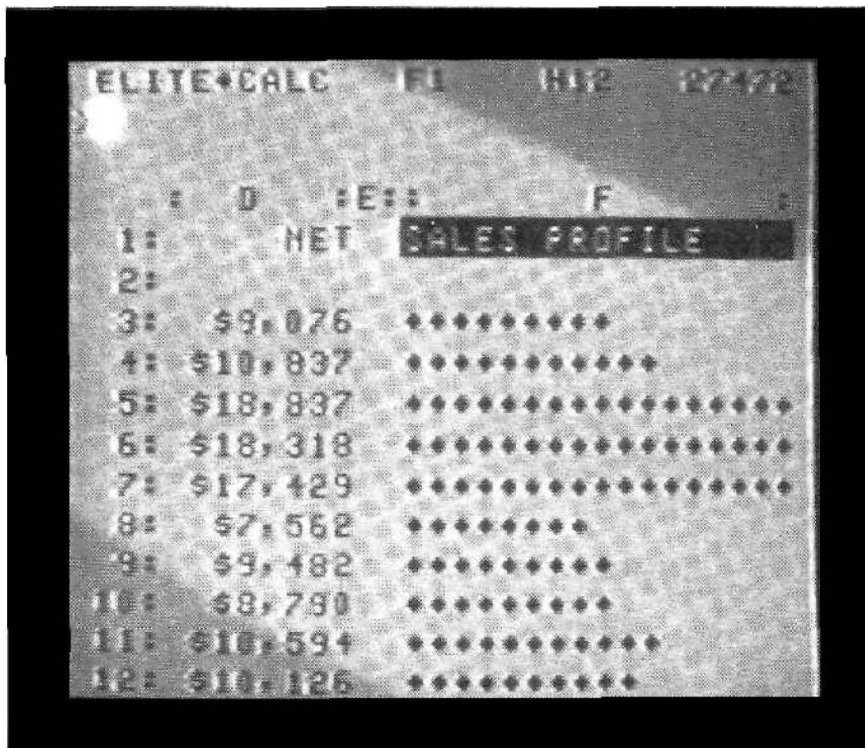


Photo 2. Example Sales Profile Produced with Elite Calc

so on.

Many primary commands have subcommand options that show up in the prompting area as needed. The bulk of the 38-page manual consists of an alphabetized description of each command, making it a simple matter to begin building an Elite Calc worksheet—especially if you've had experience with spreadsheets.

You enter a number by typing it, but you must prefix a text entry with a quotation mark, and a formula with an equal sign.

You can use a fourth type of entry, repeat text, to set up dividing lines to make a worksheet easier to read (or to set off an important section). Enter this by typing an apostrophe followed by the keyboard character to be repeated in the first cell in which the line is to appear. Dashes, hyphens, and asterisks are good choices for the separator character. A second apostrophe designates the other end of the separator line.

Elite Calc has a typical FORMAT command for specifying the width of cells, the number of decimal places for numeric entries, scientific notation, justification of entries within cells, and so on.

One nice touch is the ability to specify the height of a row; you can use this to insert blank lines between lines of data to increase the legibility of a printed spreadsheet. While you can specify column widths either before or after data entry, you should only alter row heights after the data is in place. Setting up, say, double-height rows on an empty spreadsheet will cause the program to hang up.

The TEXT-LOCK command, T, is useful when setting up a new sheet. This interprets all subsequent entries as text and enters them into the worksheet while ignoring the width specifications of any columns that it happens to cross. This command is handy for entering long worksheet titles, especially since it won't affect material entered via the text-lock instruction if you change the widths of underlying columns.

The prompting area keeps track of the address of the cell in the lower right-corner as you construct a worksheet. You'll need this information when you save the file to tape or disk, since you must then specify the range of cells to be saved. This corner will

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THE ORIGINAL

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— Color Computer News, Jan. 1982

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64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 x 24 and 85 x 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 x 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.

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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.

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often be off-screen.

Incidentally, Elite Calc uses the same format as SuperCalc for describing a range of cell addresses: first the coordinates of the upper left corner of the array, then a colon, and then the coordinates of the lower right corner.

The program uses the standard Extended Color Basic editor to modify the contents of a cell. The E command invokes it, and a pair of "undoing" options enhance it. A (abort) ignores any editing that has been done, but leaves the system in the editing mode, and Q (quit) undoes the editing and returns the system to command mode.

When you call up the editor, you must specify the cell to be worked on. Pressing the enter key designates the current cell, i.e., the one at which the cursor is at the moment. This is standard spreadsheet practice. What is unconventional is that this is the only way to see how it has arrived at a given numerical entry—by keyboard entry or by calculation. If the latter, the editing line will display the formula used.

Elite Calc does not have a GLOBAL command for displaying all the formulas in effect for various cells in a worksheet, nor is there a prompting line that reproduces the contents of each cell as the cursor moves over the sheet. Both DynaCalc and SuperCalc have these features.

In all other respects, Elite Calc formulas are at least as powerful and as easy to set up as those for other spreadsheets. You can use the five elementary mathematical operations (including exponentiation) and all combinations of equality and inequality criteria. You can also use the Boolean operations AND, OR, and NOT. There are 19 mathematical functions at your disposal: the full range of Extended Color Basic's trigonometric and logarithmic functions, truncation and rounding operators, and so on.

There are also several range functions especially designed for spreadsheets. These perform such useful chores as finding the maximum and minimum entries in a designated block of cells, counting the number of nu-

meric entries in such a block, and totalling or averaging the entries in a row or column.

How difficult is it to use them? Here's how to calculate the average of all numeric entries in the first 25 rows of column X of a worksheet and place it in the current cell. Remember, the expression begins with an equal sign because it's a formula:

$$= \text{AVERAGE}(X1 : X25)$$

Not very difficult, as you can see. Functions like this have obvious applications in many aspects of financial data processing.

Elite Calc also permits the definition of up to 26 numerical constants, designated KA..KZ, for use in formulas. Many of my own spreadsheet applications are related to research-and-development project budgeting, often involving three or four different rates at which overhead charges are accumulated. I've found it convenient to define the overhead percentages as constants, using them to multiply

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REVIEWS

appropriate base quantities (usually subtotals of other columns) to arrive at total costs. This makes it easy to redo my calculations if the overhead rates change; I simply redefine the constants.

I mentioned Elite Calc's ability to use the IF...THEN...ELSE construct in formulas. This allows the value assigned to a cell to depend on the contents of other cells in a more complex manner than could be defined by a mathematical function. The complete syntax is as follows:

= IF (rel. exp.) THEN (exp. 1) ELSE (exp. 2)

where (rel. exp.) is a relational expression and (exp. 1) and (exp. 2) are numerical values, constants, or formulas.

If the relational expression is true, then the value assigned by expression 1 will be placed in the target cell. If the expression is false, then expression 2 is evaluated. If the ELSE function is omitted, the program places a zero in the target cell whenever the relational expression is false.

"Elite Calc has the ability to replicate formulas and adjust independent variable addresses,..."

Here, for example, is an expression that places the square root of the contents of cell B10 in the target cell if B10 contains a positive number; if not, it places a value of -1 in the target:

= IF B10=>0 THEN SQR(B10) ELSE -1

An unusual instruction, perhaps, but perfectly feasible.

Unlike Color Basic, Elite Calc does not permit the nesting of IF...THEN...ELSE statements.

Elite Calc has (as does every spreadsheet worthy of the name) the ability to replicate formulas and adjust

independent variable addresses as necessary. This, plus an automatic recalculation capability, allows programs of this type to answer "what if questions."

Elite Calc gives you the usual options of adjusting all cell references in a formula (that's the default case), adjusting selected references, or just reproducing the formula with the original references intact.

You can replicate a partial row or partial column to fill an entire rectangular block of cells. For example, the range A5:D5 can be replicated to A6:D20. You can also replicate a formula appearing in just one cell, of course.

A COPY command is available for duplicating a rectangular block of cells. The COPY and REPLICATE commands have similar options regarding the degree of address adjustment that will take place in the newly filled cells.

You can also use these commands for cells filled with text or plain numerical entries, but in those cases you

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The ability to sort spreadsheet entries according to the values in a particular row or column can be very valuable, and so Elite Calc offers a convenient SORT command. (I was dismayed when I first learned that SuperCalc does not.) The sorting routine works with text or numerical entries, according to the "text before blanks before numbers" hierarchy for ascending sorts.

The documentation is in error, by the way; it claims that Elite Calc gives blanks priority over both text and numerical entries. The routine will also sort in descending order.

A few attributes of the sort option are worthy of note. You can specify the endpoints of the range of cells to be sorted in either order, and Elite Calc will still treat the entire range correctly. Thus, ranges A1:A10 and A10:A1 give identical results when sorted into ascending order.

The sorting hierarchy can play havoc with the appearance of a worksheet in which you've inserted blank rows or columns to increase legibility. The blanks will be grouped before or after the data, depending on the sorting order. For this reason (as well as for memory conservation), it is worthwhile to use the FORMAT command to increase row height or column width for legibility.

The review copy of Elite Calc (version 1.0) had a minor bug in the sorting routine: Since it treats each character as position-independent, it does not handle mixed positive and negative numbers correctly. For example, when it sorted the set (-1, 1, 0) into descending order, the result was (1, -1, 0). Elite Software is aware of the problem, and has promised to rectify it in future releases.

It is also a good idea to check the operation of formulas after a sort, to be sure that it hasn't rearranged cell references in undesired ways. In fact, it is generally worthwhile to perform sorts before you enter formulas, if that is feasible.

Elite Calc features a fairly flexible routine for preparing printed reports. The P command allows you to specify normal and alternate print fonts (which the FORMAT command assigns to particular cells), page length and width, transmission baud rate, worksheet title, and graphics charac-

ter. Like other major spreadsheets, Elite Calc can replace properly scaled numerical values with bar graphs whose lengths correspond to the integer portion of each entry.

I have found that I can ignore the various printer setup codes and leave them at their default values for "plain vanilla" output on my old Line Printer VII. This might not be true for other machines, so read your printer's manual carefully.

In any case, use the O (output) command to obtain a printout. As usual, it is not necessary to print the entire spreadsheet; you can specify any portion of it. Elite Calc routinely omits the row and column coordinates.

Worksheet files can be written to

*"Elite Calc is
the easiest to use
and most intuitive
of the major CoCo
spreadsheet calculators."*

disk or tape in either normal (compressed) or ASCII format. You can only load the former back into Elite Calc for further work. ASCII files are compatible with most word processors, and you can use them to incorporate spreadsheets into other documents. In a similar fashion, SuperCalc saves compressed spreadsheets for further work but outputs WordStar-compatible ASCII files to disk.

I have tried the ASCII files with Telewriter-64, and everything seems to work smoothly. Because ASCII files are longer, the range of cells that must be saved is a required parameter for this mode.

I am enthusiastic about Elite Calc. Perhaps my impressions are colored by the fact that I spend a good deal of time working with software of this type, but I think it worth repeating that Elite Calc is the easiest to use and most intuitive of the major CoCo spreadsheet calculators. The commands are powerful without being overwhelmingly complex, and there are very few quirks of any kind.

However, there are a few deficien-

cies. The worst is the lack of a true WINDOW command for juxtaposing two widely separated portions of a worksheet. Both DynaCalc and SuperCalc allow you to freeze one part of a worksheet while scrolling through another. In a typical application, you can keep row titles at the left edge of an on-screen sheet while you move the cursor to the extreme right-portion for data entry.

The closest you can come with Elite Calc is the HIDE/UNHIDE command. This temporarily removes rows or columns from the display. The trouble is that in the current version, you must invoke this command once for each row or column to be hidden. This can become very tedious for large spreadsheets, and I would certainly like to see it extended to a RANGE command.

Next, I would appreciate a way to delete numerical entries without disturbing formulas. This would make it much easier to store useful worksheet "templates." Elite Calc's BLANK command destroys everything in its specified range, so the best way to handle your favorite worksheet now is to save several copies of the setup before you start to enter data.

Finally, the ability to change the order of automatic recalculation would be a worthwhile enhancement. Whenever you change an independent variable cell entry, Elite Calc recalculates everything in the first column that contains formulas, then moves to the next column to the right, and so on. Sometimes, though, it would be handy to have the calculation proceed across rows rather than down columns; it all depends on how the problem is set up.

I understand that future versions of Elite Calc will probably incorporate at least the ability to zap cell entries without affecting formulas. It is also likely that there will be additional specialized spreadsheets with enhanced capabilities: statistical calculators, engineering calculators, and so on.

Elite Calc is capable of doing everything I have asked in the way of managerial calculations. Despite a recent increase, the price is quite reasonable for high-quality applications software.

And just to top things off, there is already an Elite Calc user's group. Purchasers of the program can expect to hear from them. •

COLOUR SOFTWARE WORKBENCH

The Colour Software WorkDench is a complete software development system for those who wish to do comprehensive program development on their TRS-80 Color Computer. The Colour Software Workbench transforms the TRS-60 Color Computer from a "BASIC Machine" into a "Real Computer System" by providing Color Computer users with the same tools and facilities used by professional programmers in the field. For those who want to program in an English-like language Due don't want to pay the price of slow program execution, the Colour Software WorkDench is ideal. The Colour Software Workoencn allows Color Computer users to write their programs in the familiar English-like expressions of PASCAL while achieving the execution speeds of machine language with the Colour PASCAL Compiler.

TEXT EDITOR

The Colour Text Editor is a screen mode, in-memory, text editor which provides its users with a selectively moveable "window" into a text file. The Colour Text Editor was designed primarily for the development of program source code, but it can also be used in conjunction with some text formatting capabilities (which you "install" as a learning exercise) for the production of software documentation. As an example, this text and the CSW User's Guide were both developed with and produced by the Colour Text Editor and the "Text Formatter".

The Colour Text Editor is an excellent tool for developing PASCAL and ASSEMBLER source programs. The Colour Text Editor manipulates blocks of text efficiently and minimizes delays imposed by the speeds of I/O devices such as the Color Computer's floppy disk drives or cassette tape recorder. The Colour Text Editor provides automatic left-right/right-left and up-down/down-up scrolling in conjunction with powerful FIND and CHANGE commands. Additional commands facilitate the replication of text blocks as well as their bulk movement within a text file. Text files created with BASIC are compatible with the Colour Text Editor. With the Colour Text Editor text files can be read and optionally merged from either cassette and/or disk and may then be written to either cassette, disk, or the printer. It should be mentioned that all of the keys have an auto-repeat capability.

PASCAL COMPILER

The Colour PASCAL Compiler is a fully recursive PASCAL language compiler which processes PASCAL program statements into machine executable Binary for the TRS-80 Color Computer's 6809 micro-processor. The Colour PASCAL Compiler provides Color Computer programmers with PASCAL as an ideal "Systems Programming" language or the ability to write programs in the English-like "High Level" expressions of PASCAL without any sacrifice of program execution speeds. The Colour Text Editor, 6809 Macro Assembler, and Colour Linker were all written in PASCAL and produced by the Colour PASCAL Compiler and they, like the ROM Monitor software of the TRS-80 Color Computer, are machine executable programs.

The Colour PASCAL Compiler is a device-independent software package designed to economically translate PASCAL source programs into efficient 6809 micro-processor machine programs in one pass. Program source files may be read from either cassette or disk with the resulting machine program object files written to either cassette, disk, or the serial I/O port. The Colour PASCAL Compiler parses and evaluates PASCAL language statements and declarations and generates the corresponding 6809 micro-processor machine programs in accordance with "Standard PASCAL" language syntactical rules and conventions. The Colour PASCAL Compiler supports all "Standard PASCAL" features with the major exceptions being real or floating point arithmetic and pointers. Many university of California at San Diego (UCSD) PASCAL features are also supported in conjunction with some additional comprehensive extensions which enhance both the PASCAL language and its TRS-80 Color Computer implementation. The Colour PASCAL Compiler is also equipped with powerful compiler directives and comprehensive source listing aides, such as meaningful error messages and optional corresponding assembler language representations of all PASCAL statements.

OBJECT LINKER

The Colour Linker is a program which reads the program object files produced by both the Colour PASCAL Compiler and 6809 Macro Assembler and converts them into machine executable binary image files, "Load Modules", suitable for loading with the Color Computer's LOADM command. The Colour Linker can also read multiple program object files and combine them into one larger machine executable binary "Load Module" so as to allow Color Computer users to develop very large programs one piece at a time. The Colour Text Editor, Colour PASCAL Compiler, 6809 Macro Assembler and Symbolic On-Line Debugger, were all developed with the Colour Linker.

The Colour Linker is an excellent tool for the development of "Load Modules" from either or both PASCAL and ASSEMBLER object files. The Colour Linker is a device independent software package, comparable to linkage editors found on industry computers. It is capable of linking up to thirty program object files into one machine executable load module. Up to three hundred public symbols can be defined for all object files to be linked by the Colour Linker. The Colour Linker supports object code relocation, automatic Colour Software Run Time Library module inclusion, and a built in Symbolic On-Line Debugger interface. All machine executable binary load modules produced by the Colour Linker are compatible with the Color Computer's BASIC monitor, and, during their production, the Colour Linker generates load maps and error messages so as to report the status of any linking operation.

The Colour Software Workoencn requires a TRS-30 Color Computer to be configured with at least 32K of memory, Extended Disk BASIC, and one floppy disk drive.

The Colour Software Workoencn is a complete set of software development tools designed to support a programmer through the process of creating computer programs; from the entering of source code through the execution of the resulting machine program. The Colour Software WorkDench is comprised of the following software packages:

MACRO ASSEMBLER

The 5809 Macro Assembler is a Motorola compatible macro assembler which processes Motorola 6809 Assembler language program statements into machine executable binary for the TRS-80 Color Computer's 6809 micro-processor. The 6809 Macro Assembler makes it easy to write Motorola assembler language programs which are compatible with PASCAL programs developed with the Colour PASCAL Compiler. The 6809 Macro Assembler is a powerful tool which enables Color Computer users to develop programs which are best suited for assembler language implementation. The Colour PASCAL Compiler and Symbolic On-Line Debugger were both written in Motorola 6809 Assembler language and produced by the 6809 Macro Assembler. The 6809 Macro Assembler fills any software development gaps not closed by the capabilities of the Colour PASCAL Compiler so that in its entirety, the Colour Software Workbench will support any program development effort that a Color Computer user may wish to attempt.

The 5809 Macro Assembler is a device-independent software package designed to economically translate Motorola 6809 Assembler source programs into 6809 micro-processor machine programs in two passes. Program source files may be read from either cassette or disk with the resulting machine program object files written to either cassette, disk, or the serial I/O port. The 6809 Macro Assembler parses and evaluates Motorola 6809 Assembler language statements and declarations, and generates the corresponding 6809 micro-processor machine programs in accordance with Motorola 6809 Assembler language syntactical rules and conventions. The 6809 Macro Assembler's powerful macro facility allows Color Computer users to define Lisir or "Macro" instructions; the ability to write an assembler language subroutine using only one macro instruction to identify it in the source program. Each Macro instruction defined to the 6809 Macro Assembler may have up to nine parameters for argument passing between macro subroutines. The 6809 Macro Assembler's object code format provides for program relocation, separate assembly, and easy interfacing to PASCAL via the Colour Linker. The 6809 Macro Assembler supports all Motorola 6809 Assembler mnemonics as well as several declaration extensions which simplify the interfacing of 6809 Assembler programs to PASCAL programs at the source code level. The 6809 Macro Assembler is also equipped with powerful assembler directives such as the COPY facility which provides the ability to include other source programs as parts of one larger source program. Source listing aides include such essentials as meaningful error messages and source listing control options.

SYMBOLIC DEBUGGER

The Symbolic On-Line Debugger, when linked to a program developed with the Colour Software Workbench, provides its users with a "window" into the Color Computer's 6809 micro-processor's execution of that program at the machine level. The Symbolic On-Line Debugger was designed to allow a programmer to selectively control the execution of a program, see the actual contents of the Color Computer's memory and the 6809's internal registers during that program's execution. The Symbolic On-Line Debugger's user may reference sections of a program with the same symbolic names that were used in the programs source code rather than with memory addresses so that the user need not be a computer wizard in order to debug a program at the micro-processor level. The Symbolic On-Line Debugger also allows its users to change the contents of both the Color Computer's memory and the 6809 micro-processor's internal registers so that temporary program fixes and experiments can be performed as the program is being executed.

The Symbolic On-Line Debugger is an excellent tool for debugging machine programs developed in either PASCAL or ASSEMBLER. The Symbolic On-Line Debugger allows a user to stop and start a program under test at almost any point. Once the program under test has been stopped, the Symbolic On-Line Debugger allows the user to select any memory location or micro-processor register for the display of its contents. The Symbolic On-Line Debugger user may then select any memory location or micro-processor register and enter a new value for replacement of the previous value. For example, when entering a number for a contents replacement, an expression may be entered which is converted and stored by the Symbolic On-Line Debugger. The Symbolic On-Line Debugger provides a "Trace" facility which lists all of the active procedures within a program, by name, in order of their activation by the 6809 micro-processor, thus providing a "procedure call" history. The Symbolic On-Line Debugger automatically preserves the screen of the program under test whenever that program is stopped, and automatically restores the screen of the program under test whenever that program is restarted. This makes the Symbolic On-Line Debugger very handy for use with applications using graphics.

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performance	ease of use		documentation
		error handling	

Early Games for Young Children

Counterpoint Software Inc.

4005 W 65th St.

Suite 218

Edina, MN 55435

16K

\$29.95, disk or cassette

by **John Steiner**

Counterpoint Software's first release in a series of educational programs for the CoCo is Early Games for Young Children.

The program disk contains nine programs, all designed for children from 2 to 6 years of age. A picture menu gives the children an opportunity to select the game they want. To access the picture menu, enter RUN "GAMES". The picture menu displays an identifying picture for each game. Pressing any key loads and executes the program chosen.

Pressing the break key during any game returns control to the main menu. Disk I/O occurs only when loading the programs from the menu and loading or saving pictures in the drawing program.

From the diverse selection of creative and practice activities a child reviews number and letter skills. Also, the computer helps teach the concepts of sameness and difference. The numbers and letters are written using block graphics in a semigraphics mode. They are large, in varying colors, and only a few fit on the screen at one time.

All programs that request a correct response from the child use the same reward, a series of beeps of different frequencies, and a new problem. Incorrect responses generate a series of low-frequency beeps. The child must enter a correct response before a new problem is displayed. Pressing break causes the computer to return to the main menu.

- Match Numbers and Match Letters are two similar games. Match Numbers displays a large number on the screen. The child selects the matching key on the computer keyboard. Match Letters is more difficult because the child scans the entire keyboard, rather than just the number row.

- Count displays a random number of colored blocks. To obtain a successful response, the child must press the number corresponding to the cor-

child presses the key corresponding to the number of the different shape.

- Draw is the most creative of the nine games. The pictures are drawn in large block graphics by pressing keys. I had trouble getting used to drawing with the keyboard, though my daughter didn't. The program scans the entire keyboard for drawing commands. Pressing any upper center keys cause the cursor to move up, leaving a block of cursor color in the old position. Pressing lower keys causes a downward moving cursor. Similarly left and right motion is accomplished by the left and right keys, respectively. You draw diagonal lines by hitting keys in the corners of the keyboard. Cursor color (and the color of the object being drawn) changes when you press the space bar.

One nice feature of the disk version is that it saves a picture on the disk. After completing the picture, press shift/*. A request for a file name is given. The computer accepts only eight letters and automatically saves the drawing as a binary file. Pressing shift/* during the main menu lets the child enter a file name and get a picture from the disk.

Although the child can use the program without help, the learning process is reinforced with supervision. One positive side effect of computer home instruction should be the added parent/child contact. Another positive effect should be the realization that computers can be used for something other than arcade games.

I think the author is optimistic on his lower age level. This program series is of more value to 4- to 7-year-olds. Older children will have no trouble selecting and executing games from the picture menu.

The program disk comes with an eight-page manual describing the operation of the programs. When you consider that the manual tries to cover all the computers the program is written for, there is not much description of each program, and little is needed. The only problem I had in deciphering the manual is how to load a previously stored picture.

The package is attractive and relatively inexpensive. It is a good example of what educational software can be like. I am looking forward to the next release in Counterpoint Software's series of educational programs. •

"The package is attractive and relatively inexpensive. It is a good example of what educational software can be like."

rect block count. The game becomes more difficult as the child progresses.

- Add and Subtract are similar. The game displays two groups of blocks with either a plus or minus sign between them and an equals sign to the right. The child enters the correct total of the math problem. As in Count, successful responses cause the game to become more difficult. The manual warns that subtraction is an especially difficult concept for preschoolers and patience is recommended.

- Alphabet teaches the order of letters in the alphabet. The computer displays the letter A, and the child is expected to respond with a B. If an incorrect response is given, the computer displays the correct letters to the point in the alphabet where the child responded incorrectly. More incorrect responses cause the correct letter to blink. This is the only game of the series that displays a correct answer to the child.

- Names is a program that let's you enter the child's name. The child practices entering the name with the computer checking for errors during entry.

- Compare Shapes is my 4-year-old girl's favorite game. A series of shapes is drawn above the numbers 1, 2, 3, and 4. Three of the shapes are identical, but the fourth is different. The

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performance	ease of use	documentation	error handling

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Seattle, WA 98109
32K

One strand (10 lessons)
\$24.95, cassette and disk
Junior High Series
\$225, six disks
\$245, 21 cassettes

by Scott L. Norman
and Beth A. Norman

Essential Mathematics, a Micro School program, won't "give your child an unfair advantage," as Bertamax advertising exhorts, but it will act as a valuable math review and practice supplement.

Teaching at the child's achievement level, the program provides immediate feedback to the responses, adjusts the pace and level of instruction to suit the child's needs, and provides a means of recording progress.

Essential Mathematics contains standard material for sixth through eighth grades. It's composed of six disks and an instruction manual. The lesson groupings, or "strands," are Number Concepts, Addition, Subtraction, Multiplication, Division, Fractions, Decimals, Percents, and Pre-Algebra.

The disks include review lessons that cover major concepts introduced in grades 3-6, and regular lessons that present the bulk of material. The regular lessons begin at #65, but Number Concepts goes only to #90, and Addition to #67. The manual doesn't explain this; perhaps it's assumed that older children do not need practice in addition.

When you run the program, you see a menu of whatever is on the particular disk you're using. For example, on one disk is Addition (Lessons

R1-67), Subtraction (R1-67), Multiplication (R1-72), and Division (R1-80). Using the arrow keys, you move the cursor to select a heading.

The title page is followed by a very convenient feature: a sound-level check. The computer emits a series of beeps to help you adjust the volume control on your TV set to a comfortable level. (Sound is used to signal right or wrong answers.)

Next, the computer asks for your name. By typing 911 you get into a mode where you pick the lesson, increase or decrease the number of problems, and adjust the time limit between responses—or so the manual says. On some lessons, typing "911" got the admonition, "Type your name please," and numbers couldn't be input. This could be a bug.

After the computer greets you by echoing your name, it asks which lesson you want. This is where the manual comes in handy. There's a useful guide that gives a sample problem from each lesson, along with the number of problems and the time allowed for each response.

"...pressing enter speeds up the presentation..."

In Lesson R1, a simple review, the manual says that you "add two two-digit numbers, regroup ones to tens." The problem is set up in the usual vertical style. A little arrow appears where the first digit in the answer is displayed. The computer flashes "CORRECT," and sounds a little "go" signal when you type in the correct response.

At this point, pressing enter speeds up the presentation of the next problem, or you can wait for the computer to advance.

If you input the wrong digit, there's a low tone and you're told to try again. Make another mistake and the computer tells you the correct digit and repeats the message until you type in the response. The arrow moves left for the next digit.

Under other problem groupings, such as Division, the arrow moves around, showing where the next digit goes. This function is especially useful to



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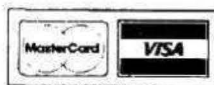
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Graphic Math Adventure
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by John Steiner

One of the advantages of using a computer for education is its motivational appeal. Baseball Math and Graphic Math Adventure both provide mathematics tutorial and entertainment value on the Color Computer. Both programs are useful in home tutorials for the elementary age level, and Graphic Math Adventure would also be useful in a classroom setting.

Baseball Math

Baseball Math, by Diane Hall, is an addition game in Basic. Its object is to score a selected number of points before accumulating three outs. A wrong answer to a question equals a strike, and three strikes make one out.

You set your goal: 3,000, 6,000, or 9,000 points. The program prompts you to select the level of play: Little League, Pony Express, Farm Club, or Major League. At the Little League level, you must add two single-digit

numbers. The problems at the Pony Express level involve a single- and a double-digit number pair. The Farm Club pits you against two double-digit numbers and the Major League player must add two three-digit numbers.

Each correct answer scores 100 points, while incorrect or late answers are considered a strike. Strikes carry a 100-point penalty.

The graphics and sound in Baseball Math are adequate for a game of this type, and a unique sound option plays organ music between innings. The organ music is on the cassette, so you can substitute a tape of your choice.

The game is interesting for elementary-level students, but most younger students will lose interest before it is over. However, because it is in Basic, you could probably make some changes in the program.

The program reinforces correct answers immediately and provides the correct answer for each incorrect response. There are no negative prompts to discourage the younger student, and an elementary educator seems to have written the program.

No program is perfect (or reviewer, for that matter), but I have found a few things that might be improved in this one. The game is too long, especially for younger children.

Pauses in the keyboard scan make it difficult to enter numbers. The program does not require you to press the Enter key so it must analyze the data after each keystroke. If you type the numbers too quickly, the program will interpret it as a wrong answer. In addition, if you enter an incorrect digit, there is no way to back up and reenter the number.

Since sound cues are such a big part of this game, using this program in a classroom might be difficult. Turn down the monitor volume, and the cues and their reinforcement disappear. I don't recommend this program for the classroom.

Graphic Math Adventure

Graphic Math Adventure is a unique educational experience for the elementary student. This program provides drill and practice in all four arithmetic functions, and it does so in an entertaining manner. The object of the game is to gather treasures from an area up to 90 screens large. There are 14 treasures to start with, and you use

the joystick to move to different areas within the terrain.

You have the option of traveling downstream, walking along the stream bank, or taking teleporters into and out of a series of caves. At many places, you come across obstacles that make you answer a question before you can pass. You must also answer a question before you can capture the treasures you find.

The PMODE 3 graphics are well done, and the program is written in Basic. Interesting even for older students, this game makes math drill and practice fun. Playing takes a while, and the students I tested did not find the last treasure. They stopped playing the game not because they were bored, but because they didn't have enough time at one sitting to finish it.

You score 26 to 50 points for each correct answer, with points deducted for incorrect answers. The difficulty level of questions is variable (20 levels), and you can choose any math operation exclusively or all four mixed randomly. You can correct any answers before pressing the enter key.

The program is well suited for classroom or home use. If a teacher prescribes a math worksheet as remedial practice, this program is a good alternative to pencil and paper at home.

The major disadvantage of the program is that it doesn't prompt with the correct answer when you type an incorrect one.

Because the program is written in Basic, it is rather slow in updating the display. A prompt asks for slow or fast display, but if you choose the fast option and the computer locks up, you must use Reset to regain control.

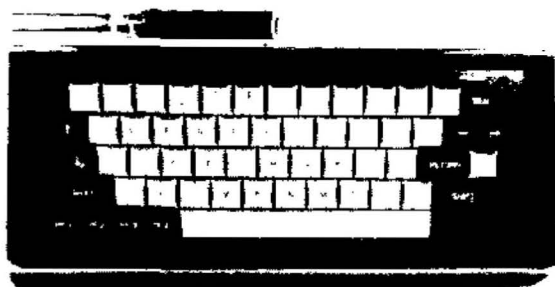
You might also find that the program does not accept certain numbers from the keyboard at high speed. In either case, you have to use the slow option if problems occur. The game goes much faster if your computer accepts the high-speed POKE.

Both of these programs are fine as tutorials at home, but I prefer the Graphic Math Adventure. To avoid confusion in the classroom, Baseball Math would require headphones for players, but the sound cues are excellent, and the background music is a nice touch.

Graphic Math Adventure is one of the better educational programs I've seen for the Color Computer. •

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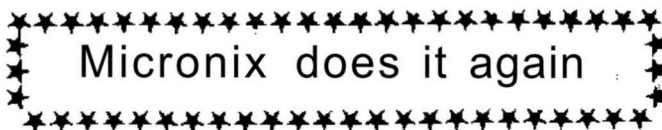
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Prereader
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 16K, Extended Color Basic,
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by James W. Wood

Prereader is a learning tool for preschoolers and beginning readers from ages 3 to 5. The educational package consists of two programs: Preread1 and Preread2.

Preread1

The first, Preread1, tests your child's cognitive skills with shape recognition and matching drills. You can choose one of five topics: colors, shapes, numbers, and upper- or lower-case letters. You do so by moving the cursor to the symbol with the joystick and pressing the fire button.

All the topic screens are set up sim-

ilarly. The topic figure appears on the left side of the screen in high-resolution graphics. On the right side of the screen, three figures will appear, one of which matches the figure on the left. The child must move the cursor with the joystick to the matching

tion would be interesting.

Preread1's questions are different each time the program is run so the child cannot memorize a pattern. At the end of a set of exercises the percentage of correct answers is given and an encouraging message is drawn.

Preread2

The second program, Preread2, strengthens a preschooler's single-letter and consonant-blend sound-recognition skills. After the child chooses one of the topics above, he is met by a high-resolution graphic representing an object with a particular phonetic sound. The child must choose one of three letter or consonant-blend responses also shown on the screen that most closely relates to the graphic. Next, the child must position the cursor with the joystick under the response and press the fire button.

Single-letter sounds are represented by 26 graphics. Consonant-blend sounds are represented by 18 graphics.

The majority of the displays are very well done. Although most of the objects are easily recognizable, a teacher's manual with full descriptions would be helpful.

The manual consists of six printed pages and includes instructions on running, loading, and making backups of the package. The tape includes autorun loaders for each of the two programs.

Prereader will give your young child a head start with reading skills. •

"Although most of the displays are easily recognizable, a teacher's manual ... would be helpful."

shape. If the child is correct, a song is played and the word "correct" appears on the screen along with a smiling face. If a wrong answer is given, a low tone sounds. If a second incorrect response is given, a sad face appears along with the correct answer.

If you choose numbers as a topic, a number is drawn on the left along with three on the right. The child must match the number. It is not necessary, however, for the child to understand that the number actually represents the quantity of a certain object. A program that dealt with number recogni-

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Library

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All **Library** programs are written in machine code specifically for the Color Computer, to work without the interference of a separate operating system such as FLEX. From this comes speed and more workspace for you. **Library** programs work perfectly with every Color Computer, from 16 to 64K. The most advanced hardware and software techniques are used to place programs in rompak cartridges for instant loading and total workspace with any Color Computer.

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The programs do not depend on BASIC, and so allow total compatibility and workspace with any size Color Computer, even 64K. Unlike other programs for the Color Computer which are said to be 64K compatible, **VIP Library™** programs are not limited to between 24 and 30K of workspace in 64K. **Library** programs have Memory Sense with BANK SWITCHING to fully use all 64K, thus giving an astounding 61K of workspace with the rompak cartridge, and up to 51K with a disk version!

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State-of-the-Art graphics allow instant use of four display colors, and eight lowercase displays featuring descending lowercase letters. You can select from 51, 64 or 85 columns by 21 or 24 lines per screen, with wide or narrow characters in the 64 display. These screens provide a pleasant and relaxing way to perform your tasks, with as much text on the

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screen as is possible. Each program is easy to learn and a joy to use. We take pride in the stringent testing done to make these programs perform flawlessly. Every feature, every convenience, sleek, simple and elegant.

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For your writing needs is the **VIP Writer™**, and its spelling checker, the **VIP Speller™**. For financial planning and mathematical calculations you can use the **VIP Calc™**. To manage your information and send multiple mailings there is the **VIP Database™**. For sending all these files to and from home or the office and for talking to your friends you can have the **VIP Terminal™**. Finally, to fix disks to keep all your **Library** files in good repair we offer the **VIP Disk-ZAP™**.

Mini Disk Operating System

The Disk versions each have a Mini Disk Operating System which will masterfully handle from 1 to 4 drives. It offers smooth operation for such features as the ability to read a directory, display free space on the disk, kill files, save and automatically verify files, and load, rename and append files. **Library** programs simply do not have the limitations of BASIC.

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A description of each of the **Library** programs, with the special sale price, is contained in the following pages. Please indulge!

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VIP Writer™

(Formerly Super "Color" Writer II)

By Tim Nelson

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"... Nearly every feature and option possible to implement on the Color Computer. The design of the program is excellent; the programming is flawless... Features for the professional, yet it is easy enough for newcomers to master... Certainly one of the best word processors available for any computer..." October 1983 "Rainbow"

The **Writer** will work with you and your printer to do things you always wanted to do. Every feature of your printer can be put to use, every character set, every graphics capability at any baud rate, **EVEN PROPORTIONAL SPACING**. All this with simplicity and elegance.

Although all versions feature tape save and load, the disk version provides the Mini Disk Operating System common to the whole **Library**, plus disk file linking for continuous printing.

Professional features of particular note:

- Memory-Sense with **BANK SWITCHING** to fully utilize 64K, giving not just 24 or 30K, but up to 61K of workspace with the rompak version and 50K with the disk version.
- **TRUE FORMAT WINDOW** to **EXACTLY** replicate the printed page **ON THE SCREEN BEFORE PRINTING**, showing centered line headers, FOOTNOTES, page breaks, page numbers, & margins in line lengths of up to 240 characters. It makes **HYPHENATION** a snap.
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16K ROMPAK \$59.95

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VIP™

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By Kevin Herrboldt

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By Dan Nelson

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16K ROMPAK \$49.95

16K DISK \$49.95

Disk version requires 32K for lowercase displays.

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RAVED ABOUT IN THE APRIL 1983 "RAINBOW!"

By Tim Nelson

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Lowercase displays not available with this program.



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**AUTHOR'S SUBMISSIONS
ARE ENCOURAGED.**

The Basic Beat

This month you'll learn commands to select parts of string arrays, a new way to create graphics, and some ways to incorporate recorded sound into your programs.

MID\$ is a command that picks out part of a string. Run Program Listing 1. For MID\$ to work, you must put three items of information in the parentheses: a string, a starting position, and the number of characters to be selected.

Line 30 sets B\$ equal to the fourth, fifth, and sixth characters of A\$, because the information in parentheses directs it to begin at the fourth position in A\$ and take three characters. Therefore, B\$ will equal DEF. In line 40, C\$ will equal FG.

The command LEN returns the length of a string (the number of characters in the string). Run Program Listing 2. Notice that spaces count as characters unless they precede the characters.

RIGHTS is similar to MID\$, except that it starts at the extreme right end of a string and needs only two items of

THE FIRST STEPS TO BASIC PROGRAMMING LESSON I

by James W. Wood

information: the string and the number of characters. From this, you might guess how the command LEFTS works.

Program Listing 3 demonstrates these new string functions. The left five characters are ABCDE and the right three are HIJ.

How can you be creative with these new commands? Program Listing 4 causes a word to slowly disappear. How about a method for slowly printing sentences on the screen?

Program Listing 5 lists several phrases in the A\$() array. Each phrase is less than one screen width. The loop in line 50 goes to three for the three elements of the A\$() array. Line 60 finds the length of the string. Line 80 prints the individual characters. You can alter the time-delay loop in line 90 by changing the number 20. Substituting a higher number makes the print appear more slowly, and a lower number makes it appear more quickly.

The print in line 100 causes each phrase to start on a new line. I prefer

this method to print long readings; seeing an entire page of text instantly splash on the screen can be a little unnerving.

Several columns ago you learned to POKE numbers into high memory. The command NEW did not erase the numbers you stored. You can use a similar method to store letters and names.

Program Listing 6 is written for a 16K machine. To run it on a 4K computer, first change all 16353s to 4048, and change the 16354 to 4049. A 32K machine will run the program as is, but more memory will be available if you change the 16353s to 32737 and the 16354 to 32738.

There are two parts to Listing 6. Lines 5-80 store the name, and lines 100-120 bring it back to the screen from high memory. Run Listing 6 and enter a name, after which you can delete lines 5-80 or just type RUN 100. Typing NEW will erase the program, but the name is still stored, so just type in lines 100-120 and RUN. The pro-

```
10 CLS
20 A$="ABCDEFGHJIJ"
30 B$=MID$(A$,4,3)
40 C$=MID$(A$,6,2)
50 PRINTB$,C$
60 LIST
```

Program Listing 1

```
10 CLS
20 INPUT"TYPE A WORD OR PHRASE";
A$
30 L=LEN(A$)
40 PRINT"THE STATEMENT HAS";L;"C
HARACTERS"
50 PRINT
60 GOTO20
```

Program Listing 2

```
10 A$="ABCDEFGHJIJ"
20 B$=LEFT$(A$,5):PRINTB$
30 C$=RIGHT$(A$,3):PRINTC$
```

Program Listing 3

```
10 CLS
20 A$="DISAPPEAR"
30 L=LEN(A$)
40 FOR A=L TO 0 STEP-1
50 PRINT0215-A," "+RIGHT$(A$,A)
60 FORB=1 TO 200:NEXTB
70 NEXT A
```

Program Listing 4

```
10 CLS
20 A$(1)="THIS SENTENCE SHOULD S
LOWLY"
30 A$(2)="APPEAR ON THE TRS-80 C
OLOR"
40 A$(3)="COMPUTER SCREEN."
50 FOR A=1 TO 3
60 L=LEN(A$(A))
70 FOR B=1 TO L
80 PRINTMID$(A$(A),B,1);
90 FOR T=1 TO 20:NEXTT
100 NEXT B:PRINT:NEXT A
110 PRINT
```

Program Listing 5

```
5 CLEAR200,16353
10 INPUT"NAME";NA$
20 L=LEN(NA$)
30 IF L>30 THEN NA$=LEFT$(NA$,30)
:L=30
40 POKE16353,L
50 FOR A=1 TO L
60 POKE A+16353,ASC(MID$(NA$),A
,D)
70 NEXT A
80 STOP
100 N=PEEK(16353)
110 FOR O=16354 TO 16354+N-1
120 PRINTCHR$(PEEK(O));:NEXT O
```

Program Listing 6

System Requirements

4K RAM
Color Basic

COLOR COMPUTER SOFTWARE

EL BANDITO—El Bandito has to be a crafty little hombre to stay alive as he loots for a single player or two may compete simultaneously for a unique playing experience.

COSMIC CLONES—Clonial Warriors, Superklones, Double Bombs and "the Death Layer" relentlessly challenge the most skillful player in this unique, very fast action game. Great sounds and colors. This one rates high on our favorite game list.

SHENANIGANS—You dedicated adventure fans without disc systems have asked for this one... all the fun and challenge of Calixto and Sanctum plus spectacular graphics. From the heart of the city to lonely wilderness. There's a pot of gold at the end of the rainbow, but you can bet it won't be easy to find.

BUMPERS—Tension mounts as you race through a randomly generated maze made even more challenging by walls that are invisible until you bump into them. This outstanding game allows two players to compete simultaneously or you may play alone against the computer.

GLAXXONS—Pit your playing skill against squadrons of swooping, diving spacecraft. This is a fast and furious version of the arcade game with seven selectable skill levels and automatic game acceleration. Guaranteed to blister your joystick finger.

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The Basic Beat

gram will still print the name on the screen.

With a little modification you can use this program to record into memory everything you've typed at the keyboard.

You can also use Listing 6 to recall a program's name after CLOADing a new program. A CLOAD will erase the old program, but not information POKEd into high memory. Use lines 5-80 to store a name, and get ready to load lines 100-120.

Wait a minute—what is the CHR\$ in line 120? Good question! It is ASC backwards. For example, the command PRINT CHR\$(65) returns an A, and PRINT ASC("A") returns a 65. See the ASCII chart in your computer manual. CHR\$ codes are the same as those used by POKE, except that you position characters on the screen with PRINT@.

Run Program Listing 7 for an example of CHR\$ graphics. Ever try to print quotes in a program? Try PRINT CHR\$(34); "word"; CHR\$(34).

```
20 CLS0:PRINT
20 REM ALPHABET
30 FOR A=65 TO 90:PRINTCHR$(A);:
NEXT:PRINT
40 REM LOWER CASE
50 FORA=97 TO 122:PRINTCHR$(A);:
NEXT:PRINT
60 REM NUMBERS
70 FORA=48 TO 57:PRINTCHR$(A);:N
EXT:PRINT
80 REM GRAPHICS
90 FOR A=128 TO 255:PRINTCHR$(A)
;:NEXT
```

Program Listing 7

```
5 CLS0
10 A$=CHR$(243)
20 B$=CHR$(243)+CHR$(254)+CHR$(2
55)+CHR$(253)+CHR$(243)
30 C$=CHR$(244)+CHR$(253.)+CHR$(2
55)+CHR$(254)+CHR$(248)"
40 PRINT@37,A$;:PRINT@67,B$;:PRI
NT@99,C$;
50 GOTO50
```

Program Listing 8

```
10 CLS0
20 FORA=1 TO 32
30 AS=A$+CHR$(204)
40 NEXT A
50 PRINT@70,"PRESS ANY KEY";
60 I$=INKEY$:IFI$=""THEN60
70 PRINT@256,A$;
80 GOTO80
```

Program Listing 9

Figure 1 can be useful for designing CHR\$ pictures. It shows how to use CHR\$ graphics to color the various combinations of the four set positions within one PRINT@ position.

Program Listing 8 uses CHR\$ graphics to draw a space ship. Notice how fast the ship is drawn.

Have you ever lain awake nights wondering why STRINGS was not included in Color Basic? Don't worry, now you can have STRINGS without Extended Color Basic.

Program Listing 9 builds AS into the same string as STRING\$(32,204), a string of 32 of the CHR\$ character 204. The small delay is due to the FOR loop being repeated 32 times. Once the program creates the string, it prints it very quickly.

AS can be up to 255 characters long; just remember to CLEAR n, where n is the amount of string space needed. Otherwise, you will see a lot of OS errors.

Two more commands, AUDIO ON and MOTOR ON, involve the cassette recorder. One use for these commands is to play a prerecorded tape while a program is running. Perhaps you'd like some audio instruction in an educational program, or *Star Wars* music to

play while a space game is initializing.

To use these commands you must insert the audio tape and press the recorder's play key. AUDIO ON plays any recorded sound through the TV speaker. It will even let you listen while CLOADing a program. MOTOR ON runs the cassette player. AUDIO OFF and MOTOR OFF reverse these commands.

Add line 5, MOTOR ON:AUDIO ON, to Program Listing 10, insert a music tape, press play, and watch your own micro-disco screen.

In Listing 10, line 30 chooses a graphic pattern. The CHR\$ codes for graphics start at 128 and end at 255 (128+127 is the largest possible graphic number for AS). Line 40 prints this pattern with one blank on each side to prevent the screen from becoming too crowded.

Line 20 uses the number 508 because the strings printed are three positions long. If A is chosen as 508 then the end of the string is position 510. If a character is printed at 511, then the screen scrolls up and leaves an ugly-

```
10 CLS0
20 A=RND(508)
30 A$=CHR$(128+RND(127))
40 PRINT@A,CHR$(128)+A$+CHR$(128)
;:GOTO20
```

Program Listing 10

```
10 CLS0:FORC=1T023:F$=F$+CHR$(19
5):NEXTC
20 A=35:FORL=1T023:DL$=DL$+CHR$(
128):NEXTL:D$=LEFT$(DL$,5)
30 E1$=CHR$(132)+CHR?(139)+CHR$(
142)
40 A$=CHR$(128)+CHR$(128)+CHR$(2
43)+CHR$(128)+CHR$(128)
50 B$=CHR$(243)+CHR$(254)+CHR$(2
55)+CHR$(253)+CHR$(243)
60 C$=CHR?(244)+CHR$(253)+CHR$(2
55)+CHR$(254)+CHR$(248)
70 PRINT@A-32,D$;:PRINT@A,A$;:PR
INT@A+32,B$;:PRINT@A+64,C$;
80 FORU=1T05
90 EP=8+RND(20)+32*RND(15)
100 PRINT@EP,E1$;
110 FORT=1T030
120 IFNS=10 THEN140
130 G$=INKEY$:IFG$<>" THEN NS=NS
+1:PRINT@A+37,F$;:FORT=1T05:NEX
TTI:PRINT@A+37,DL$;:IF EP>A+32 A
ND ABS(EP-(A+32))<30 THEN FOR R=
1 TO 5:PRINT@EP,CHR$(128+RND(127
)))+CHR$(128+RND(127));:NEXT R:NH
=NH+1:PRINT@0,NH;
140 NEXTT
150 PRINT@EP,LEFT$(DL$,3);
160 NEXTU
170 A=A+32:IFA<451THENGOTO70
```

Program Listing 11

PRINT@ position

```
84
21
```

blank all sections colored

green	128	-	143
yellow	144	-	159
blue	160	-	175
red	176	-	191
buff	192	-	207
cyan	208	-	223
magenta	224	-	239
orange	240	-	255

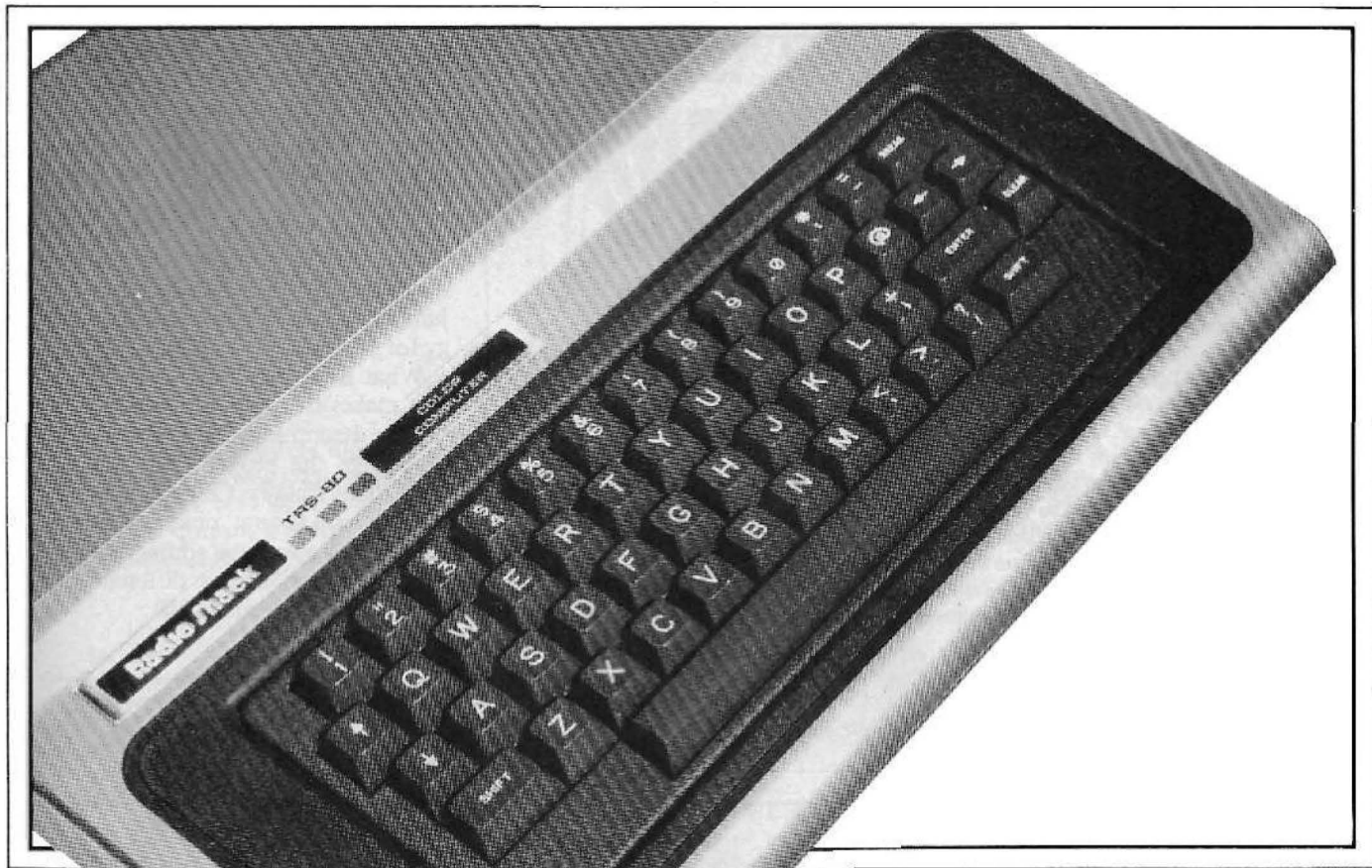
Example

```
RR
R
```

```
red
176+8+4+2=190
PRINT CHR$(190)
```

Fig. 1. CHR\$ and POKE Graphic Patterns

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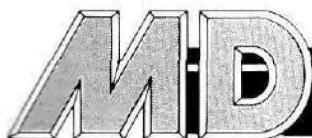
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The Basic Beat.

looking green stripe at the bottom of the screen.

Program Listing 11 grew a little longer than I originally planned, but I

kept finding ways to improve this space game. Here's the setting: You're the only remaining crew member on board the orange ship. Your orbit is decaying with no hope to pull away from the planet's gravity. The only thing you can do is shoot as many green alien saucers as possible before you crash.

Press any key to fire. The laser only fires straight to the right from the middle of the ship. The aliens keep hyper-jumping around. You only have energy for 10 shots. Good luck!

What is all that stuff in Listing 11 that makes the program work? Study the line description. For homework try to change the program so that you have 20 laser blasts. Can you make the screen flash several times when you crash? Or how about adding a sound when you fire and a different one when you hit the enemy? •

Line	Description
10	creates a string for the laser blast.
20	(original position of your space ship) creates a string of blanks to erase the laser blast; creates a short string of blanks to erase the top of your ship as you descend.
30	creates the enemy ship.
40	is the top of your ship.
50	is the middle of your ship.
60	is the bottom of your ship.
70	prints your ship.
80	U is the number of times the enemy ship appears each time your ship falls one PRINT® position.
90	positions the enemy ship eight units plus a random number of spaces to the right and in one of 15 lines down.
100	prints the enemy ship.
110	is a time delay to leave the enemy ship on the screen.
120	directs the program so you can't fire again after you've fired 10 times.
130	checks for any key pressed (indicating a shot), counts the number of shots, prints the laser blast, erases the laser blast, checks to see if the enemy was in a position to be hit, prints the random graphics for an explosion, increases the number of hits by one, and prints the number of hits.
150	erases the enemy ship.
170	moves your ship down.

Fig 2. Line description of Listing 11

Write James Wood c/o HOT CoCo, Pine St., Peterborough, NH 03458.

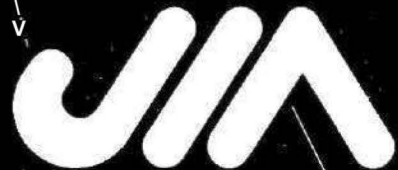
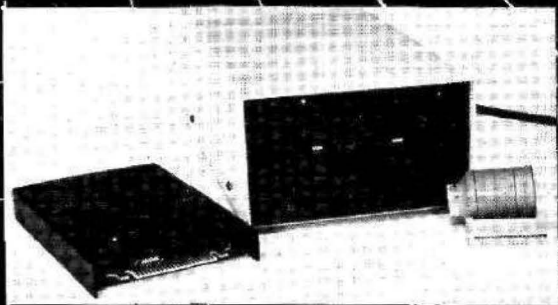
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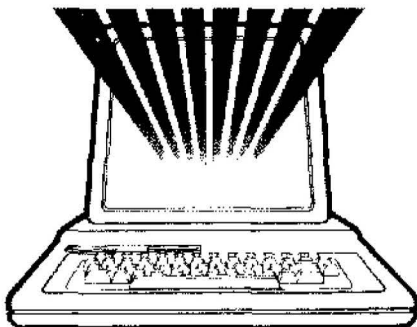
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You can now write truly professional looking programs that combine text with hi-res graphics. Super Screen allows you to create graphics displays with the Basic LINE, DRAW and CIRCLE statements and then notate the graphics with descriptive text. You 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!

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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.

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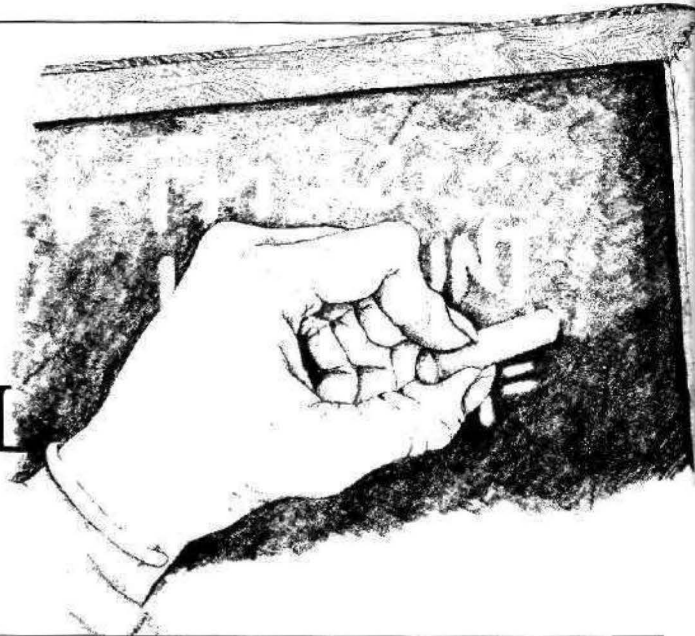
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BY F. J. RAESKE

WRITING EDUCATIONAL SOFTWARE



Ask a proud parent what he intends to do with his new computer and his list of answers usually includes an excited description of the powers of computer-aided education. He might say, "This machine can teach anything from math to brain surgery in two easy lessons!" This is almost true. The trick is finding the right programs to use.

Where do you find the right software? If what you need isn't available commercially, you must write your own training programs. This seems to be a formidable task. You ask, "Isn't pro-

gramming supposed to be creative and difficult? Doesn't it take years to write a good program (like a good novel)? Where would I get my ideas from?"

First, you need inspiration. How do

you come up with a good program theme? The answer to this comes in two parts, but before looking further, deactivate your sense of moral outrage. The answer? Steal them. Think of all the games you played in school to help you learn. For spelling there were spelling bees, Hangman contests, and word mazes. For math there were flash cards, timed exercises, and theory puzzles.

If these ideas have stood the test of time, why not adapt them for use on your home machine? Then, test market your children: Ask what games they like playing. If the kids already like a game, adding TV graphics and an impartial scorekeeper can make a hit.

For this article I selected the game of Hangman. It fulfills many of the requirements of a good game in that it can be topical (stick in a weekly spelling list), it uses graphics, children like playing it, and best of all, it's simple to write and can run in Color Basic.

Programming

The trick to assembling any program is in the word assemble. Break the job in parts and do one part at a time. An easy way to do this is to play the game by hand and jot down each element of the activities. To finish the job, write a subroutine for each element. Examine Hangman, the spelling game.

- Create a word list (or spelling list).

Lines 10-20	initiate string space
Lines 100-200	pick a word and test used word list
Lines 300-400	draw gallows and clear variables
Lines 400-440	enter and test guess letter or number
Lines 440-480	is guess right or wrong?
Lines 500-610	score wrong guess and select draw sbr.
Lines 620-660	draw head
Lines 670-690	draw body
Lines 700-710	draw left arm
Lines 720-730	draw right arm
Lines 740-750	draw left leg
Lines 760-800	draw right leg
Lines 800-850	print word after last wrong guess
Lines 850-900	do dance
Lines 900-950	book-keeping for right guess
Lines 1000-1030	set-up for right solution
Lines 1030-1080	draw fireworks arch
Lines 1090-1200	fireworks display
Lines 1200-1250	hint subroutine
Lines 1300-1400	used letter checker (right guess duplication)
Lines 1500-1600	end of game decision (repeat old words?)

Table 1. Program Directory

System Requirements

**16KRAM
Color Basic**

- Pick one word at random.
- Draw a gallows.
- Let the player enter a guess letter.
- Evaluate the player's guess.
- Take appropriate actions (draw a body part, show letter placement).
- Implement win/lose routine.

Take a look at the Program Listing. Each segment is separated by remark statements. The beginning few lines are utilities, necessary for all programs although they contribute nothing to the game. Even so, it never hurts to leave room to expand these statements or add features.

Initiating the Game

When you set up the word list, keep in mind that you have two limits to work with in generating options for children. First, set a limit to the number of words the participants can enter. This makes guessing easier for little children and also keeps a bright child from trying to enter the encyclopedia into memory. Next, vary the amount of words you enter. For a short game with two children you might select only 5-10 words. For a spelling list the number can jump from 10-20. Be flexible.

Beginning a Round in the Game

To start the game you must pick a word from the list, and this poses a problem. In a number game it is permissible, even advantageous, to select the same number more than once. Here, it might not be as valuable an option so this sort routine keeps each word exclusive. In this way you can also guarantee that for N turns you get N different words.

Draw a Gallows

It's time for some policy decisions again. With what kind of media are you competing for your child's attention? Things like television cartoons and comic books come to mind. To com-

pare favorably you must provide a variety of colors and some animation. For this reason I selected the low-resolution screen. It was justified because I needed several colors and the necessary animation was minimal as was the need for fine detail. Low-res graphics also means non-Extended Basic. Setup also includes showing the length of the word and the present score of the participant.

Evaluating the Guess

In this area several things are necessary. Most of the activities shown are simple requisites of the game (house-keeping). Consider these points, however. Every right entry gets a beep-boop noise. It only costs part of a line and it

Program Listing. Hangman

```

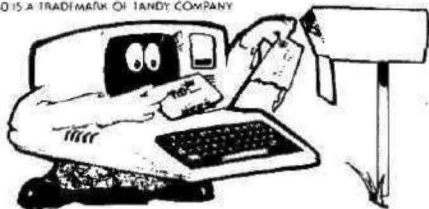
10 CLEAR 500:CLS
20 DIM PL(20),W$(25),UL(20),UW(2
5)
30 GOSUB 1610
40 FOR A=1 TO NU:UW(A)=0:NEXT
100 ' WORD SELECTOR
110 WS=RND(NU):IF WS=0 THEN 110

```

Listing continued

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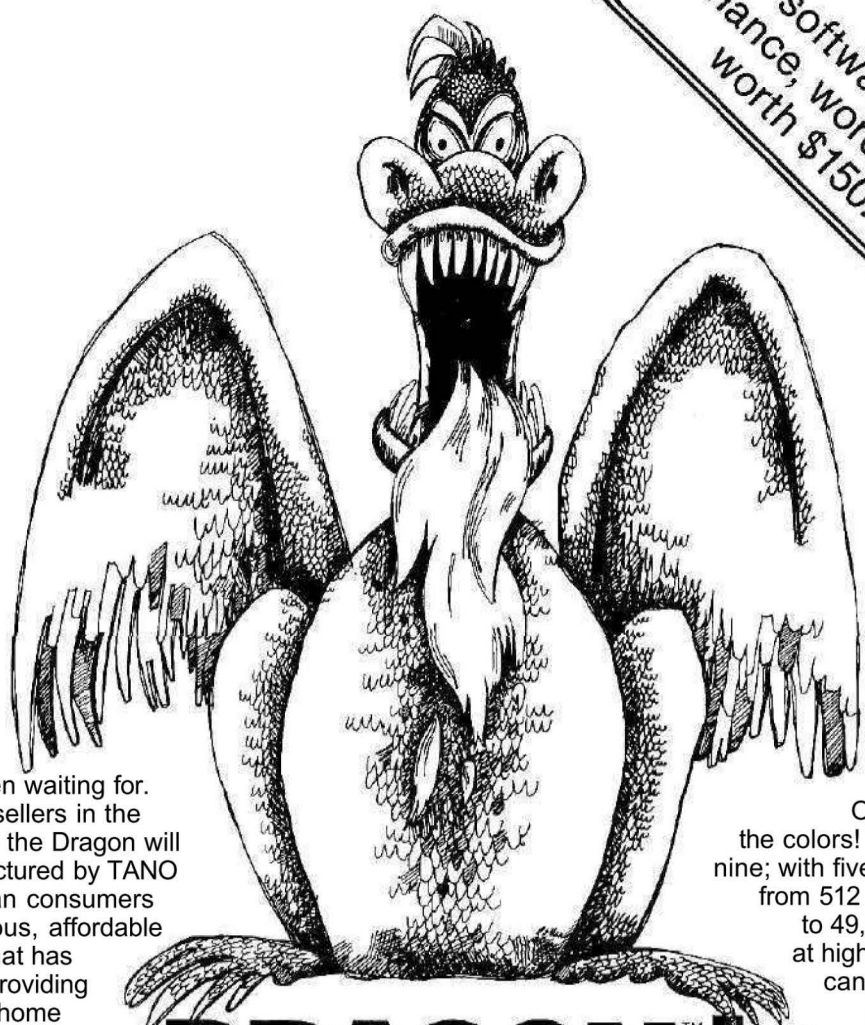
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```

120 F=0
130 IF TU=NU THEN 1510
140 FOR A=1 TO NU
150 IF WS=UW(A) THEN F=1
160 NEXTA
170 IF F=1 THEN 110
180 TU=TU+1:UW(TU)=WS
190 W$=W$(WS)
200 L=LEN(W$)
300 'DRAW GALLOWS
310 CLS(0):FOR A=10 TO 20:PRINT
@ A,CHR$(159);:NEXT
320 FOR A=20 TO 383 STEP 32:PRIN
T @ A,CHR$(159);:NEXT
330 FOR A=448 TO 448+(L-1)*2 STE
P 2: PRINT @ A, CHR$(156);:NEXT
340 PRINT @ 32,L;: PRINT @96,PT;
:PRINT @ 128,"POINTS";
350 T=0: P=0: CT=0: R=0
360 FOR A=1 TO 20:UL(A)=0:NEXT
370 F=0:FOR A=1 TO 20:PL(A)=0:NE
XT:N=0
400 ' GUESS ENTRY ROUTINE
410 PRINT @410,"?";
420 K$=INKEY$:IF K$=""THEN 420
430 IF ASC(K$)<57 THEN GOSUB 120
0
440 FOR A=1 TO L
450 IF K?=MID$(W$,A,1)THEN F=A
460 IF F=A THEN N=N+1
470 IF F=A THEN PL(N)=A
480 NEXT A
490 GOSUB 1300
500 IF F=0 THEN T=T+1 ELSE 900
510 IF F=0 THEN PT=PT-1
520 PRINT @ P+30,K$;:P=P+32
600 'WHICH PART TO DRAW?
610 ON T GOTO 620,670,700,720,74
0,760
620 PRINT @ 42,CHR$(197);
630 FOR A=1 TO 3:PRINT @ A+72,CH
R$(191);:NEXT
640 PRINT @ 105,CHR$(187);CHR$(1
91);CHR$(183);
650 PRINT @ 137,CHR$(191);CHR$(1
79);CHR$(191);
660 GOTO 370
670 FOR A=1 TO 5:M=138+32*A
680 PRINT @ M,CHR$(166);:NEXT
690 GOTO 370
700 FOR A=1 TO 3: PRINT @ 202+A,
CHR$(156);:NEXT
710 GOTO 370
720 FOR A=1 TO 3: PRINT @ 198+A,
CHR$(156);:NEXT
730 GOTO 370
740 FOR A=1 TO 3:PRINT @(299+32*
A),CHR$(156);:NEXT
750 GOTO 370
760 FOR A=1 TO 3: PRINT @ (297+3
2*A),CHR$(156);:NEXT
800 'SPELL THE WORD
810 FOR A=1 TO L
820 K$=MID$(W$,A,1):PRINT @ 416+
((A-1)*2),K$;:NEXT
850 'ANIMATION ROUTINE
860 FOR A=1 TO 3:PRINT @ 360+A,C
HR$(128);:NEXT:PRINT @ 360,CHR$(
156);:PRINT@364,CHR$(156);
870 FOR A=1 TO 3:PRINT @ 392+A,C
HR$(128);:NEXT:PRINT@391,CHR$(15
6);:PRINT @ 3 97,CHR$(156);
880 PRINT@360,CHR$(128);:PRINT@3
64,CHR$(128);:PRINT@391,CHR$(128
);:PRINT@397,CHR$(128);
890 CT=CT+1: IF CT=10 THEN 110 E
LSE 850
900 'RIGHT ANSWER ROUTINE
910 FOR A=1 TO N:PRINT @ 416+((P
L(A)-1)*2),K$;:NEXT
920 PT=PT+N
930 R=R+N:PRINT @ 0,R;
940 SOUND 160,3:SOUND 120,1
950 IF R=L THEN 1000 ELSE 370
1000 'GOT THE WORD RIGHT ROUTINE
1010 FOR A=1 TO 800:NEXT
1020 CLS(0):DE=360/(2*3.14159)
1030 FORA=1 TO 40:B=A*3/DE:X=A*3
2/40:Y=SIN(1.5708-B)*32
1040 IF Y<0 THEN Y=Y*-1
1050 RESET(D,E):SET(X,Y,1):D=X:E
=Y
1060 SOUND(200-Y),1
1070 NEXT A
1080 RESET(D,E)
1090 FOR A=1 TO L*10
1100 X=32+(RND(20)-10):Y=16+(RND
(20)-10)
1110 FOR C=1 TO RND(5):SOUND(L*1
5),1:NEXTC
1120 SET(X,Y,RND(8))
1130 NEXT A
1140 FOR A=1 TO 800:NEXT:GOTO 11
0
1200 ' HINT ROUTINE
1210 K=VAL(K$): IF K=0 THEN RETU
RN
1220 H$=MID$(W$,K,1)
1230 PRINT $ (416+(K-1)*2),H$;
1240 R=R+1
1250 RETURN
1300 'USED LETTER CHECKER
1310 F1=0
1320 FOR A=1 TO N
1330 IF UL(PL(A))=1 THEN F1=1
1340 IF F1=0 THEN UL(PL(A))=1
1350 NEXT A
1360 IF F1=1 THEN F=0
1370 F1=0
1380 RETURN
1500 ' END GAME ROUTINE
1510 INPUT"SAME WORDS AGAIN";D$
1520 IF D$="N" THEN 10
1530 TU=0:PT=0
1540 FOR A=1 TO NU:UW(A)=0:NEXT
1550 GOTO 110

```

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```

1600 ' WORD ENTRY SUBROUTINE
1610 INPUT"HOW MANY WORDS FOR TH
IS GAME ? (25 MAXIMUM)"; NU
1620 FOR A=1 TO NU
1630 PRINT"ENTER WORD #-";A;
1640 INPUT W$(A)
1650 NEXT
1660 RETURN
    
```

PL=position of guessed letter	W\$ = guess word
UL = used letter position	WS = selected word
NU = number of words in list	F,F1 = status flags
PT=points scored	UW=used word*
TU = turn number (words used)	L = word length
CT=animation move count	T = number of tries
R = number of right guesses	M,P=screen place
DE = degree/radians constant	KS = guess letter
D,E=old fireworks position	H\$=hint letter
X, Y=new fireworks position	

Table 2. Glossary of Variables

adds positive reinforcement. The hint mode (** press the number of the position of the letter to be hinted **) keeps a player from getting frustrated and quitting, but it can't be a free tip. Every hint costs a point. The points are functions of the length of the word and the number of wrong guesses and provide a little competitive drive. Think of the variety of body components' color and shapes as visual stimulation.

The Win/Lose Routine

Assume the child guesses wrong. It is important to let him see the correct spelling of the word. Without this he learns nothing. There is also a delay function at this point that can vary depending upon age and learning ability. I

threw in a little animation to diminish the agony of defeat.

The win routine is a bit of a trap. As you enter the last correct letter the screen blanks and an audio-visual reward is generated. The length of the display is proportional to the length of the word. The trap is that new authors tend to go overboard with their creations and children can get bored quickly. The key words for rewards in a program are fast and flashy. Leave them hoping for more.

Never assume your program is complete or perfect. Give a kid five minutes and he will want something added or changed. Try to be fair in evaluating re-

quests because many of them will have merit. One last suggestion: Let the child help with the programming. They learn some Basic and you learn what they like. Imagine their faces when they tell their friends, "Sure it's great, and I helped make it!"

Now for your homework assignment: You can enhance this program. A word-list storage routine is useful in some applications as are multiple scores, depending on the needs of the user. ■

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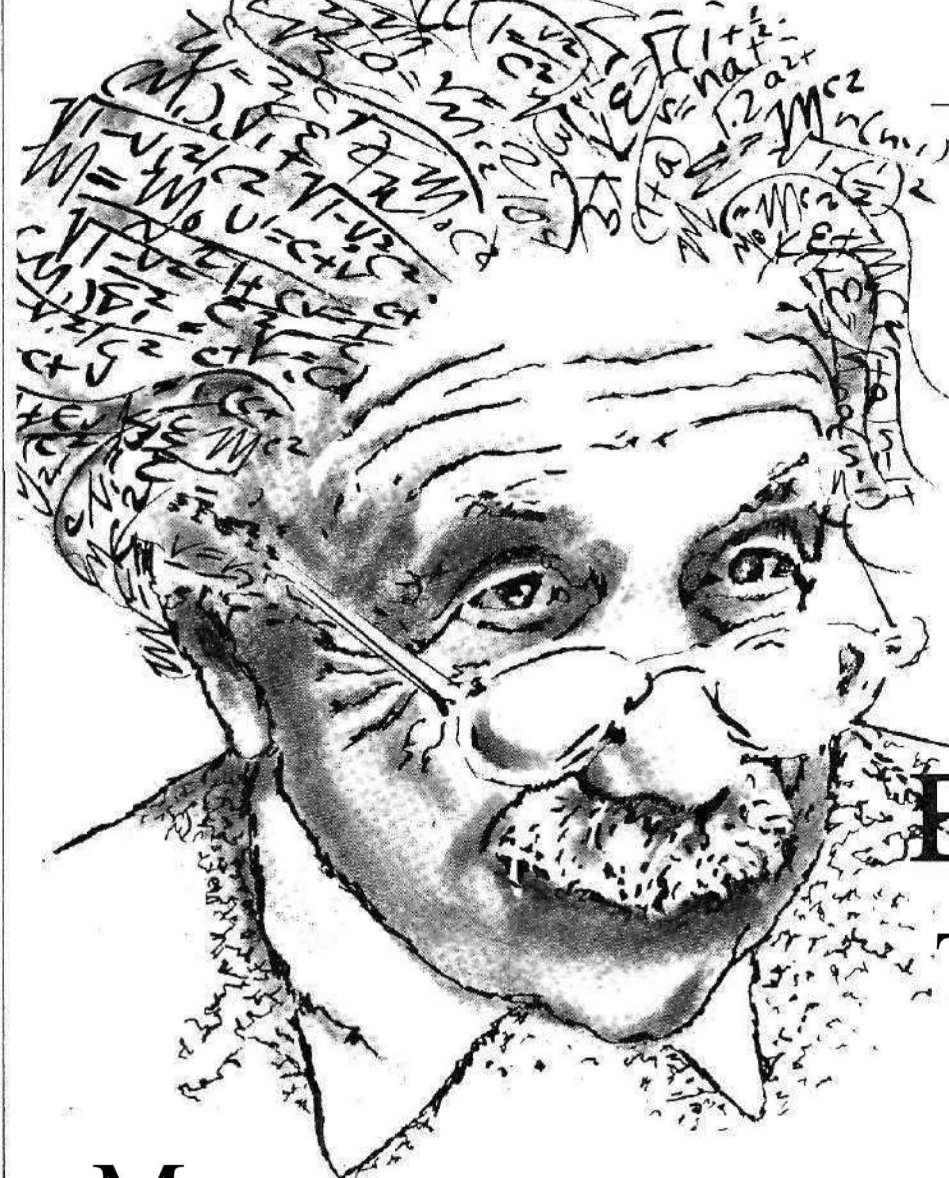
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EINSTEIN'S TUTORIAL

My Color Computer has been most helpful in presenting science projects, especially the schematics, graphics demonstrations, and sound analysis. This program presents graphics information about a project on particle physics including Einstein's theory of special relativity.

What follows is a tutorial on special relativity with pictures and animation. It is a straightforward program that discusses time dilation, relativistic mass increase, relative velocity addition, and particle accelerators.

A POKE in line 100 speeds up the computer. In line 800, at the end of the program, another POKE slows the computer down to allow for normal input/output. Only one graphics screen is allocated and it is sufficient for animation while allowing the program to fit into 16K. To avoid an OM error, remember to type PCLEAR1 on 16K machines before loading the program from disk or tape.

At the end of each page of information, the program calls line 810, the IN-

Brush up on Einstein!
This article explains
particle physics using
pictures and animation.

KEY routine that blinks enter in inverse.

At line 320 the first animation routine begins. The line that grows from and reflects off of the car is the light from A's flashlight. In the second routine the path of the light is shown from B's point of view. The horizontal scale is exaggerated to demonstrate the time-dilation principle.

If at any time during the previous two routines parts of the letter A appear to be missing, don't worry. With the speed-up POKE, the computer is sending the TV information a little faster than it can put it on the screen.

At 470, the third animation routine

begins. This routine is slower because of the time it takes to draw two circles.

Next comes the relative-velocity section. If two people were running away from each other, each at 8/10ths the speed of light, how fast would one person be moving away from the other? Your first response is probably 1.6 times the speed of light. This portion shows how relative velocities are calculated.

Input two numbers, the speed of a train relative to the earth, and of a man relative to the train. These responses are kept within a certain range to make sure that the results are meaningful. If they were much less, the effect would be nearly nil. In addition, the .division routine only allows divisors under 11

System Requirements

16K RAM

Extended Color Basic

digits, and the lower portion of the fraction gets so near two that 11 digits is not enough.

The linear-accelerator section gives a brief overview of the subject and the part relativity plays. The synchrotron and cyclotron are then graphically compared. As soon as you press the enter key, the computer asks if you want to go over the material again. The entire program takes no more than five minutes.

In the math subroutines the input is two string encoded numbers [(N1\$,

N2\$)]. Remember to leave a space or a hyphen before the number if you do not use the STR\$ function to string encode your number.

To allow for space for the tutorial, the math subroutines have been bunched together. See the flowchart in Fig. 1 if you need help understanding the routines.

The OPS variable is the operation, either a +, /, or * . Note that - is not included and that trying to add a negative number does not work.

The P variable is the precision of the

division and tells the computer how far to go before giving up. When setting up a division problem, write it out as you would solve it on a piece of paper, with N1\$ as the left number and N2\$ as the right.

Remember not to use a divisor that is more than 11 characters long when measured by the LEN function. •

Address correspondence to Michael L. Johnson, 7481 Greenway Drive, Jacksonville, FL 32210.

Program Listing. Relativity Tutor.

```
100 POKE 65495,0:PCLEAR1:PCLS:CL
EAR1000:CLS:PRINTTAB(8)"RELATIVI
TY TUTOR"
110 PRINT:PRINT" THIS PROGRAM I
S A CAI COVERING EINSTEIN'S THEO
RY OF RELATIVITY AND HOW IT APPLI
ES TO HIGH SPEED PARTICLE PHYSICS
EXPERIMENTS. THE TUTORIAL S
WITCHES BACK AND FORTH BETWEEN TE
XT AND GRAPHICS,";
120 PRINT"WITH THE TEXT PORTI
ON EXPLAINING THE UPCOMING PICTU
RE OR ANI-MATION. THE ENTER K
EY IS DE-PRESSED AT THE END OF
ANY LESSON IN THE TUTORIAL OR AT
THE END OF A GRAPHICS SCREEN IN
ORDER FOR THE PROGRAM TO MOVE ON
..";
130 GOSUB 810
140 PRINT@64," AT TIMES DURIN
G THE PROGRAM YOU WILL BE ASKE
D TO INPUT A VALUE SO THAT YO
U CAN SEE HOW THAT VALUE EFFECT
S THE OUTCOME. WHEN ENTERING A VA
LUE BE SURE TO PRESS THE 'ENTER'
KEY AFTERWARDSTO ENTER THE VALUE
INTO THE COM-";
150 PRINT"PUTERS MEMORY.
AT THE END, YOU WIL
L BE ASKED WHETHER OR NOT YOU WAN
T TO GO O-VER THE MATERIAL AGAIN
.FEEL FREE TO REPEAT THE TUTORIAL
AS OFTEN AS DESIRED."
160 GOSUB 810
170 CLS:PRINT@10,"TIME DILATION"
180 PRINT:PRINT" EINSTEIN'S THE
ORY OF SPECIAL RELATIVITY STATE
S THAT THERE ARE NO SPECIAL FRAM
ES OF REFERENCE, AND THAT THINGS
DO NOT HAVE TO LOOK THE SAME FR
OM OTHER FRAMES. IN OTHER WORDS,
ALL THINGS ARE RELATIVE."
190 PRINT" ONE THOUGHT EXPERIME
NT THAT WE CAN USE TO SHOW HOW TH
E DURATION OF AN EVENT CHANGES
FROM FRAME TO FRAME CONSISTS OF
TWO PEOPLE, ONE MOVING RELATIVE
```

```
TO US AND ONE STATIONARY RELATIV
E TO US."
200 GOSUB 810
210 PRINT@64," AT THE ORIGIN OF
THE FRAME OF REFERENCE THAT IS
MOVING THERE IS A BOY IN A CAR
WITH A MIRROR. IN THE STATIONARY
FRAME THERE IS A BOY WITH A FLASH
LIGHT. THE BOY WITH THE FLASHLIGH
T IS GOING TO TURN ON HIS FLASHL
IGHT AND MEAS-";
220 PRINT"URE THE DURATION OF TH
E EVENT IN HIS TIME FRAME. THE
N WE WILL CALCULATE THE DURATIO
N AS SEEN BY THE BOY IN THE MOVI
NG CAR. LET US SAY THAT TH
E DISTANCE BETWEEN THE BOYS IS '
WHEN THE";
230 GOSUB 810
240 PRINT@64," LIGHT ARRIVES AT T
HE MIRROR. THEN THE DISTANCE TRAVE
RSED IS (2S), AND THE DURATION
IN THIS FRAME IS (2S/C). FOR T
HE BOY IN THE MOVING CAR, IT I
S A DIFFERENT STORY. TO HIM IT
APPEARS AS IF THE BOY WITH THE
FLASHLIGHT IS";
250 PRINT"TURNING ON THE FLASHL
IGHT JUST BEFORE THE CAR IS DIRE
CTLY OPPOSITE HIM AND IT RETURN
S TO THAT BOY A SPLIT SECOND L
ATER. THE BOY WITH THE FLASHLIGH
T APPEARS TO MOVE A DISTANCE (VT
) WHICH IS";
260 GOSUB 810
270 PRINT$64,"DEPENDENT UPON TH
E TWO FACTORS, VELOCITY (V) AND T
IME. THROUGH THE PYTHAGOREAN TH
EOREM, HE WILL FIND THAT THE DIST
ANCE WHICH THE LIGHT HAS TRAVELED
IN HIS FRAME IS EQUAL TO 2SQR(
(VT/2)^2+A^2). SINCE THE SPEED
OF LIGHT IS A";
280 PRINT"CONSTANT, TIME MUST B
E DILATED IN THIS TIME FRAME TO
ALLOW FOR THE INCREASED DISTANCE
TAKING THE EQUATION ABOVE AN
```

Listing continued

```

D SOLVINGFOR T, WE GET T=2A/SQR
(C^2-V^2)=2A/(C*SQR(1-V^2/C^2)).
SINCE 2A/";
290 GOSUB 810
300 PRINT@64,"C=TIME STATIONARY
, THEN THE FI-NAL EQUATION IS RE
ACHED,WHICH ISTR=TS*SQR(1-V^2/C^
2), WHERE TR=TIME IN THE MOVING
FRAME AND TS=TIME IN THE STATIO
NARY FRAME.";
310 FORI=1TO8:PRINT:NEXT:PRINTST
RING$(32,32);:GOSUB810:COLOR1,0
320 LINE(0,144)-(255,144),PSET:L
INE(123,0)-(123,191),PSET:DRAW"B
M128,160R6D8U4L6U4D8":A$="C BM40
,70 R20D3R5D5L5D3L20U1ln
330 SCREEN 1,1:FOR X=40 TO 216 S
TEP 2:Y=INT((69+(ABS(128-X)/88)*
73)/2)*2:IF X<128 THEN PSET(128,
Y) ELSE PRESET(128,Y)
340 MID$(A$,2,1)="0":DRAWA$:MID$(
A$,2,1)="1":MID$(A$,5,3)=MID$(S
TR$(X+5),2):DRAW A$:LINE(123,70)
-(123,81),PSET:NEXTX
350 FORX=1TO700:IFINKEY$=""THENN
EXTX
360 PCLS:LINE(123,0)-(123,191),P
SET:LINE(0,144)-(256,144),PSET:M
ID$(A$,5,7)="113,140,, :DRAWA$:DRA
    
```

```

W"BM140,160R6F2DG2L6U3D8R6E2UH2"
370 A$="BM40 ,70U8R6D8U4L6"
380 FORX=40TO216 STEP2:Y=INT((14
3-(ABS(128-X)/88)*73)/2)*2:PSET(
X,Y):DRAWA$:COLOR0,1:DRAWA$:COLO
R1,0:MID$(A$,3,3)=MID$(STR$(X),2
):LINE(123,0)-(123,191),PSET:NEX
TX:DRAWA$
390 FORX=1TO700:IFINKEY$=""THENN
EXT
400 CLS:PRINTTAB(9);"MASS INCREA
SE":PRINT
410 PRINT" BY USING ANOTHER TH
OUGHT EXP-ERIMENT, AND THE EQU
ATION FROMTHE LAST EXPERIMENT,RE
LATIVISTICMASS INCREASE CAN BE
EXPLAINED.FIRST, LET US DEFINE M
OMENTUM ASTHE PRODUCT OF AN OBJE
CTS MASS &ITS ACCELERATION."
420 PRINT" BY USING THE SAME BO
YS IN THISEXPERIMENT, IN THEIR S
AME MOVINGAND STATIONARY FRAMES,
WE PLACERUBBER BALLS OF EQUAL
SHAPES ANDSIZES IN THEIR POSSESS
ION. THEYARE TO THROW THESE BAL
LS ATTHE";
430 GOSUB 810
440 PRINT@64,"FACT,'A' CONCLUDES
THAT VELOCITYOF B'S BALL=VELOCI
    
```

Listing continued

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TY OF A'S BALL*SQR(1-V^2/C^2).
SINCE THE BALL HAS TO RETURN TO '
B' DUE TO CON-SERVATION OF MOMEN-
TUM. THE MOM-ENTUM REMAINS THE
SAME. DUE TO THIS, THE MASS MUST
INCREASE. THE";
450 PRINT"FORMULA FOR CALCULATIN-
G THE MASS INCREASE IS RELATIVIST-
IC MASS. =REST MASS*SQR(1-V^2/C^
2)."
460 FOR X=1 TO 3:PRINT:NEXT X:GOSUB
810
470 PCLS:A$="BM110,13 4R6D8U4L6U4
D8":B$="BM40 ,26R6F2DG2L6U3D8R6E
2UH2":SCREEN 1,1:COLOR 1,0
480 DRAWA$:FOR X=40 TO 216 STEP 4:Y1=
50-INT((ABS(128-X)/88)*50):CIRCL-
E(X,Y1+40),4,1:CIRCLE(124,144-Y1
),3,1:CIRCLE(X,Y1+40),4,0:CIRCLE
(124,144-Y1),3,0
490 COLOR 0,1:DRAWB$:COLOR 1,0: MID
$(B$,3,3)=MID$(STR$(X),2):DRAWB$
:NEXT
500 FOR X=1 TO 700:IF INKEY$="" THEN
NEXT X
510 CLS:PRINT TAB(7)"RELATIVE VEL-
OCITY":PRINT
520 PRINT" HERE IS AN OPPORTUNI-
TY TO PLUG SOME VALUES IN TO AN

```

```

EXPERIMENT IN ORDER TO SEE HOW T-
HEY EFFECT THE RESULT. IN THI-
S EXPERIMENT, WE HAVE A TRAIN W-
HICH MOVES AT ANY RATE BETWEEN 1.
5*10^8 AND 2*10^8. INSIDE THE T-
RAIN IS A";
530 PRINT"MAN IS ABLE TO MOVE WI-
THIN THESE LIMITS ALSO. YOU ARE
TO TYPE IN THE RATE OF THE MAN RE-
LATIVE TO THE TRAIN AND THE TRAI-
N RELATIVE TO THE EARTH. IN A MOM-
ENT I WILT.";
540 GOSUB 810:CLS:PRINT TAB(7)"RE-
LATIVE VELOCITY"
550 PRINT@64,"RETURN THE VELOCI-
TY RELATIVE TO THE EARTH BY USING
THE FOLLOWING EQUATION
                                V1+V2
                                V=-----
                                1+V1*V2/
                                C^2";
560 INPUT"SPEED OF TRAIN (M/S)
(1.5*10^8-2*10^8)";V1:
IF V1>200000000 OR V1<150000000
THEN PRINT@256,"";:GOTO 560 ELSE
V1$=STR$(V1)
570 INPUT"SPEED OF MAN (M/S)
(1.5*10^8-2*10^8)";V2:
IF V2>200000000 OR V2<150000000

```

Listing continued

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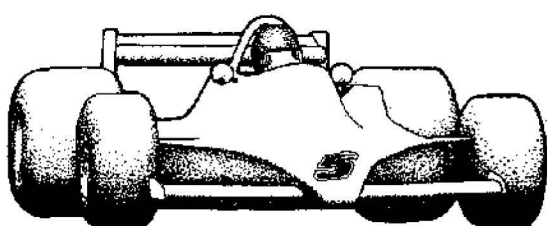
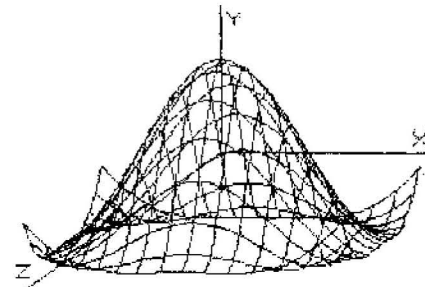
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```

THEN PRINT@320,"";:GOTO 570 ELSE
V2$=STR$(V2)
580 P=15:N1$=V1$:N2$=V2$:OP$="*"
:GOSUB10000:N1$=" 300000000":N2$
=R1$:OP$="/":GOSUB10000:N1$=" 30
0000000":N2$=R1$:GOSUB10000:N1$=
" 1":N2$=R1$:OP$="' +":GOSUB 10000
:V3$=R1$:N1$=V1$:N2$=V2$:GOSUB10
000:N1$=MID$(V3$,2,11):N2$=R1$:O
P$="/":GOSUB10000
590 PRINT"RESULT IS=
      ";R1$
600 PRINT:PRINT"WANT TO TRY DIFF
ERENT #'S (y/N)";
610 FOR X=1 TO 50:A$=INKEY$:IF A
$="" THEN NEXT X ELSE 650
620 PRINT@507,"Y/n";
630 FOR X=1 TO 50:A$=INKEY$:IF A
$="" THEN NEXT X ELSE 650
640 PRINT@507,"y/N";:GOTO 610
650 IF A$O"Y" AND A$<>"N" THEN
630
660 IF A$="Y" THEN PRINT@256,"";
:FOR X=1 TO 7:PRINT:NEXTX:PRINTS
TRING$(31," ");:PRINT@256,"";:GO
TO560
670 CLS:PRINT"          LINEAR ACCE
LERATORS          & SYNCHR
OTRONS"
680 PRINT:PRINT" SCIENTISTS USE
PARTICLE ACCEL-ERATORS TO DISC
OVER HOW PARTI-CLES BEHAVE AT
VERY HIGH ENER-GIES. SPEEDS HA
VE REACHED INTO THE RELATIVISTIC
RANGE TO WITH-IN DECIMAL POINT
S OF THE SPEED";
690 PRINT"OF LIGHT. AT THESE SP
EEDS, MORE ENERGY INCREASES THE
MASS MUCH MORE THAN THE SPEED.
SCIENTISTSHAVE USED THIS PROPERT
Y TO INC-REASE THE EFFICIENCY
OF THE ACCELERATOR.";
700 GOSUB 810:PRINT@96," SINCE
ALL OF THE PARTICLES AREMOVING A
T NEARLY THE SPEED OFLIGHT WH
EN THEY ARE AT THE OUT-ER EDGE
OF THE CYCLOTRONS. THEREVOLUTI
ON TIME FOR THE PARTI-CLES REMA
INS THE SAME. A SYNCHROTRON TAKE
S ADVANTAGE OF THIS BY";
710 PRINT"ONLY APPLYING ENERGY A
T THE OUT-ER CIRCUMFRENCE AND BY
BEING AB-LE TO SUPPLY ENERGY AT
A STEADYRATE INSTEAD OF A GRAD
UALLY INC-REASING RATE."
720 GOSUB 810

730 PCLS:DRAW"BM66,161L6D8R6":DR
AW"BM194,161L6D4R6D4L6":CIRCLE(6
4,96),60:CIRCLE(192,96),60
740 SCREEN 1,1:FORI=1TO0STEP-1
750 FOR D=0TO6.283STEP.1:X1=64+C
OS(D)*D*10:Y1=96-SIN(D)*D*10:X2=
192+COS(D)*45:Y2=96-SIN(D)*45:PS
ET(X1,Y1,I):PSET(X2,Y2,I):A$=INK
EY$:IFA$=CHR$(13) THEN 760 ELSE

```

```

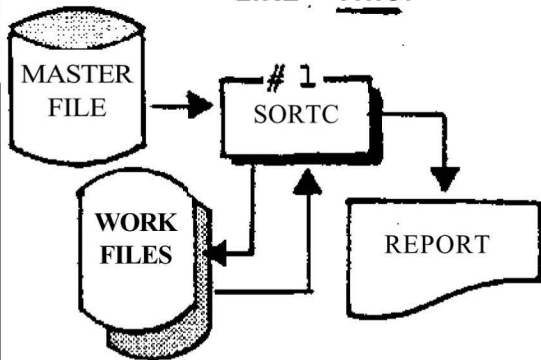
NEXT D,I:GOTO 740
760 CLS:PRINT@256,"WANT TO GO OV
ER THAT AGAIN (y,N)"
770 PRINT@284,"Y,n";:FOR X=1 TO5
0:A$=INKEY$:IF A$=""THEN NEXTX E
LSE 790
780 PRINT@284,"y,N";:FORX=1TO50:
A$=INKEY$:IF A$=""THEN NEXTX:GOT
O 770
790 IF A$="Y"THENRUN ELSE IFA$<>
"N" THEN 770
800 POKE 65494,0:END
810 PRINT@484,"PRESS <ENTER> TO
CONTINUE";
820 PRINT@491,"enter";
830 FOR I=1TO100:IF INKEY$=CHR$(
13) THENRETURNELSENEXT
840 PRINT@491,"ENTER";
850 FOR I=1TO100:IF INKEY$=CHR$(
13) THENRETURNELSENEXT
860 GOTO 810
10000 FL=0:D=0:R1$="":S1$=LEFT$(
N1$,1):N1$=MID$(N1$,2):S2$=LEFT$(
N2$,1):N2$=MID$(N2$,2):ONINSTR(
"+*/",OP$)GOTO10010,10090,10120
10010 D1=INSTR(N1$,"."):D2=INSTR
(N2$,"."):IFD1=0THENN1$=N1$+"."":
D1=LEN(N1$)
10020 IF D2=0 THEN N2$=N2$+"."":D
2=LEN(N2$)
10030 D=ABS(D1-D2):IF D1<D2 THEN
N1$=STRING$(D,"0")+N1$ ELSE N2$
=STRING$(D,"0")+N2$
10040 D1=LEN(N1$):D2=LEN(N2$):D=
ABS(D1-D2):IFD1>D2 THENN2$=N2$+S
TRING$(D,"0")ELSE N1$=N1$+STRING
$(D,"0")
10050 R1$=STRING$(LEN(N1$)," "):
BC=0:C=0:FORI=LEN(N1$)TO 1 STEP
-1:IFMID$(N1$,I,1)="." THEN MID$(
R1$,1,1)="." :NEXT
10060 BC$=STR$(VAL(MID$(N2$,I,1)
)+VAL(MID$(N1$,I,1))+C):C=0:IF L
EN(BC$)=3 THEN C=VAL(LEFT$(BC$,2
))
10070 MID$(R1$,I,1)=RIGHT$(BC$,1
):NEXT I:IFC=0THENR1$=LEFT$(BC$,
1)+R1$ ELSE R1$=STR$(C)+R1$
10080 GOTO 10260
10090 GOSUB 10290:D1=LEN(N1$):D2
=LEN(N2$):L=D1+D2:R1$=STRING$(L,
"0"):FORI=1TOL:FORJ=1TOD1:FORK=1
TOD2:IF J+K-1=I THEN10330
10100 NEXT K,J,I:IF D<>0 THENR1$
=LEFT$(R1$,D-2)+"."+MID$(R1$,D-1
)
10110 R1$=S$+R1$:RETURN
10120 D1=INSTR(N1$,".")
10130 IF S1$=S2$ THEN S$=" " ELS
E S$="-"
10140 D1=INSTR(N1$,"."):IF D1=0
THEN D1=LEN(N1$)+1
10150 D2=INSTR(N2$,"."):IF D2=0
THEN D2=LEN(N2$)+1

```

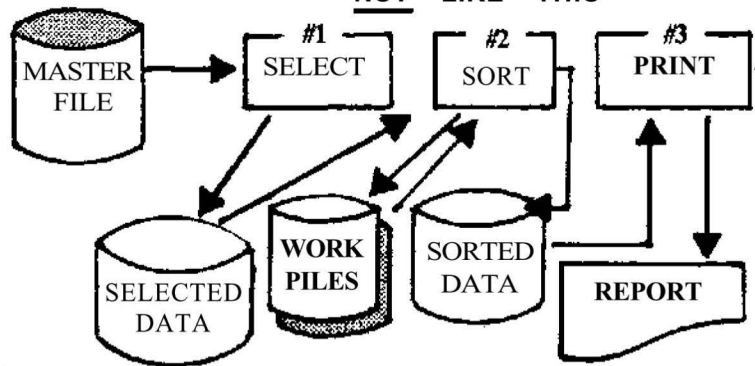

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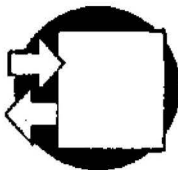
SORTC is a high speed, full-record compounding disk sort, which gives microcomputer users mainframe capabilities. It has been specifically designed to sort data efficiently while offering the user great flexibility in designing sort programs. It is written in BASIC09* for use under OS9.

COMPOUNDING FUNCTION

SORTC has the capability of summing user-specified numeric fields on equality of keys. This allows significant savings in memory, disk space, and program development time. A reduction in the number of disk accesses required when compared to other sorts is inherent in the design of **SORTC**.

DISK BASED

Specifically designed to sort large volumes of data, **SORTC** imposes no size restrictions on the amount of data to be sorted. It also places no limits on the number of sort keys which can be used or the order in which the keys are sorted. Furthermore, the sort procedure can be performed as many times as necessary within the same program. This feature allows the programmer to take advantage of any existing data bias, and possibly even reduce the size of the sort key.



JBM'S MIDWARE

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**Uses the same algorithm as JBM's SORTC for Digital Equipment Corp. RSTS Systems.

ADVANCED DESIGN

While most disk sorts are partially based upon the Fibonacci series, **SORTC** is not. **SORTC** is a generation ahead of the normal sorts based upon the "Fib series". Its unique algorithm is automatically optimized at run time for a reduction in workspace, reduced # of disk accesses and shorter run times. Designed to be as "crash proof as possible, the sort procedure will not abort if it is accidentally asked to sort zero items.

EASY TO USE

It is not difficult to design a program which will use **JBM's SORTC**. Since **SORTC** is a subroutine, the user may write any procedure he or she wants to format the data for sorting and then to process the sorted data. The sorted data need not be written back to disk, but instead is immediately available. The sort code is automatically inserted into the source procedure by a simple Sort Generator.

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SORTC, from **JBM's MID WARE** line of quality software, is available on either five and one-quarter or eight inch diskettes for a price of \$150.00. All of **JBM's** software packages come complete with comprehensive user's manuals.

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```

10160 IF D1>D2 THEN N2$=STRING$(
D1-D2,"0")+N2$:D=D2-D1+D2:D2=D1:
ELSE D=D2-1
10170 D=D-D1+1
10180 N1$=LEFT$(N1$,D1-1)+MID$(N
1$,D1+1):N2$=LEFT$(N2$,D2-1)+MID
$(N2$,D2+1)
10190 N1$="0"+N1$:N2$="0"+N2$
10200 N2$=N2$+STRING$(P+D1-(LEN(
N2$)-D2-1),"0"):R1$=STRING$(LEN(
N2$),"0"):FOR I=1 TO LEN(N2$)-LEN(N
1$):T=VAL(MID$(N2$,I,LEN(N1$))):
R=T/VAL(N1$)
10210 MID$(R1$,I,1)=MID$(STR$(IN
T(R),2):T$=MID$(STR$(VAL(MID$(N
2$,I,LEN(N1$)))-FIX(R)*VAL(N1$)
),2):MID$(N2$,I,LEN(N1$)+1)=STRIN
G$(LEN(N1$)-LEN(T$),"0")+T$:NEXT
10220 IF D<0 THEN R1$="."+MID$(R
1$,2):GOTO 10240
10230 R1$=LEFT$(R1$,D+1)+"."+MID
$(R1$,D+2)
10240 FOR X=1 TO LEN(R1$):IF LEF
T$(R1$,1)="0" THEN R1$=RIGHT$(R1
$,LEN(R1$)-1):NEXT
10250 IF LEFT$(R1$,1)="." THEN R
1$="0"+R1$
10260 FOR X=LEN(R1$) TO 1 STEP-1
:IF RIGHT$(R1$,1)="0" THEN R1$=L
EFT$(R1$,LEN(R1$)-1):NEXT
10270 IF RIGHT$(R1$,1)="." THEN
R1$=LEFT$(R1$,LEN(R1$)-1)
10280 GOTO 10110
10290 IF S1$=S2$ THEN S$=" " ELS
E S$="-"
10300 D1=INSTR(N1$,"."):IF D1=0
THEN D1=LEN(N1$)+1 ELSE N1$=LEFT
$(N1$,D1-1)+MID$(N1$,D1+1)
10310 D2=INSTR(N2$,"."):IF D2=0
THEN D2=LEN(N2$)+1 ELSE N2$=LEFT
$(N2$,D2-1)+MID$(N2$,D2+1)
10320 D=D1+D2:RETURN
10330 P1$=STR$(VAL(MID$(N1$,LEN(
N1$)-J+1,1))*VAL(MID$(N2$,LEN(N2
$)-K+1,1)):IFLEN(P1$)<>2 THENC=
VAL(MID$(P1$,2,1))

```

```

10340 P1$=" "+RIGHT$(P1$,1):T=VA
L(MID$(R1$,LEN(R1$)+1-I,1)):P1$=
STR$(VAL(P1$)+T):IFLEN(P1$)<>2 T
HENC=C+VAL(LEFT$(P1$,2))
10350 MID$(R1$,LEN(R1$)+1-I)=RIG
HT$(P1$,1):Q=I
10360 IFC=0 THEN10100
10370 Q=Q+1:T=VAL(MID$(R1$,LEN(R
1$)-Q+1,1)):P1$=STR$(T+C):IFLEN(
P1$)=2 THENC=0:GOTO10400
10380 P1$=STR$(T+C):IF LEN(P1$)=
2 THEN C=0:GOTO 10400
10390 C=VAL(LEFT$(P1$,2))
10400 MID$(R1$,LEN(R1$)-Q+1)=RIG
HT$(P1$,1):GOTO10360

```

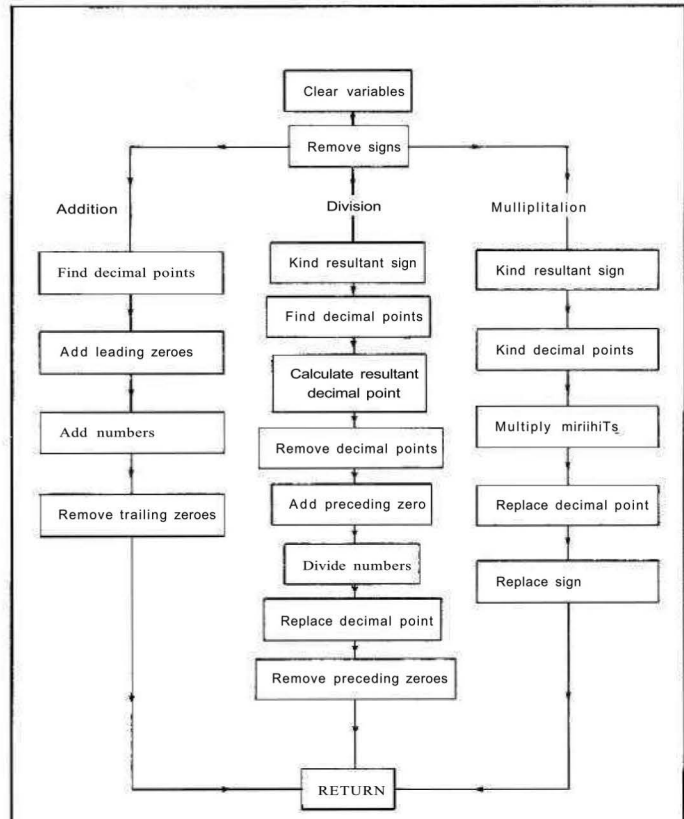
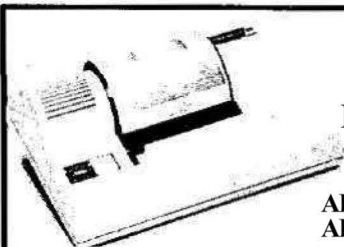


Fig. 1. Math Routine Flowchart



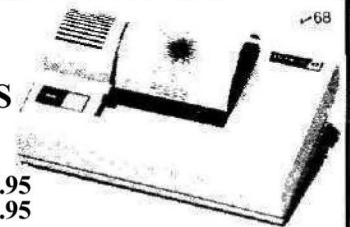
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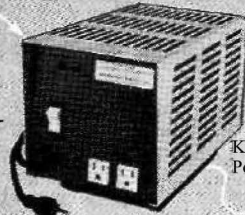
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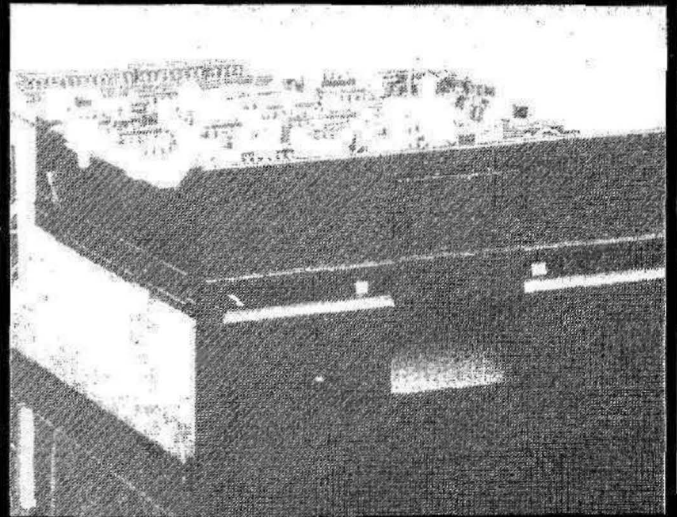
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The program incorporates the motor/audio capabilities of the Color

This spelling program features a vocal presentation that you record and positive reinforcement.

Computer to call out spelling words through the TV speaker.

The computer reads the target word from data lines and checks the student's spelling against that standard. If spelled correctly, the program compliments the

System Requirements

16K RAM
(4K with modification)
Color Basic

Program Listing. Hear Here!

```

10 ' ***HEAR HERE***SPELLING GAME
20 ' (CLOAD AS "HEAR")
30 REM: ENTER NUMBER OF WORDS AS
  'N=##' ON LINE 950 (MAXIMUM OF
  50)
40 REM: ENTER SPELLING WORDS ON
  DATA LINES STARTING LINE 1000
50 REM: RECORD LIST OF WORDS ON
  SEPERATE 'WORD LIST' CASSETTE,
60 'SAYING EACH WORD TWICE AND P
  AUSING BETWEEN WORDS
70 'PUT DEMO SENTENCE BETWEEN TW
  0 PRONOUNCIATIONS IF DESIRED.
80 'BY TOM W. JONES
90 '608 KENSINGTON STREET
100 'LAKELAND, FL 33803
110 CLEAR 1000: P=0:T=0:D=0:J=0
120 DIM R$(50), P$(50), T$(50),
  G$(50)
130 A$=" PRESS <ENTER> TO HEAR N
  EXT WORD
140 B$=" THEN PRESS <ENTER> AFTE
  R WORD IS SAID SECOND TIME.
150 C$=" NOW PLEASE TYPE THE W
  ORD:
160 'GOSUB 950
170 CLS
180 'PRINT:PRINT" HERE IS THE G
  AME OF
190 PRINT:PRINT" HEAR HERE
  !
200 PRINT:PRINT:PRINT" GIVE A L
  ISTEN, OK?"
210 PRINT:PRINT"
  AND HAVE FUN"
220 PRINT:PRINT:PRINT:PRINT:PRIN
  T" PRESS <ENTER>":INPUT X$
230 CLS:PRINT:PRINT" PLACE 'WOR
  D LIST' CASSETTE IN PLAYER AND
  REWIND TO BEGINNING
240 PRINT:PRINT" THEN PRESS <PL
  AY> BUTTON
250 PRINT:PRINT" THEN TURN- UP V
  OLUME ON SCREEN OF THE COMPUTE
  R
260 PRINT:INPUT" PRESS <ENTER>
  WHEN READY";X?
270 '***LISTEN***
280 CLS:PRINT:PRINT" PRESS <EN
  TER> TO LISTEN TO FIRST
  WORD": GOTO 310
290 PRINT
300 PRINT A$
310 PRINT:PRINT B$
320 INPUT X$
330 MOTOR ON: AUDIO ON
340 INPUT X$
350 AUDIO OFF: MOTOR OFF
360 PRINT:PRINT C$:PRINT
370 '***INPUT***
380 T=T+1

```

Listing continued

student with both video and audio routines and moves on to the next word.

If the learner spells the target word incorrectly, the CoCo sounds a "raspberry" and immediately erases the misspelling to avoid visual reinforcement of errors. It then displays the correct spelling, with a prompt to copy it three times. An incorrect typing here gets an "Oops, type it again." When the student has correctly typed the word three times, the computer moves on to the next word.

The program retains all misspelled words in memory for review. After the student has gone through the list, prompts instruct him that a missed word will be flashed on the screen for three seconds when enter is pressed. Arrows focus attention to the point at which the word will appear on the screen.

change tapes and prepare Word List to play in the recorder. Prompts within the program will now activate the cassette player to pronounce the target words through the TV speaker.

Keep in mind that separate Hear Here! and Word List tapes can be prepared for each child in the family, and can be updated with a new spelling list weekly, or as often as a new assignment is brought home.

In the classroom, the teacher must record the list only once, but it can be called out any number of times. The children can then use this program as a learning game without adult attention.

In home or classroom, a child with a particular spelling problem will find

that the review routine of flashing word and intermittent attention tone does indeed mentally set the correct spelling.

The Program Listing contains a number of remark lines, which will help in following the flow as it is written. Of course, these can be omitted when entering.

The program as listed is written for 16K. I think it will fit on a 4K machine if you delete lines 20-70, 270, 370, 430, 510, 650, 890; change the CLEAR 1000 to CLEAR 500 in line 110; and change each (50) to (25) in line 120. However, the word-list capacity is then reduced from 50 to 25. •

Address correspondence to Tom W. Jones, 1320 West Hill Road, Flint, MI 48507.

"Speaking very distinctly, pronounce the word, and use it in a sentence (optional). Then repeat the word."

The correct spelling appears and flashes 12 times in the three seconds, accompanied by a high-pitched beeping. Both the intermittent flashing and the attention tone tend to set the correct spelling in the student's memory bank.

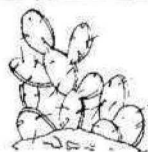
The screen then displays the correct spelling of the reviewed word, and the program advances to the next word for review. An incorrect spelling returns the screen to the flashing corrected spelling.

Once the review is finished, the CoCo gives the affirmation, "I'll bet you know every one of the words."

The mechanics of the program are reviewed in remark lines 30, 40, and 50. To prepare the program for use, enter the total number of words (up to 50) as N = ## on line 950. Next, enter the correctly spelled words as DATA statements, beginning on line 1000.

Now, using a separate cassette (which might be labeled Word List), record the spelling list for calling out. Speaking very distinctly, pronounce the word, and use it in a sentence (optional). Then repeat the word. Allow a pause of about four seconds and proceed to the next word. Continue on through the end of the list.

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Each of the seven programs fills 16K of memory and each covers one aspect of music reading completely. These programs are complete in themselves — a student can use them without reference to an instruction manual. This means that no knowledge of the computer is needed. Also, all staffs and notes are shown on the screen just as they appear on the sheet of music. The graphics are fantastic! The rhythm program is a good example. After a few lines of on-screen instructions, the student is shown a staff containing three measures of music. The notes are of different lengths, forming a rhythm, and the student taps the rhythm on the space bar. If you tap it incorrectly, the program not only tells you it was w-cng, it actually shows you the staff of notes you played. By comparing this staff to the one you intended to play (both are on the screen together), it is easy to see where you went wrong, and all of this is done in full high resolution graphics.

These programs were written by a professional musician who teaches music and directs the band program at a college, so you can trust them to be educationally correct. That they are also fun to use is certainly a bonus. If you've always wanted to learn to read music let your computer and the Music Reader join you. You'll be reading music like a pro before you know it!

The tape version of this package consists of seven different programs and requires 16K of memory with extended BASIC. The disk version consists of the same seven programs driven by an interactive menu for ease of use and requires 32K with disk extended BASIC. Tape — \$34.95; Disk — \$39.95

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Listing continued

```

390 READ R$(T)
400 INPUT"          "; T$(T)
410 IF T$(T)=R$(T) THEN 440
420 IF T$(T)OR$(T) THEN 520
430 '***RIGHT***
440 J=J+1
450 PRINT:PRINT"  THAT'S RIGHT -
- VERY GOOD"
460 FOR S=90 TO 220 STEP 8
470 SOUND S,1:NEXT S
480 CLS: IF J=N THEN GOTO 900
490 IF T=N THEN 660
500 GOTO 290
510 '***WRONG***
520 P=P+1: D=D+1: P$(P)=R$(T)
530 CLS:PRINT:PRINT"  SORRY - T
HAT'S WRONG
540 SOUND 5,12
550 PRINT:PRINT"  HERE'S THE RIG
HT SPELLING:
560 PRINT @ 202, R$(T)
570 PRINT:PRINT"  PLEASE TYPE IT
RIGHT 3 TIMES  PRESS <ENTER>
AFTER EACH TIME
580 M=1:PRINT
590 INPUT L$(M)
600 IF L$(M)=R$(T) THEN 610 ELSE
620
610 M=M+1: IF M=4 THEN 480 ELSE

```

```

590
620 PRINT"          OOPS - BE MORE
CAREFUL          AND TYPE IT AGA
IN:
630 SOUND 5,3
640 GOTO 590
650 '***REVEIW***
660 G=1:CLS:PRINT"  THAT'S ALL T
HE WORDS
670 PRINT"  AND YOU ARE DOING FI
NE.
680 PRINT:PRINT"  NOW FOR REVIEW
I WILL SHOW
690 PRINT"  YOU EACH WORD YOU MI
SSED.
700 PRINT:PRINT"  I WILL FLASH I
T ON SCREEN FOR 3 SECONDS
-- THEN YOU TYPE
IT.
710 PRINT"  PRESS <ENTER> WHEN R
EADY
720 PRINT@354,">>>>>
730 INPUT X$
740 FOR H=1 TO 12
750 PRINT@360,P$(G)
760 SOUND 200,3:CLS:NEXT H
770 CLS: PRINT:PRINT:PRINT:PRINT
780 PRINT"  NOW YOU TYPE THE WOR
D:"
790 PRINT:INPUT G$(G)
800 IF G$(G)=P$(G) THEN 820 ELSE
810
810 CLS:PRINT:PRINT:PRINT"          0
OPS - TRY AGAIN:" :SOUND 5,3:GOTO
700
820 IF G=D THEN 850 ELSE G=G+1
830 CLS: PRINT:PRINT"          YOU GOT
IT          HERE'S
THE NEXT ONE:
840 GOTO 700
850 CLS: PRINT:PRINT"          YOU GOT
IT!
860 PRINT:PRINT"          AND THAT'S AL
L
870 PRINT:PRINT"          I'LL BET YOU
KNOW          EVERY ONE OF
THE WORDS.
880 PRINT:PRINT"          BYE, BYE FOR
NOW":END
890 '***ALL RIGHT***
900 CLS:PRINT:PRINT"          THAT'S A
LL THE WORDS
910 PRINT:PRINT"          YOU GOT THEM
ALL RIGHT
920 PRINT:PRINT"          V E R Y  G
O O D !
930 PRINT:PRINT"          THAT'S AN
A+":END
950 N=10
960 RETURN
1000 DATA FREQUENT, RADIO, STEAK
1010 DATA HAPPY, DRIVE, CHORES
1020 DATA FLORIDA, POSSIBLE, TEL
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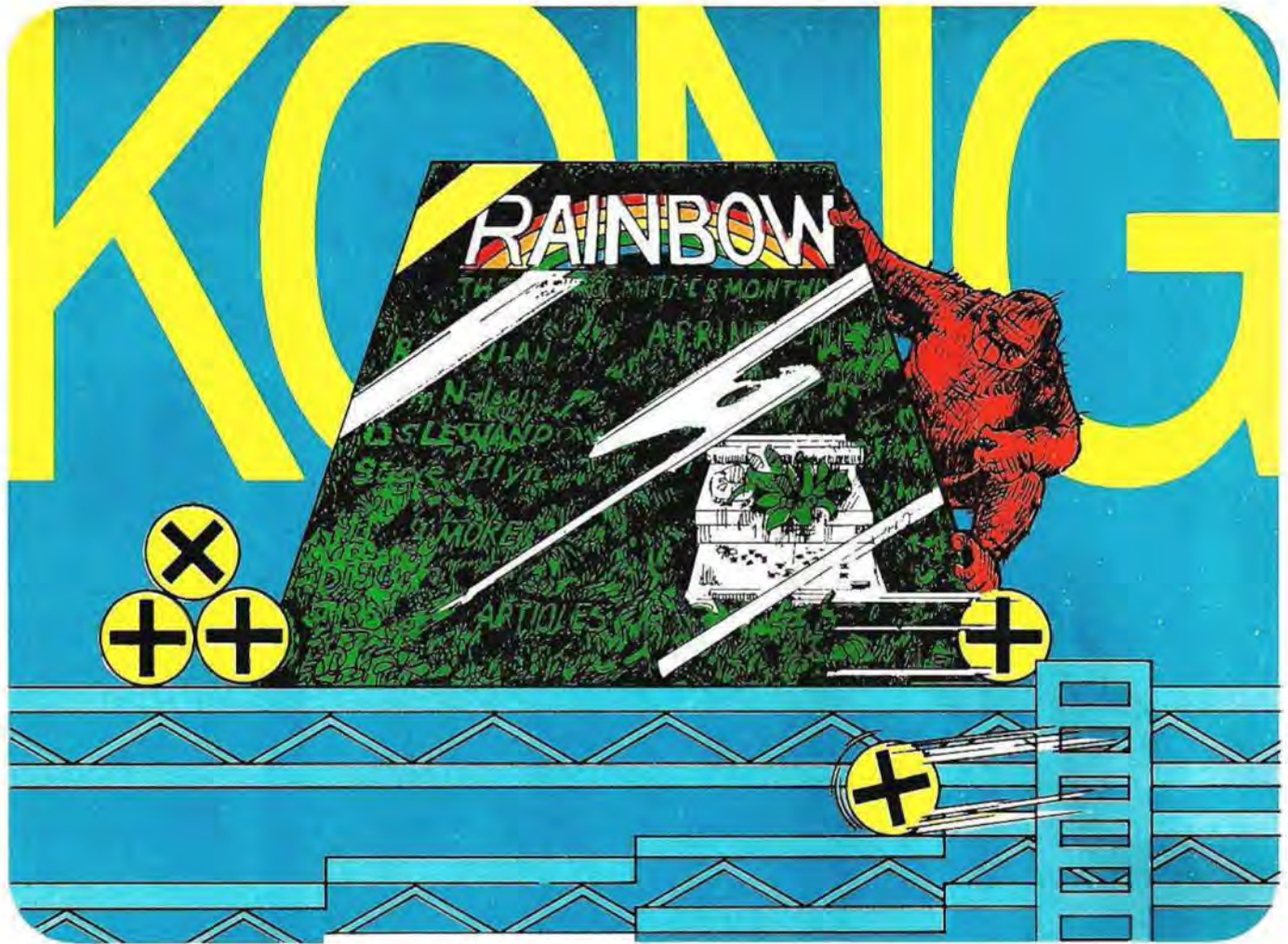
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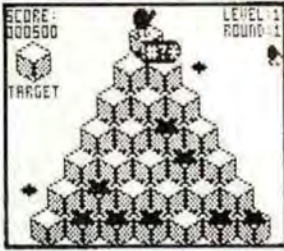
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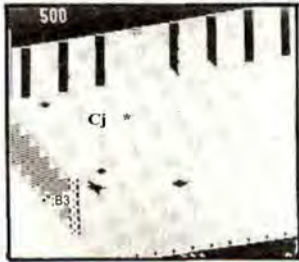


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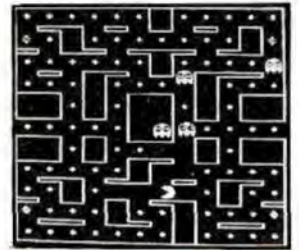


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We originally planned to sell this major piece of programming for about \$40.00 but decided it was so useful that no 'Real Talker' user should be without it. Besides, it really shows off the capability of 'Real Talker'.

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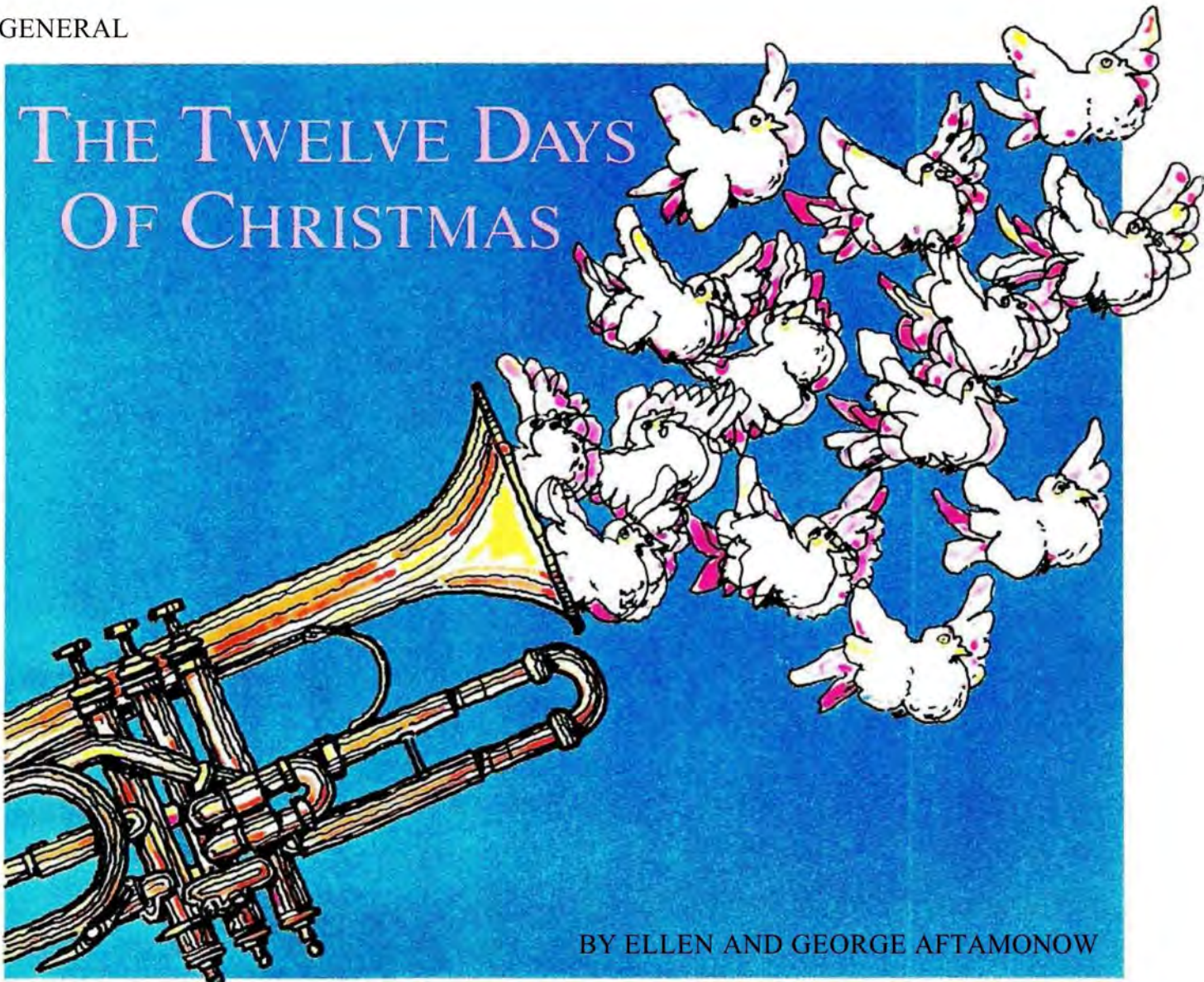
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The Twelve Days of Christmas is a musical graphics program that uses the commands DRAW, LINE, CIRCLE, GET, PUT, PSET, and PAINT to draw the objects on the screen. Early in the program, when there are only a few gifts, I used the DRAW statement. As the screen fills,

Use this program to add some cheeriness to your holiday season. Merry Christmas from *HOTCoCo*.

the GET and PUT statements move the objects. See Table 1 for a line description.

The song that plays as the program executes changes an octave after the first run.

The last gifts are listed first; the program continues to run until the partridge in a pear tree appears on the screen. Once you key in the program, the CoCo can entertain your holiday guests. •

Address correspondence to Ellen and George Aftamonow, 46 Howe St., Milford, CT 06460.

10	Reserves space for strings	530-570	Drummers drumming
20	Dimensions used for the gifts in the song	580-620	Maids a-milking
30-190	Strings for the song	630-670	Swans a-swimming
200-220	Strings for the turtle doves, French hens, and calling birds	680-720	Geese a-laying
230-300	Title and song	730-750	Golden rings
310-350	Author credits	760-780	Calling birds
360	This line runs the whole program	790-810	French hens
370-410	Lords a-leaping	820-840	Turtle doves
420-470	Ladies dancing	850-920	Partridge in a pear tree
480-520	Pipers piping	930-940	Counts the number of run-throughs
		950-980	Animated ending

Table 1. Line Descriptions

System Requirements

16KRAM
Extended Color Bask

```

10 CLEAR1000
20 DIML(1,15),A(1,15),P(1,15),D(
1,15),M(1,15),W(1,15),S(1,15),T(
1,16),B(1,10),K(1,10)
30 S1$="T2L8O2DDL4DL8GGL4GL8F+GA
BO3CO2AL4.B"
40 S2$="O3L8CL4DL8ECO2BGL4AL2.G"
50 S3$="O2L8DDDDGGL4GL8F+GABO3CO
2AL2B"
60 S4$="O3L4DO2L8ABO3L4C"
70 S5$="O2L8BO3CL4DL8ECO2BGL4AL2
.G"
80 S6$="O3L4DO2L8ABO3CO2A"
90 S7$="O3L2DL8EL4.C+L2.D"
100 S8$="O3L4CO2EG"
110 S9$="O2L8AGF+EL4D"
120 P$="O3L8DDO2ABO3CO2A"
130 P1$="O2L8DL16DDL8DDGGL4GL8F+
GABO3CO2AL4.B"
140 P2$="O3L8DDO2ABO3CO2A"
150 P3$="O2L8DDL4DL8GGL4GL8F+GAB
O3CO2AL2B"
160 P4$="O4L8DDDO3ABO4CO3A"
170 P5$="O2L4DO1L8ABO2CO1A"
180 P6$="O4L8DDO3ABO4CO3A"
190 K$="T3O2L4DGL8GAGF+L4EEEEAL8A
BAGL4F+DDBL8BO3CO2BAL4GEL8DDL4EA
F+L1G"
200 T2$="S8C8LEND5ERN2FNG2DNG2
DNG3DNG2FNG2RNG3RNG3RNG4RNG4E2DG
2NG2DGLGC8D2LBEBUC5L2HC8D3NLBU3C
5HNE2HU2EHREBD4C7F2R2"
210 F3$="S8C8LEC5URC8NUNEC5FC8NE
C5DNGFGRNG2C8ER2FD2H2LBDRFBLBHC5
GC8D2LNLU2C5NRNE2LHNEU2NU2NRNEUR
2"
220 C4$="S8C8FNGC7URFDLHNEBDG2B
DE2BRG2BDE3BRG3BRC8ND3C7E3BEBRG4
C8D3NL2C7BR2BU4E4"
230 PMODE3,1:SCREEN1,1:PCLS6
240 DRAW"BM40,80;S8C5H2U11LNGERF
D13NEBR4 NEU2E6U4H2G3FE3F3D2G6RF
BLNL2FBUR2FNE2NL3BR12 NGNR7ENR7B
LERENU9BLNGU3NLU5EL2HNHR7F2ND9BL
ND10HL2NL2D11R3NEGBR7"
250 DRAWLHU3ED4FEU2NH2U3L3ER2FD
6NHNEBR6 LHU5HNGRFND6BR3ND4HRFD3
G5D2FR2BE3BU E2R4BHNE2HNE2NU3HU2
ER4NEGNL3BGF2G3NL4BR19"
260 DRAWL2HNU5HU3E2RNF2RF2D3GNU
4GBR7 LHU7L2ERU2E2RDLGD2RDL7FE"
270 DRAW"BM42,120;C5L5H3U8ENE2D9
NF2E2NEU6END6ENRER4GL3D12NL3R3NE
GBR8 HEU10ENED12GBR5NG3U7HNG3RFD
6GBR9"
280 DRAW"LHU6HNGRF2E2F2LHG2D4FNE
BR10 LHU6HRBURUGBDFD6FBR4 NGNR4E
R4BHNE2HNE2HU2END4HR3NEGL3BF2F2G
3BR13 LHU11LE2D3R2DL2D9FNEBR6"
290 DRAW"HU7NGFDNE2D6EBRNFU7FDNE
2D6EBRNFU7FD7NEBR8 L2HU3ED3F2ENF
U3H2GBU3NR2GR3FND2BRNH2D6NEBR4 E

```

```

2R4BHNE2HNE2NU3HU2ER4NEGNL3BGF2G
3NL4"
300 PLAYK$
310 PMODE3,1:SCREEN1,0:PCLS:DRAW
"BM50,60;S12L3NU3LU6R4DBD3D2BR4
NU3LU3NR3U3R3D3RD3BR6 L2NU3LU3NR
3U3R3BD6BR4 LU3RND3U3R2D3NL2RD3B
R5 NU3LU3NRU3NL2R2BD6BR5"
320 DRAW"L2NU3LU3NR3U3R3BD6BR4 N
U3LU3NRU3R2FD4GLBR15 L3NU3LU3NR3
U3R3D3RD3BR5 NU3L2U3NR3LU3BR4D3"
330 DRAW"BM32,100;S12L2NU3LU3NR3
U3R3BD6BR4 LU3NU3RD3R2BR3 LU3NU3
RD3R2BR5 L2NU3LU3NR3U3R3BD6BR4 N
U3LU3NRU3R4D6BR7 BUUNRLUNR2URNUR
BD4BR9"
340 DRAW"L2NU3LU3NRU3R3BD3NLD3BR
6 L2NU3LU3NR3U3R3BD6BR4 NR2NU3LU
3NRU3R3D6BR4 NU3LU3NR3U3R3D3RD3B
R6 L2NU3LU3NRU3R3BD3NLD3BR6 L2NU
3LU3NR3U3R3BD6BR4"
350 DRAW"BM40,140;S12LU3RND3U3R2
D3NL2RD3BR5 NU3LU3NR3U3R3BD6BR5
NU3LU3NRU3NL2R2BD6BR5 LU3RND3U3R
2D3NL2RD3BR5 NU3LU3NRU3R2ND6R2D6
BR5 NR2NU3LU3NRU3R3D6BR4 NU3LU3N
RU3R4D6BR5 NR2NU3LU3NRU3R3D6BR4
LU3NU3RD3RNU4R2U6"
360 PLAYS1$:GOSUB850:PLAYS3$:GOS
UB820:PLAYP3$:GOSUB790:PLAYP3$:G
OSUB760:PLAYP3$:GOSUB730:PLAYP3$
:GOSUB680:PLAYS3$:GOSUB630:PLAYS
3$:GOSUB580:PLAYP3$:GOSUB530:PLA
YP3$:GOSUB480:PLAYP1$:GOSUB420:P
LAYP3$:GOTO370
370 PCLS2:SCREEN1,0
380 DRAW"BM36,36;S4C3NR2HUHUNU2N
HC4L10BR2ER6HR4ND6RC4ULU2ER2D4C3
LNL6R2U6NLR2ND2R2ND2C4F6D2NR2H6
C3L2DGDGC1F4DNDC4F3R5C1F2DH2C4L5
H3C1L2NU4L2NU6L2NU6L2NU4C4L4G3C1
GL4UR4C4E4R3C1NFHE2U2"
390 GET(24,26)-(55,47),L,G
400 FORY=26TO161STEP58:FORX=24TO
200STEP58:PUT(X,Y)-(X+31,Y+21),L
,PSET:NEXTX,Y
410 PLAYS6$
420 PCLS7:SCREEN1,1:B=B+1:IF B>1
THEN450
430 DRAW"BM40,35;S4C6ENR3C8NU4HU
2E3ND2R2ND2F3D2GNU4C6L3ND14C5HND
HUERN4RFDGNDGGBR3C6FC5F3E3RNEG4H
3C6NULGNU3GD2FND7F2ND5F2ND3F3L7C
5F7C6NDRNEGHC5H7C6NRL2NLC5D8C6NL
DL2NLEBU8L7E3ND3E2ND5E2ND7EU2HNU
3HLNUC5L4U7"
440 GET(35,28)-{58,57},A,G
450 FORY=28TO190STEP110:FORX=35T
O230STEP55:PUT(X,Y)-(X+23,Y+29),
A,PSET:NEXTX,Y
460 FORX=46TO210STEP69:PUT(X,83)
-(X+23,112),A,PSET:NEXTX

```

Listing continued

Listing continued

```
470 IF B=1 THEN PLAY P2$ ELSE PL
AY P4$
480 PCLS1:SCREEN1,0:C=C+1:IF C>1
THEN510
490 DRAW"BM34,74;S8C2R2C3H4E3C2H
2UC4NEC2F2EC4HC2NH3C4ERDGC2RNG2D
NG2DGC3G2LNE2F3D"
500 GET(30,48)-(40,74),P,G
510 FORY=48TO120STEP70:FORX=30TO
250STEP46:PUT(X,Y)-(X+10,Y+26),P
,PSET:NEXTX,Y
520 PLAYS6$
530 PCLS2:SCREEN1,0:D=D+1:IF D>1
THEN560
540 DRAW"BM52,24;S8C3RC4HEFGC3NG
RNG2DNG2DNGDC1E3BL3C3F2C4FBLC1NL
4DNL6DL2NL2C3D4FL2NU5L2EU4C1L2U2
R2C3U3G2C4GC1BU3F3"
550 GET(46,20)-(64,44),D,G
560 FORY=20TO144STEP62:FORX=46TO
194STEP74:PUT(X,Y)-(X+18,Y+24),D
,PSET:NEXTX,Y
570 IF D=1 THEN PLAY S6$ ELSE PL
AY P5$
580 PCLS6:SCREEN1,1:E=E+1:IF E>1
THEN610
590 DRAW"BM38,52;S4C7R2ND4C5NU4H
2E2U2E2ND4R2ND2R2ND4F2D2ND4F2G2C
```

```
7ND4L4NL4C8NU6H2U2E2F2D2G2C7ND18
BR4R2DNDC8F3D6C5F2D10L2NU8L2NU8L
U10E2C8BU6H2C7G4NU6D2ND10F2D8LNL
C8D8C7NLFHND8BU8C7L4NLC8D8C7NDNL
GLEBU8C7LU8E2ND10U2NU6H4NU2C8G2D
6C5F2D10L2NU8L2NU8LU10E2"
600 GET(32,44)-(55,79),M,G
610 FORY=44TO130STEP70:FORX=32TO
200STEP55:PUT(X,Y)-(X+23,Y+35),M
,PSET:NEXTX,Y
620 PLAYS6$
630 PCLS6:F=F+1:IF F>1 THEN660
640 DRAW"BM110,90;S8C8E2C5ELGDRE
NUNDFNL2NGDNDNG2DG2NGDNGD2HR2NNGR
NGERNG2ERNG3ERNG4RNG4RNG4RNG4DNG
3DNG2DNGRNEG":PSET(113,87,7)
650 GET(108,80)-(144,104),W,G
660 FORX=40TO120STEP40:PUT(40,X)
-(76,X+24),W,PSET:PUT(180,X)-(21
6,X+24),W,PSET:NEXTX:PUT(108,80)
-(144,104),W,PSET
670 IF F=1 THEN PLAY P$ ELSE PLA
Y P6$
680 PCLS6:G=G+1:IF G>1 THEN710
690 DRAW"BM69,64;S8C8LEND5ERNG2
NGFNLNLDNGDNG2NGDNGDNGDNGRNG2ERNG
3RNG4RNG4RNG4FNG3RNG3ERG4LC8D2LB
U2C5NRNE3LC8D2LBU8E5NE3NR2L3HU5
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E2ULNEL":CIRCLE(87,85),3,5,.5
700 GET(65,60)-(91,86),S,G
710 FORX=65TO165STEP50:PUT(X,60)
-(X+26,86),S,PSET:PUT(X,108)-(X+
26,134),S,PSET:NEXTX
720 PLAYS6$
730 PCLS6
740 CIRCLE(84,84),20,8:CIRCLE(12
4,84),20,8:CIRCLE(164,84),20,8:C
IRCLE(104,108),20,8:CIRCLE(144,1
08),20,8
750 PLAYS7$
760 PCLS6
770 DRAW"BM60,48;XC4$;BM172,48;X
C4$;BM60,120;XC4$;BM172,120;XC4$
;"
780 PLAYS4$
790 PCLS6
800 DRAW"BM48,92;XF3$;BM116,92;X
F3$;BM180,92;XF3$;"
810 PLAYS8$
820 PCLS6
830 DRAW"BM72,88;XT2$;BM160,88;X
T2$;"
840 T=T+1:IF T=1 THEN PLAY S4$ E
LSE PLAY S9$
850 PMODE3,1:SCREEN1,1:PCLS5
860 DRAW"BM128,100;S8C6UHLHLHL3H
    
```

```

L5HL2GLG2L2DFRFRFRFRFR3FR2FR3E2R
E"
870 PAINT(112,102),6,6
880 GET(82,88)-(128,106),T,G
890 PUT(82,88)-(128,106),T,PSET:
PUT(76,108)-(122,126),T,PSET:PUT
(124,106)-(170,124),T,PSET:PUT(1
30,84)-(176,102),T,PSET:PUT(112,
56)-(158,74),T,PSET
900 DRAW"BM120,166;S8C7NU22G5NL2
RNE5RENE3RENERNU34RNU35RNU2 9RNHF
RNH3RNH4FR2BLH5U19NE4UNE3U5BM128
,100;NE3NU14BLBU2NU12BRBU7NE5UNE
4BD10DNE4D3BGNU4BLNU4LNH2DNH3D2"
910 DRAW"BM94,88;S8C8U3C7NE2LNE3
UNE2LNE2UENEUNEUNEHC8NGC7NRUERNE
2NG2NR2D5R2BR2NG3RBEG2"
920 P=P+1:IF P=1 THEN PLAY S2$ E
LSE PLAY S5$
930 IF P=12 GOTO950
940 RETURN
950 DRAW"BM94,89;C5U3":GET(88,62
)-(108,82),B,G:GET(0,0)-(20,20),
K,G
960 FORX=88TO0STEP-2:PUT(X,62)-(
X+20,82),B,PSET:NEXTX:PUT(0,62)-(
20,82),K,PSET
970 PLAYK$
980 CLS:END
    
```

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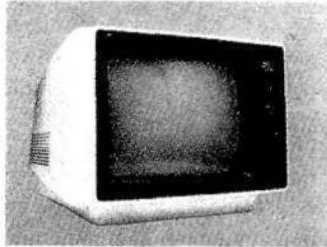
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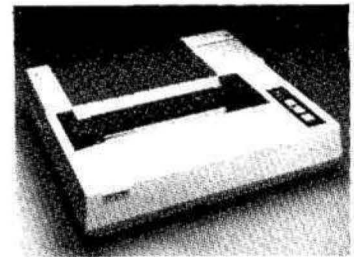
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Photo 1. The Dragon by Tano has an attractive color and a distinctive shape.



Photo 6. The 64K CoCo comes with an off-white case identical in shape to its predecessor's. The external changes make for a much more aesthetically pleasing appearance.



Photo 2. The Dragon's keyboard is full sized and typewriter-like.



Photo 7. Radio Shack also improved the CoCo's keyboard. The keys are sculpted, giving the typist a better feel.

the Dragon is very much like the Color Computer. Nearly every command that the Radio Shack CoCo recognizes is listed in the Dragon's manual. The Basic is virtually identical to Extended Color Basic, which is not surprising since Microsoft supplies it. However, there is one command that is not mentioned anywhere in the Dragon's manual—DLOAD. Perhaps Tano had as much trouble getting it to work as Tandy did. The Dragon does recognize the command as a valid Basic statement.

One would think that because the Dragon's Basic is identical to Radio Shack's (both were written by Microsoft) and since they both use the 6809E processor that Tano just made a copy of the insides and changed the case. This is not really true. Upon power-up the Dragon gives a completely different, if somewhat misleading, message:

*"Nearly every command
(hat the Radio Shack
CoCo recognizes
is listed in
the Dragon's manual.
The Basic is
virtually identical to
Extended Color Basic..."*

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Of course, there is actually 64K (24,871 when you do a PRINT MEM and 31,025 when immediately after power-up you do a POKE25,6:NEW).

Also, Tano has designed the Dragon

so that upon power-up it is configured like the Dragon-32 (to make use of the wealth of software for the Dragon-32). By typing EXEC you can reconfigure the Dragon (changing memory addresses and RAM locations), freeing up a total of 41,241 bytes of memory. If you do a POKE 25,6:NEW before typing EXEC, you have 47,385 bytes after you print MEM!

Since the Basic is the same, any programs that are entered on the keyboard that were written for the CoCo should run perfectly on the Dragon. Programs in machine language and ROM-cartridge-based programs might give problems. The tokenization of the Basic keywords differs on the Dragon, so you cannot CLOAD CoCo programs into it.

Of the half-dozen or so programs tried on the Dragon, only a few worked and those did not work perfectly. Most



Photos 3 and 4. (upper and middle left) From the right side, the Dragon has (from left to right) a TV socket, reset button, left joystick port, cassette port, right joystick port, serial I/O port, and a parallel printer port. The back side has, from left to right, a power-pack socket, channel-select switch, and the monitor socket. The ROM cartridge port is on the left side, which is not shown.

Photo 5. (lower left) The Dragon's innards are much less cluttered than the 64K CoCo's, due mainly to the former's external power supply.

Photo 8. (upper right) At first, there appears to be little changed inside the new CoCo, but closer inspection reveals that most of the chips have been upgraded. The RF shielding has also been improved.

Photo 9. (lower right) There has been no change in the number of ports on the 64K CoCo. From left to right, they are the reset button, TV socket, channel-select switch, cassette port, serial I/O port, right joystick port, left joystick port, and the on/off switch.

would not run at all and the ones that did would either lose color and sound or just color. Only Megabug from Radio Shack seemed to work without fault.

When you open the Dragon (there are only four screws holding it together, but each one has a warning label stating, "Breaking this seal invalidates the guarantee"), it becomes apparent that the only thing in common with the Tandy CoCo is the 6809E and the Microsoft Basic (Photo 5). Inside there is an inter-

national collection of chips from Japan, West Germany, Malaysia, Korea, Portugal, and the United States. There is an oversized heat-sink, which is a plus, but nearly every chip is soldered rather than socketed, which could make any repairs more difficult.

Those who are used to the insides of the CoCo will find a rather simple, almost stark and empty interior in the Dragon (Photo 5). With no internal power supply, the Dragon looks very

open and uncluttered. There is so much extra room inside the Dragon that it is a wonder they didn't make the whole unit smaller. The keyboard could easily fit over the main board (there is nothing under the keyboard except air). The Dragon could have been made one-third smaller and still have plenty of air circulation inside.

There are a few drawbacks with the Dragon. First, the software incompatibility is not a minor drawback because

Advantages: Dragon by Tano

- Video output port built in
- Parallel output port built in
- Full-sized keyboard
- External power supply, making the Dragon lighter—combined with the oversized heat-sink and the extra space inside, the Dragon should run cooler
- Radio Shack joysticks compatible
- Works with almost any cassette player that has motor, microphone, and auxiliary ports
- Microsoft Basic will run most program entered directly on keyboard
- Plans for many peripherals, including OS-9
- Full 64K RAM
- Simple circuit board layout
- Concise manual
- Repeating keys
- Extended Basic standard

Disadvantages: Dragon by Tano

- Not compatible with existing CoCo software or hardware
- Soldered chips instead of socketed will make repairs more difficult
- Limited availability of service centers, at present
- No door on ROM cartridge port
- Switches on both left side and back side (should not be much of a problem once the arrangement becomes familiar)
 - External power supply could be considered a disadvantage in that it means more clutter on an already too cluttered desk top, and taking the Dragon anywhere will involve extra cable tangles, which could cancel the advantage of a lighter computer

Advantages: 64K Color Computer

- Full-sized keyboard
- Extended Basic standard
- 64KRAM
- ROM fixes
- Compatible with almost all existing software
- Numerous Radio Shack service centers
- Upgraded ROM chips
- Cleaner internal layout
- New RF shield design
- OS-9 operating system and Basic-09
- Radio Shack warranty
- Many software and hardware vendors already producing products for the CoCo
- White case

Disadvantages: 64K Color Computer

- No video output port
- No parallel output port
- Keyboard soldered rather than socketed
- Standard Radio Shack problems (availability, detailed information, no memory maps, etc.)
- Old Radio Shack manuals could stand a great deal of improvement

Table 1. This is how the pluses and minuses of the Dragon by Tano and the 64K Color Computer compare.

only a few vendors are selling CoCo programs that will run on the Dragon.

Another drawback is the lack of peripherals. Tano says that it is going to be marketing numerous hardware peripherals (and software) at almost the same time the Dragon hits the stores, but it is certain that there is going to be a time lag between the release of the Dragon and the release of this hardware. It will

also take some time before outside sources adapt their products to the Dragon.

One final drawback is serviceability. There might not be many Dragon dealers able to repair it should anything go wrong.

If things go well for Tano, this problem will be overcome as will the other problems. Tano has big plans for the

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future (including an OS-9 disk system), and I think the Dragon stands a good chance in America.

64K CoCo

There is not a lot to say about the 64K CoCo except that it is the Rolls Royce of Color Computers. The changes that have been made are all understated refinements proving that Tandy has been listening to Color Computer owners all along. It also proves that Tandy is not about to give up on the Color Computer. Where the MC-10 might have been considered a "toy-like" version of the Color Computer, the 64K CoCo is a clean, high-powered upgrade.

On the outside there are only two changes from the old CoCo (Photo 6). First is the color. The 64K CoCo is an off white in a simpler case (actually an older model case with raised lettering on the back instead of stenciled letters).

The nameplate is centered instead of off to one side, and there is no extra button on the top with 64K RAM. The second change is the keyboard (Photo 7). Radio Shack calls it an electric typewriter-quality keyboard. The keys are not much bigger than the old-style

CoCo keys (if at all) and they still do not have a full-travel keystroke, but the design and shape of the keys make it much easier to type on.

Radio Shack, is planning to sell the keyboard separately to owners of the old CoCo at a price much lower than any of the other commercially available keyboards. The price is hard to pass up, but there are still advantages to those other keyboards.

Externally these are the only differences, and apart from the 64K there is not much internally that an owner of the old CoCo would notice. Every piece of software (cassette based, machine language, and ROM cartridges) tried worked perfectly. There are no new ports (Photo 9), no new peripherals except a new disk drive, and they even supply exactly the same manuals, though they include a page that states that some game programs will not work properly unless you hold down the shift key.

What is the big difference? When you open the 64K CoCo, you find that nearly every chip is an upgraded version of the chips used in the old CoCo and some of the chips are completely changed

(Photo 8). The RAM chips are housed under a special RF shield box. The power supply and even the cassette input ports are relay triggered for solid connections. (You can hear the switches close when loading tapes or turning on the computer.) These new or upgraded chips have solved some of the problems that the old CoCo suffered from, such as changing PCLFAR in a program and a nonworking DLOAD command.

But perhaps the biggest change is not in the 64K CoCo at all. The OS-9 operating system and Basic-09 put the new 64K CoCo on another plane. Features such as multitasking, timesharing, a resident editor/assembler interactive compiler, and debugger give the CoCo capabilities not found on other machines in its price range. (*HOT CoCo* will have an in-depth review on OS-9 and Basic-09 in an upcoming issue.)

The only disadvantage, internally, is that the keyboard cable is soldered to the main board rather than socketed. This is easy enough to correct, but is surprising that they didn't think of it while putting it together. (There is also the question raised about the keyboard selling separately. Will there be an

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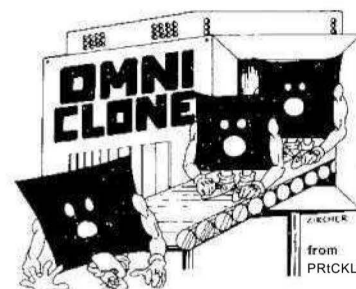
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adapter sold for people with E or earlier boards the same way that other keyboard manufacturers supply adapters?)

The new 64K Color Computer has few oven changes apart from the color of the case and the keyboard, but the few subtle changes that have been made are enough to set the 64K CoCo far ahead of its predecessor, perhaps even in another class.

Overview

The Tano company had a good idea in releasing the Dragon-64 and the Dragon-32 in England when the cost of an imported Radio Shack CoCo was prohibitive. It might be a good idea to

"Looking at the two computers, there are reasons to buy either, but the pros of software, hardware, serviceability, and upgrades of the new 64K CoCo seem to outweigh the advantages of the Dragon."

release another 6809-based computer in America, especially with the 64K, parallel, and video output ports solving some of the problems that Tandy CoCo owners have, but their timing may not be the best.

The Dragon and the new 64K Color Computer from Radio Shack will hit the market at almost the same time (Radio Shack getting a month jump), and with the Tandy name, publicity, and thousands of stores, more people will hear about the 64K CoCo.

Looking at the two computers, there are reasons to buy either, but the pros of software, hardware, serviceability, and upgrades of the new 64K CoCo seem to outweigh the advantages of the Dragon. The Dragon's full-sized keyboard is a definite advantage over the old CoCo keyboard, but the 64K CoCo's new keyboard is more attractive and cancels the advantage.

The Dragon has Extended Basic standard and 64K, which means it compares very well against the old CoCo. But against the new 64K CoCo, the Dragon faces tough competition. ■

An "Interesting Challenge"

How will the Dragon by Tano compete with Tandy's 64K Color Computer? After all, there are Radio Shack stores almost everywhere, while Tano is still trying to get retail outlets. Radio Shack has had years head start in the development of software and hardware for the Color Computer. Tano must import software from England and manufacture their own hardware until outside American companies begin to support the Dragon.

There are other marketing problems that Tano will have to overcome. Tandy is already a well-known, giant company that can spend a great deal of money promoting the 64K CoCo, while Tano must start from scratch.

So how is Tano going to overcome these obstacles? George Merchant, director of sales at Tano, admits that it is going to be "an interesting challenge," but he feels that Tano's marketing plans do entice buyers.

The first thing they are doing is bundling software with the Dragon. The purchaser of a new Dragon will get a software package including:

- CC Writer, a word processing program;
- CC Filer, a data base;
- CC Mailer;
- CC Merger, which ties the word processor, mailer, and data base together;
- CC Calc, a spreadsheet program;
- Dragon Quest and Tower of Fear, adventure games;
- Gold Digger, an arcade-style game; and
- Currier Pilot, a low-resolution game designed as a game programming, tutorial.

Tano will also include a detailed memory map for the Dragon and publish a comprehensive technical manual. They are not stopping there. Tano plans to support the end user as much as possible. They are going to assist user groups and seem most eager to release information about the Dragon, which is something that CoCo owners have wished Radio Shack would do.

Tano plans to have about 150 dealers by Christmas, according to Merchant. They hope to have about 25,000 units in those outlets. In six months, Merchant predicted that Tano would have 500 dealers. Outlets will include Broadway stores, Macy's, Byte Shops, and ComputerLands.

There is a 90-day warranty on the Dragon, and the current repair policy is total exchange. Merchant said, however, that Tano is setting up repair centers.

Merchant said that Tano's approach to the people who purchase a Dragon is "diametrically opposed" to what they perceive as Tandy's "once you buy it, it's your problem" attitude toward Color Computer owners.

Tano is actively soliciting software from American owners of Dragons and selecting the best programs for distribution. They already have over 55 programs imported from England, and that list will grow as soon as American programmers and software manufacturers convert existing software and write new software.

On the hardware end, Tano's disk drives (being released by early November at \$399 for a single drive and controller, or at \$599 for a double disk drive and controller) will come with OS-9 standard, making the Dragon a machine of interest for the more serious users. There are numerous other plans to come out with hardware and software for the Dragon either through outside vendors or licensed and marketed by Tano directly.

These plans reflect Tano's philosophy that, according to Tano Vice President Dan Albert, "The Dragon answers the question, 'why buy a computer?'"

Merchant said that the key issue is going to be who can supply a better product for the end user, and he said he is confident that Tano has a better product, better support, and a better attitude toward the buyers, who will decide if the Dragon will make it in America.—Guier S. Wright ■

CERTIFIED

GOOD STUFF

MACRO-BOC

This is a disk-based editor, macro assembler and monitor, written for Color Computer by Andy Phelps. THIS IS IT — The ultimate programming tool!

The powerful 2-pass macro assembler features conditional assembly, local labels, include files and cross referenced symbol tables. MACRO 80C supports the complete Motorola 6809 instruction set in standard source format. There are no changes, constraints or shortcuts in the source language definition. Incorporating all of the features of our Rompack-based assembler (SDS80C), MACRO-80C contains many more useful instructions and pseudo ops which aid the programmer and add power and flexibility. The screen-oriented text editor is designed for efficient and easy editing of assembly language programs. The "Help Key" feature makes it simple and fun to learn to use the editor. As the editor requires no line numbers, you can use the arrow keys to position the cursor anywhere in the file. MACRO-BOC allows global changes and moving/copying blocks of text. You can edit lines of assembly source which are longer than 32 characters.

DCBUG is a machine language monitor which allows examining and altering of memory, setting break points, etc.

The editor, assembler and monitor — as well as sample programs — come on one Radio Shack compatible disk. Extensive documentation included. MACRO-BOC Price: \$99.95

SOFTWARE DEVELOPMENT SYSTEM

The Micro Works Software Development System (SDS80C) is a complete 6809 editor, assembler and monitor package contained in one Color Computer program pack! Vastly superior to RAM-based assemblers/editors, the SDS80C is non volatile, meaning that if your application program bombs, it can't destroy your editor/assembler. Plus it leaves almost all of 16K or 32K RAM free for your program. Since all three programs, editor, assembler and monitor are coresident, we eliminate tedious program loading when going back and forth from editing to assembly and debugging!

The powerful screen-oriented Editor features finds, changes, moves, copies and much more. All keys have convenient auto repeat (typematic), and since no line numbers are required, the full width of the screen maybe used to generate well commented code.

The Assembler features all of the following: complete 6809 instruction set; conditional assembly; local labels; assembly to cassette tape or to memory; listing to screen or printer; and mnemonic error codes instead of numbers.

The versatile monitor is tailored for debugging programs generated by the Assembler and Editor. It features examine/change of memory or registers, cassette load and save, breakpoints and more. SDS80C Price: \$89.95

MICRO WORKS COLOR FORTH

• Forth is faster to program in than Basic • Forth is easier to learn than Assembly Language • Forth executes in less time than Basic Forth is a highly interactive language like Basic, with structure like Pascal and execution speed close to that of Assembly Language. The Micro Works Color Forth is a Rompack containing everything you need to run Forth on your Color Computer.

Color Forth consists of the standard FORTH Interest Group (FIG) implementation of the language plus most of FORTH-79. It has a super screen editor with split screen display. Mass storage is on cassette. Color Forth also contains a decompiler and other aids for learning the inner workings of this fascinating language. It will run on 4K, 16K, and 32K computers. Color Forth contains 10K of ROM, leaving your RAM for your programs! There are simple words to effectively use the Hi-Res Color Computer graphics, joysticks, and sound. The 112-page manual

includes a glossary of the system-specific words, a full standard FIG glossary and complete source listing. COLOR FORTH . . . THE BEST! From the leader in Forth, Talbot Microsystems. Price \$109.95

NEW!

MagiGraph will turn your Color Computer into a graphic design center with the ease of a keystroke! This utility makes it simple to draw highly detailed graphic figures, up to and including an entire graphic screen. Nine animation buffers are provided for you to test and revise the movements of animated figures. To see your creations, just toggle between the design screen and graphic display screen. A full set of logical operation and pixel manipulation functions simplify the development of a figure in all its different possible color and position combinations. Save the graphic screen to cassette or disk for later recall, or send the pixel codes of a graphic image to a printer. If you are an experienced basic or assembly language programmer, you won't want to be without this program! Demonstration programs are included in the comprehensive documentation package. Comes on cassette (16K required) for \$34.95; disk (32K Extended Color Basic required) for \$39.95 and Amdisk cartridge for \$44.95.

MICROTEXT: COMMUNICATIONS VIA YOUR MODEM!

Make your Color Computer an intelligent printing terminal with off-line storage! The Microtext module is just what you'll need for:

- Talking to a timeshare system or information service
- Printing out what is received as it is received
- Saving received text to cassette tape
- Re-displaying the received text even while on-line
- Communications with other computers
- Using your computer as a general-purpose 300-baud terminal
- Downloading programs from other computers

The Microtext module is a program pack containing not only firmware but a second serial port so that both your printer and modem can be connected at the same time. Microtext can be configured for any serial printer that will work with the Color Computer, even if it requires line feeds! But even if you don't have a printer, you can keep a permanent copy of your data by storing to cassette tape. Also, any Radio Shack/ Centronics-compatible parallel printer may be used by adding the Micro Works' P180C parallel interface.

For those of you with special terminal applications, Microtext has selectable parity; it sends odd, even, mark or space. With mark parity (which is default) you can send to computers requiring either seven or eight bits. All 128 ASCII codes can be sent. Exchange programs with other Color Computer users! Basic programs may be downloaded from other computers or timesharing systems.

You'll find many uses for this versatile module! Available in ROMPACK, ready-to-use, for \$59.95.

MACHINE LANGUAGE

MONITOR TAPE: A cassette tape which allows you to directly access memory, I/O and registers with a formatted hex display. Great for machine language programming, debugging and learning. It can also send/receive RS232 at up to 9600 baud, including host system download/upload. 19 commands in all. Relocatable and reentrant. CBUG Tape Price: \$29.95

MONITOR ROM: The same program as above, supplied in 2716 EPROM. This allows you to use the entire RAM space. And you don't need to re-load the monitor each time you use it. The EPROM plugs into the Extended Basic ROM Socket or the Romless Pack I. CBUG ROM Price: \$39.95

SOURCE GENERATOR: This package is a disassembler which runs on the Color Computer and generates your own source listing of the BASIC interpreter ROM. Also included is a documentation package which gives useful ROM entry points, complete memory map, I/O hardware details and more. A 16K system is required for the use of this cassette. 80C Disassembler Price: \$49.95

SYSTEMS SOFTWARE

GAMESS

Star Blaster — Blast your way through an asteroid field in this action-packed Hi-Res graphics game. Available in ROMPACK; requires 16K. Price: \$39.95

Pac Attack — Try your hand at this challenging game by Computerware, with graphics, sound and action! Cassette requires 16K. Price: \$24.95

Haywire — Have fun zapping robots with this Hi-Res game by Mark Data Products. Cassette requires 16K. \$24.95

Dunkey Munkey — Arcade excitement awaits those who dare to conquer the Munkey! Joystick and 32K required, by Intellectronics. Cassette: \$24.95

Colorpede — Great graphics, two-player option, and pause control in this exciting game by Intracolor Communication. Cassette requires 16K: \$29.95

Adventure — Black Sanctum and Caiixto Island by Mark Data Products. Each cassette requires 16K: \$19.95 each.

Cave Hunter — Experience vivid colors, bizarre sounds and eerie creatures in hot pursuit as you wind your way through a cave maze in search of gold treasures. This exciting Hi-Res game by Mark Data Products requires 16K for cassette version. \$24.95

Starfire — Fly around the planet defending Earthlings from being snatched up by aliens in this challenging game from Intellectronics. Cassette requires 16K: \$21.95

Doodle Bug — Joystick-controlled Doodle Bugs must move quickly through mazes while being chased by enemy bugs in Hi-Res game by Computerware. Cassette requires 16K: \$24.95

Astro Blast — You'll need to act fast as you protect Earth from wave after wave of alien invaders in this Hi-Res game by Mark Data. Cassette requires 16K: \$24.95

BOOKS

6809 Assembly Language Programming, by Lance Leventhal, \$16.95

TRS-80 Color Computer Graphics, by Don Inman, \$14.95

Assembly Language Graphics for the TRS-80 Color Computer, by Don Inman, \$14.95

Starting Forth, by L. Brodie, \$17.95

HARDWARE

PARALLEL PRINTER INTERFACE — Serial to parallel converter allows use of all standard parallel printers. P180C plugs into the serial output port, leaving your Rompack slot free. You supply the printer cable. P180C Price: \$59.95

MEMORY UPGRADE KITS: Consisting of 4116 200ns. integrated circuits, with instructions for installation. 4K-16K Kit Price: \$39.95. 16K-32K Kit (requires soldering experience) Price: \$39.95.

For Rev. level E., ET, NC and TDP-100s, we carry 64K chips; upgrading is easy! Eight prime 64K chips and instructions: \$64.95

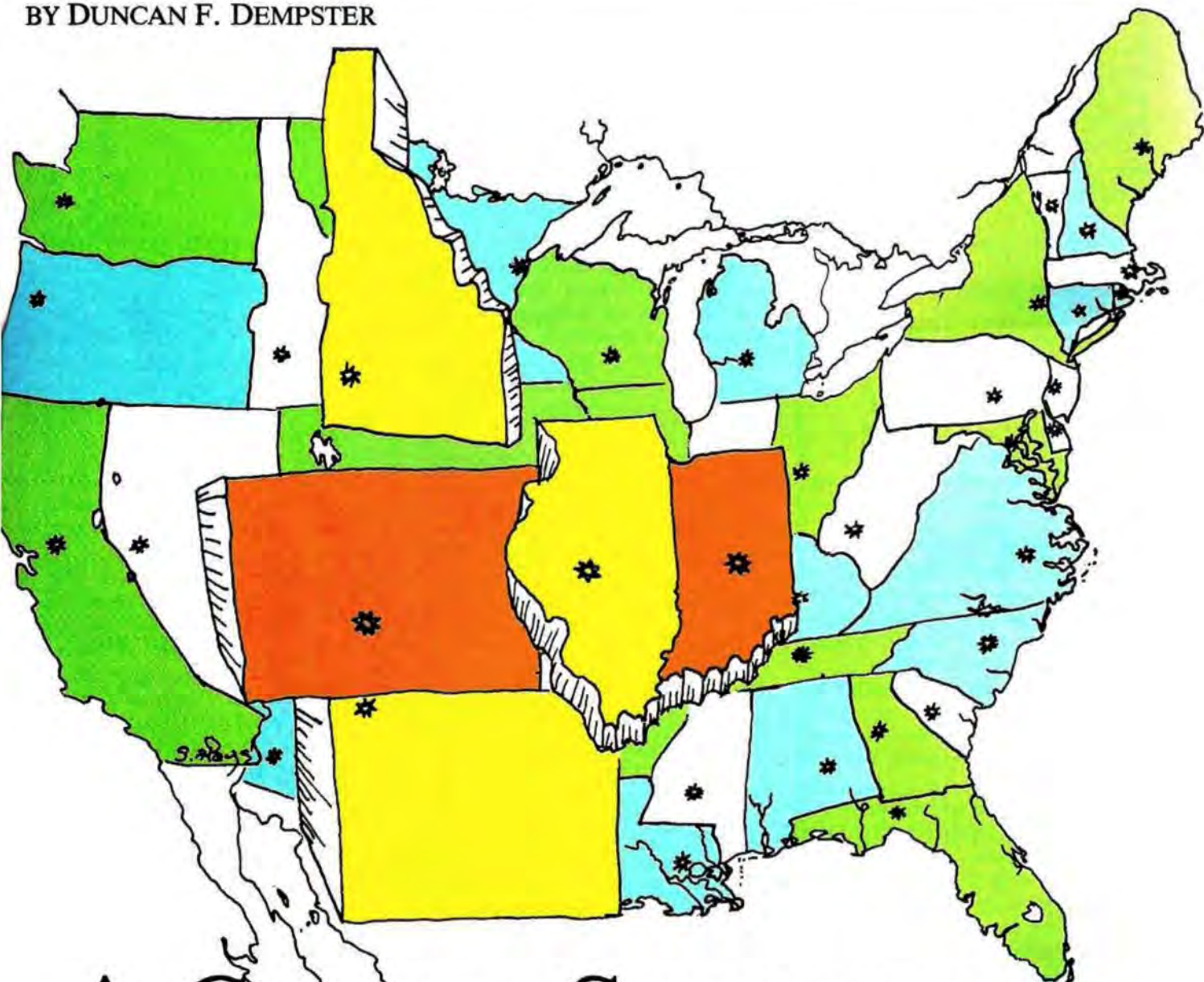
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BY DUNCAN F. DEMPSTER



A CAPITAL SUGGESTION

Do your children know all the states' capitals in the U.S.? How about the capitals of other nations? States and Nations is a drill program that teaches the capital cities of the world, including those of the U.S. states and the Canadian provinces.

You can modify this program for different subject areas. Also, if you follow it closely, you'll pick up some valuable pointers on educational programming.

The program uses three string-variable arrays to do the job: one to store the seven areas of the world, one to read the names of states and nations, and the other to read capital cities. All the val-

This drill program not only teaches the U.S. state capitals, but the capitals of nations, too.

ues for these are listed in numerous DATA lines at the end of the program.

Before entering the program, you must type "PMODE0:PCLEAR1 to allocate enough memory on 16K machines. After you choose your world area from a menu, the main question routine presents you with the name of a

nation or state and then asks you to type in the corresponding capital city name. If you miss the question by giving the wrong city, or misspelling it, you get another chance. If you miss this second chance, you are asked if you want a hint.

Responding with a "YES" or a "Y" results in a hint of the first letter of the

System Requirements

16KRAM
Color Basic

swers. Ordinarily you wouldn't have to initialize these variables because the system does this automatically.

However, because this program allows for multiple quizzes by routing you back to line 160 each time you opt for a new quiz, H, IH, and R keep incrementing from previous quizzes and you end up with some inaccurate final scores. Variables Q and G need no such initialization because they all reside inside the main loop and are revalued each time the program invokes line 330 or 350. Variable S is revalued to a new start point each time you take a new quiz.

Lines 432-438 comprise a special-purpose loop that forces the computer to display the correct answer in a blinking mode. You are telling the computer to print two different string values, a city name and some blank spaces, in the exact same grid position. The strange line at 439 is a sleeper that I will explain later.

- *Quiz Complete and Scoreboard Routine* (lines 465-520): Here the scores are figured and some real computing comes into play. The Raw Score (RS) is a percentage score based on number of questions answered correctly divided by total number of questions. It wouldn't be fair, however, to take full credit for a question answered correctly as a result of a hint, would it? Therefore, one-half the value of a correct answer is deducted for each hint-assisted correct answer.

If you ask for a hint and still get the question wrong then you are in for double jeopardy, with full deduction for a wrong answer and half deduction for requesting the hint. To get out of this the program must keep track of the hints that didn't result in a correct answer. Call this IH (ineffective hints) and use that sleeper line, 439.

If you are on your last guess (G = 3), and if you did ask for a hint (Z\$ <> "N0") and still got the wrong answer (G\$ <> C\$(S)), then line 439 increments IH by one hint. IH is in turn deducted from H in the final score (FS) computation at line 472.

The GOSUB at line 495 branches to a small subroutine that translates your final score to a verbal description. After that, line 500 personalizes either a complimentary message or a slap in the face, depending on how you did.

- *Box Score and Quiz Retake Routine* (lines 525-570): This final flourish displays your progress to date and gives you the chance to take another quiz by assigning each final score to a numeric variable (FScore) to keep track of your score on each quiz. This numeric

value has to be correlated with the geographic area for which each final score was obtained. As with anything in Basic, orderly reasoning helps.

Each time you take a quiz on a particular area, the system knows which area it is by the value of I in A\$(I). You must link the value of FS with the particular A\$(I) used. Why not create a new array called FS(I)? The scoreboard now keeps a running tally of your score for each geographic area quiz, and continues to do so until you finish all areas. If you repeat an area quiz you've already taken, it substitutes your new score for your previous score in that area.

- *Error Trap Routine* (lines 575-578): This precludes a can't-divide-by-zero error. In line 365, you are allowed to stop a quiz at any time by answering a question with the word "STOP." If you do this on the first question, however, the program breaks because the Q - 1 in line 470 equals zero and the computer returns an error when it tries to divide by zero to find RScore. Line 357 avoids this problem by trapping the inadvertent error. If Q = 1 and G\$ = "STOP", then the routine at line 575 is invoked, forcing you to correctly or incorrectly answer at least one question.

- *Delay Subroutine* (lines 580-585): This is the multipurpose subroutine for creating delays of any length in the program.

- *Score Description Subroutine* (lines 590-598): This subroutine translates your final score of any area quiz into a verbal description for use in the last part of the scoreboard section of the program.

- *Geographical and Data Parameters* (lines 600-1299): These are all the GOSUB addresses for line 240 when you first choose a quiz area. It is critical that you get the correct values for I, N, and

S. I denotes which one of the seven world areas you're in and it plays a part in the menu, the questioning routine, and the box-score routine. N represents the total number of states or nations in an area. Most important, S directs the data pointer to the correct first state or nation within a geographic area.

If S or N is wrong in any of these subroutines, you get a mish-mash of questions and answers that won't make any sense, and you'll also get some OD errors as you go along in a quiz. The numbering system is cumulative; for the United States, which is the first area, N = 50 for the 50 states, and S = 1 because the first U.S. state is the first nation in the DATA statements. Then for area #2, Canada, N = 11 for the 11 provinces, but S must equal the first data string beyond the 50th U.S. state. Therefore, S = 51. Similarly, as you go down the list, S must be valued at the number just one higher than the last data string of the previous geographical area.

- *DATA Statements* (lines 1300-1399 and 1400-1499): Make sure you type these lines in accurately. One small error and your entire sequence of reading the proper nations and cities into N\$ and C\$ is incorrect. Type them all in sequentially, remembering the comma after each. The N\$ nations come first in the 1300 series, followed by the CJ cities.

RUN the program, debug as necessary, and enjoy learning and competition with your kids and their friends. You should be able to use these programming methods for other educational programs of your own. ■

Address correspondence to Duncan F. Dempster, 47-401 Lulani St., Kaneohe, HA 96744.

Lines	Purpose
5-18	Array Dimensioning and Reading Routine
19-75	Title Screen and Name Input Routine
80-240	Quiz Directions and Menu Routine
300-460	Main Questioning Routine
465-520	Quiz Complete and Scoreboard Routine
525-570	Box Score and Quiz Retake Routine
575-578	Error Trap Routine
580-585	Delay Subroutine
590-598	Score Description Subroutine
600-699	Geographic Area Subroutines
through 1200-1299	
1300-1399	Nations and States DATA Statements
1400-1499	Capital Cities DATA Statements

Table 1. Program Organization

Radio Shack
Color Computer
TDP System 100



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Chromasette

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city, and you have a third guess. Finally, if you still get it wrong, the correct answer blinks for a few seconds on the screen, before the next question appears.

When you have completed all the questions for a given geographical area, or if you respond with the word "STOP," the program calls up a scoreboard routine that gives the number of correct responses out of the total number of questions, your raw percentage score, an adjusted score considering the number of hints you asked for, and a descriptive phrase characterizing your performance on that section. Finally, a cumulative box score shows your results.

The Program

- *Dimensioning and Read Routine* (lines 5-19): This is the initial setup to establish your arrays and read the data into them. To change the total number of nations in the program, you must change the dimensioning of N\$ and C\$ in line 15, as well as the counters in lines 17 and 18. Otherwise, you'll end up with a mismatch of nations and capital cities.

- *Title Screen Routine* (lines 20-75): This section formats the title screen and asks for your name input. Note the reference in line 75 to the subroutine at line 580. This is a multipurpose branch routine. Each time the program requires a delay of any sort, a statement establishes a certain value of T and then invokes this subroutine with that T value for the required delay.

- *Directions and Menu Routine* (lines 80-240): Here are the rules of the quiz and your choices of geographical areas tested. A\$ serves triple duty in this program; once here, once in the main question routine, and later in the box-score routine.

- *Main Questioning Routine* (lines 300-460): This is the meat of the program. After it learns the specific values of N\$ and C\$ for the chosen area, the computer sequentially runs you through all the appropriate nations (or states), allowing you three guesses (G) for each question. I programmed three guesses instead of two because of the literal-mindedness of the processor. You might answer with the right city, but misspell it. Your guess becomes G\$ each time and it is then compared with the value of C\$ (S).

Most of this section contains routine programming procedure except lines 320-325. Variables H, IH, and R count the requested number of hints, ineffective hints, and the number of correct an-

TRS-80
COLOR
COMPUTER



TOOLS

Programs that make it easy to exploit the power and beauty of your Color Computer without making it hard on your wallet:

Graphics #1 - Displays and text delightfully manipulated! Watch and use First Cover, Drawer (the best drawing program anywhere), Graptext (puts text on the graphics screen), Smalltext, Rotate (create and spin 3D objects in real time), World Map, 3D World, Star Map, String Art, Kaleidoscope, and Display Demo (text screen wizardry)!

Utilities #1 - Programming is simpler when you use Lister, Listmod, Newtrace (a better TRON), Lazkey (define keys as phrases), Append (easily combine two BASIC programs), BASIC Map, Varmap, Deleter, and CK Monitor (look at and modify memory).

Disk Utilities #1 - Harness the hidden powers of your disksystem with Disk Edit (change things on disk directly), Disk Aid, Offset (EXECs most tape-only programs), Track Lock, DIR Save/Get (foil I/O errors), Cataloger, Master Catalog (keep track of your program library), and File Copy (a better BACKUP).

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```

5 REM dimension and read routine
10 DIM A$(7),FSCORE(7)
15 DIM N$(191),C$(191)
16 FOR I=1TO7:READ A$(I):NEXT
17 FOR X=1TO191:READ N$(X):NEXT
18 FOR X=1TO191:READ C$(X):NEXT
19 REM title page routine
20 CLS
25 PRINT@34,"nations, states and
  capitals"
30 PRINT@109,"A QUIZ"
40 PRINT @ 164,"TO TEST YOUR KNOWLEDGE"
50 PRINT@230,"OF WORLD GEOGRAPHY
  BY"
60 PRINT@293,"BY DUNCAN F. DEMPS
  TER"
65 PRINT@384,"ENTER YOUR NAME HERE:";
70 INPUT NAME$
75 T=460:GOSUB 580
80 REM directions and menu routine
85 CLS
90 PRINT@8,"OK, ";NAME$;","
100 PRINT"HOW SHARP ARE YOU AT NAMING"

```

```

110 PRINT"STATE/NATIONAL CAPITAL
  CITIES?"
120 PRINT"SELECT YOUR AREA FROM
  THE MENU"
130 PRINT"BELOW AND HIT THE enter
  KEY."
140 PRINT"THEN, FOR EACH QUESTION
  ASKED,"
150 PRINT"YOU'LL GET 3 CHANCES TO
  ANSWER."
160 PRINT"          **menu**"
180 FORI=1TO7
200 PRINT "  (";I;")-";A$(I);" CA
  PITALS"
210 DATA "U.S. STATE",CANADA PROVINCE,
  CEN/SO AMERICAN,AFRICAN,EUROPEAN,
  MIDDLE EASTERN,ASIAN
220 NEXT I
225 T=460:GOSUB 580
230 PRINT@480,"CHOOSE YOUR AREA:
  ";:INPUT A
235 IF A=0 OR A>7 THEN 230
240 ON A GOSUB 600,700,800,900,1000,
  1100,1200
300 REM main question routine
305 CLS
310 PRINT@3,"OKAY, ";NAME$;"," YOU'VE
  CHOSEN"
315 PRINT A$(I);" CAPITALS."
320 H=0
323 IH=0
325 R=0
330 FOR Q=1TO10
335 PRINT "          QUESTION #:
  ";Q
340 G=1
345 PRINT "WHAT'S THE CAPITAL OF
  ";N$(S);"?"
350 PRINT "          GUESS #:";G;
355 INPUT G$
357 IF Q<2 AND G$="STOP"THEN575
360 IF G$=C$(S) THEN 445
365 IF G$="STOP" THEN 465
370 IF G=2 THEN 390
375 IF G=3 THEN 425
380 PRINT "INCORRECT - TRY AGAIN"
  ":G=G+1
385 GOTO 350
390 PRINT "SORRY, WRONG AGAIN. WANT
  A HINT?"
395 INPUT"TYPE IN yes OR no:";Z$
400 IF .Z$="NO" THEN G=G+1:GOTO350
405 H$=LEFT$(C$(S),1)
410 PRINT "THE CAPITAL STARTS WITH:
  ";H$
415 H=H+1:G=G+1
420 GOTO 350
425 PRINTQ416,"SORRY, YOU BLEW IT.
  THE ANSWER"
430 PRINT "          IS: ";
432 FOR B=1TO200

```

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```

434 PRINT@460, C$(S)
436 PRINT@460, " "
438 NEXTB
439 IF G=3 AND Z$<>"NO" AND G$<>
C$(S) THEN IH=IH+1
440 GOTO 455
445 PRINT "RIGHT ON, ";NAME$; ",
YOU GOT IT!"
447 SOUND89,1:SOUND133,1:SOUND15
9,1:SOUND176,3:SOUND159,1:SOUND1
76,4
450 R=R+1
455 T=460:GOSUB 580
460 CLS:S=S+1:NEXT Q
465 REM quiz complete routine
467 CLS
470 RSCORE=INT(100*R/(Q-1)+.5)
472 FSCORE(I)=INT{(100*R/(Q-1)-(
H-IH)*100/(Q-1)/2)+.5)
475 PRINT@68,"OK, ";NAME$;" YOU
ANSWERED"
480 PRINT R;"OUT OF";Q-1;"QUESTI
ONS RIGHT"
485 PRINT "AND YOU ASKED FOR HIN
TS";H;"TIMES"
490 PRINT:PRINT"          YOUR SCORE
IS ";RSCORE;"%"
491 PRINT "BUT BECAUSE YOU USED"
;H-IH;"HINTS"
492 PRINT "YOUR FINAL SCORE IS "
;FSCORE(I);"%"
495 GOSUB 590
500 PRINT W$;NAME$
505 T=920:GOSUB 580
510 PRINT:PRINT "PRESS b TO GET
YOUR BOX SCORE"
515 B$=INKEY$
520 IF B$="" THEN 515
525 REM box score routine
527 CLS
530 PRINT@37,NAME$;"'S BOX SCORE
"

535 PRINT:PRINT "          AREA","FINA
L SCORE"
540 FOR I=1T07
545 PRINT A$(I),FSCORE(I)
550 NEXT I
555 PRINT
560 T=920:GOSUB 580
565 INPUT "WOULD YOU LIKE ANOTHE
R QUIZ";Y$
570 IF Y?="YES"ORY$="Y" THEN 160
ELSE END
575 REM error trap routine
576 PRINT "SORRY, YOU MUST ANSWE
R AT LEAST"
577 PRINT "ONE QUESTION, RIGHT O
R WRONG"
578 GOTO 335
580 REM delay routine
585 FOR D=1T0T:NEXT D:RETURN
590 REM description routine
595 IF FSCORE(I)>89 THEN W$="EXC

```

```

ELLENT WORK, "
596 IF FSCORE(I)>79 AND FSCORE(I
)<90 THEN W$="NOT BAD FOR A STAR
T, "
597 IF FSCORE(I)>64 AND FSCORE(I
)<80 THEN W$="FAIR, BUT BETTER B
ONE UP, "
598 IF FSCORE(I)<64 THEN W$="SOR
RY, YOU FLUNKED, "
599 RETURN
600 REM united states state capi
tals
605 I=1
610 N=50
615 S=1
699 RETURN
700 REM Canadian province capita
ls
705 I=2
710 N=11
715 S=51
799 RETURN
800 REM cen/so american capitals
805 I=3
810 N=21
815 S=62
899 RETURN
900 REM african capitals
905 I=4
910 N=53
915 S=83
999 RETURN
1000 REM european capitals
1005 I=5
1010 N=31
1015 S=136
1099 RETURN
1100 REM middle eastern capitals
1105 I=6
1110 N=11
1115 S=167
1199 RETURN
1200 REM asian capitals
1205 I=7
1210 N=14
1215 S=178
1299 RETURN
1300 REM u.s.state data
1302 DATA CONNECTICUT,MAINE,MASS
ACHUSETTS,NEW HAMPSHIRE,RHODE IS
LAND,VERMONT,NEW JERSEY,NEW YORK
,PENNSYLVANIA,ILLINOIS,INDIANA
1304 DATA MICHIGAN,OHIO,WISCONSI
N,IOWA,KANSAS,MINNESOTA,MISSOURI
,NEBRASKA,NORTH DAKOTA,SOUTH DAK
OTA,DELAWARE,FLORIDA,GEORGIA
1306 DATA MARYLAND,NORTH CAROLIN
A,SOUTH CAROLINA,VIRGINIA,WEST V
IRGINIA,ALABAMA,KENTUCKY,MISSISS
IPPI,TENNESSEE,ARKANSAS
1308 DATA LOUISIANA,OKLAHOMA,TEX
AS,ARIZONA,COLORADO,IDAHO,MONTAN
A,NEVADA,NEW MEXICO,UTAH,WYOMING

```

, ALASKA, CALIFORNIA, HAWAII
 1310 DATA OREGON, WASHINGTON
 1312 REM Canadian province data
 1314 DATA ALBERTA, "BRIT. COLUMBIA", MANITOBA, NEW BRUNSWICK, NEWFOUNDLAND, NORTHWEST TERRITORIES, NOVA SCOTIA, ONTARIO, QUEBEC
 1316 DATA SASKATCHEWAN, YUKON
 1318 REM cen/so america data
 1320 DATA BRAZIL, BOLIVIA, PARAGUAY, URUGUAY, ARGENTINA, CHILE, PERU, ECUADOR, COLUMBIA, VENEZUELA, GUYANA, SURINAME, FRENCH GUIANA
 1322 DATA MEXICO, GUATAMALA, BELIZE, EL SALVADOR, HONDURAS, NICARAGUA, COSTA RICA, PANAMA
 1324 REM african data
 1326 DATA ALGERIA, ANGOLA, BENIN, BOTSWANA, BURUNDI, CAMEROON, CAPE VERDE, CEN. AFRICAN REP., CHAD, CONGO, DJIBOUTI, EGYPT, EQUATORIAL GUINEA
 1328 DATA ETHIOPIA, GABON, GAMBIA, GHANA, GUINEA, GUINEA-BISSAU, IVORY COAST, KENYA, LESOTHO, LIBERIA, LYBIA, MADAGASCAR, MALAWI, MALI
 1330 DATA MAURITANIA, MAURITIUS, MAYOTTE, MOROCCO, MOZAMBIQUE, NAMIBIA, NIGER, NIGERIA, REUNION, RWANDA, SENEGAL, SEYCHELLES, SIERRA LEONE
 1332 DATA ST. HELENA, SOMALI REPUBLIC, SOUTH AFRICA, SUDAN, SWAZILAND, TANZANIA, TOGO, TUNISIA, UGANDA, UPPER VOLTA, ZAIRE, ZAMBIA, ZIMBABWE-RHODESIA
 1334 european nation data
 1336 DATA ENGLAND, SCOTLAND, IRELAND, ICELAND, NORWAY, SWEDEN, FINLAND, DENMARK, EAST GERMANY, WEST GERMANY, HOLLAND, BELGIUM, FRANCE
 1338 DATA LUXEMBOURG, SWITZERLAND, CZECHOSLOVAKIA, AUSTRIA, POLAND, SPAIN, PORTUGAL, ITALY, MONACO, ANDORRA, YUGOSLAVIA, HUNGARY, ROMANIA
 1340 DATA BULGARIA, GREECE, ALBANIA, TURKEY, RUSSIA
 1342 REM middle east nation data
 1344 DATA INDIA, AFGANISTAN, IRAN, ISREAL, NEPAL, IRAQ, PAKISTAN, BHUTAN, SRI LANKA, BANGLADESH, BURMA
 1346 REM asian nation data
 1348 DATA MALAYSIA, SINGAPORE, TAIWAN, CHINA, MONGOLIA, PHILIPPINES, THAILAND, VIETNAM, CAMBODIA, NORTH KOREA, SOUTH KOREA, JAPAN, INDONESIA, LAOS
 1400 REM u.s. state capitals
 1402 DATA HARTFORD, AUGUSTA, BOSTON, CONCORD, PROVIDENCE, MONTPELIER, TRENTON, ALBANY, HARRISBURG, SPRINGFIELD, INDIANAPOLIS, LANSING
 1404 DATA COLUMBUS, MADISON, DES MOINES, TOPEKA, "ST. PAUL", JEFFERSON CITY, LINCOLN, BISMARCK, PIERRE, DO

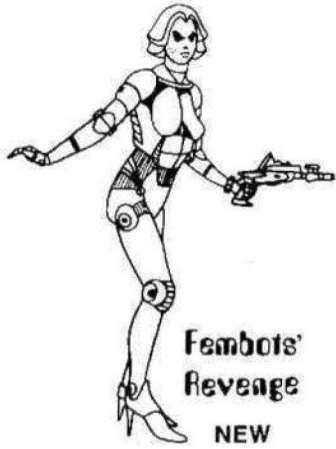
VER, TALLAHASSEE, ATLANTA
 1406 DATA ANNAPOLIS, RALEIGH, COLUMBIA, RICHMOND, CHARLESTON, MONTGOMERY, FRANKFORT, JACKSON, NASHVILLE, LITTLE ROCK, BATON ROUGE
 1408 DATA OKLAHOMA CITY, AUSTIN, PHOENIX, DENVER, BOISE, HELENA, CARSON CITY, SANTA FE, SALT LAKE CITY, CHEYENNE, JUNEAU, SACRAMENTO
 1410 DATA HONOLULU, SALEM, OLYMPIA
 1412 REM Canadian capital data
 1414 DATA EDMUNTON, VICTORIA, WINNIPEG, FREDERICTON, "ST. JOHN'S", YELLOWKNIFE, HALIFAX, TORONTO, QUEBEC, REGINA, WHITEHORSE
 1416 REM cen/south america data
 1418 DATA BRASILIA, LA PAZ, ASUNCIÓN, MONTEVIDEO, BUENOS AIRES, SANTIAGO, LIMA, QUITO, BOGOTA, CARACAS, GEORGETOWN, PARAMIRABO, CAYENNE
 1420 DATA MEXICO CITY, GUATEMALA, BELIZE CITY, SAN SALVADOR, TEGUCIGALPA, MANAGUA, SAN JOSE, PANAMA
 1422 REM africa capital data
 1424 DATA ALGER, LUANDA, PORTO NOVO, GABORONE, BUJUMBURA, YAOUNDE, PRAIA, BANGUI, NDJAMENA, BRAZZAVILLE, DJIBOUTI, CAIRO, MALABO
 1426 DATA ADDIS ABABA, LIBREVILLE, BANJUL, ACCRA, CONAKRY, BISSAU, ABIDJAN, NAIROBI, MASERU, MONROVIA, TARABULUS, ANTANANARIVO, LILONGWE
 1428 DATA BAMAKO, NOUAKCHOTT, PORT LOUIS, DZAOUZDI, RABAT, MAPUTO, WINDHOK, NIAMEY, LAGOS, SAINT-DENIS, KIGALI, DAKAR, VICTORIA, FREETOWN
 1430 DATA JAMESTOWN, MOGADISHO, PRETORIA AND CAPETOWN, KHARTOUM, MBABANE, DAR-ES-SALAAM, LOME, TUNIS, KAMPALA, OUAGADOUGOU, KINSHASA, LUSAKA, SALISBURY
 1432 REM european capitals data
 1434 DATA LONDON, EDINBOROUGH, DUBLIN, REYKJAVIK, OSLO, STOCKHOLM, HELSINKI, COPENHAGEN, EAST BERLIN, BONN, AMSTERDAM, BRUSSELS, PARIS
 1436 DATA LUXEMBOURG, BERN, PRAGUE, VIENNA, WARSAW, MADRID, LISBON, ROMEO, MONACO, ANDORRA LA VELLA, BELGRADE, BUDAPEST, BUCHAREST, SOFIA
 1438 DATA ATHENS, TIRANE, ANKARA, MOSCOW
 1440 REM middle east capital data
 1442 DATA NEW DELHI, KABUL, TEHRAN, JERUSALEM, KATHMANDU, BAGDAD, ISLAMABAD, THIMPHU, COLOMBO, Dacca, RANGOON
 1444 REM asian capitals data
 1446 DATA KUALA LUMPUR, SINGAPORE, TAIPEI, PEKING, ULAANBAATAR, MANILA, BANGKOK, HANOI, PHNOM PENH, PYONGYANG, SEOUL, TOKYO, DJAKARTA, VIENTIANE

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Fyr-Draca

NEW ARCADE GAME

Fyr-Draca (Fire Dragons), from egg to the daemonic behemoth, greet you in five waves with nine colors on the screen at one time! This machine code game is going to sweep the Color Computer market. It is by far, the best game to come out tor along, long time. The real arcade look is here at last!

Fire Dragons uses the nine color mode to create a screen of dazzling color with a black background and a black border. Dragons swoop from their stellar watch, singly, in groups and in squadron formation. First you face the single wyrms, then the squadron, next the twin giants, followed by the Battle Drake and its minions. Even with four star vessels and shields you will be hard put to survive their spitting fire and diving attacks!

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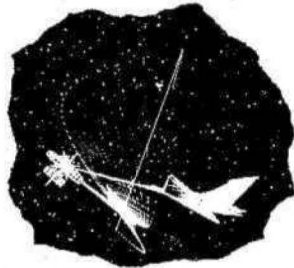


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Your ship is being enshrouded by the Xygoid Web. Certain death is minutes away! You must blast through the enveloping Web and destroy the Xygoid vessel before you are crushed. This is a multi-colored machine-code game in the highest resolution mode on a black background- Xygoid, from the galactic beginning! It will ensnare your mind!

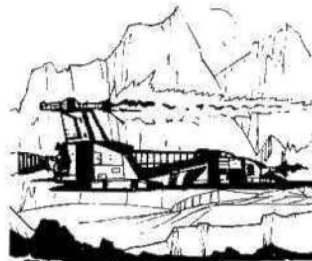
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Another arcade hit! The Asteroid Belt is crashing down on Earth. You are the first-line defense. You must destroy the blazing asteroids and the homing orbs with your disruptor. Machine-code speed, multi-colors on a black background - the crash and explosions of the asteroids rain on your senses!

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MS. NIBBLER

Ms. Nibbler is not just another pretty face with glossy red lips. She's a feisty lady, who moodily prowls her black maze. This game has the real arcade action and the real arcade look too! Your joystick will almost burn out as you try to keep up!

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THE NIBBLER

The King of Pac games is here. This fast-paced maze-chase game will challenge the mostskilled. You guide The Nibbler through the maze, the portals, onward to the Energy Pills. Then the Ghouls, constantly at your heels, will end up in your belly! The better you get the better you have to become to master the blazing speed. You haven't pushed your skill until you've tried this one!

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COLORFUL CRYPTOLOGY—PART IV

Many years ago when I was a radio operator aboard ship I stood watch with headphones on my ears and a telegraph typewriter at my fingertips. There was a standard telegraph key fastened to the desk and a "bug" (a semiautomatic key) just to its right. We were on duty four hours and off four hours, around the clock. Business was brisk most of the time, and each of us took our turn at receiving the day's newspaper at about 50 words per minute.

Fifty wpm is fast when you are aurally and manually converting International Morse Code to words on paper. Seventy wpm is about the maximum. But to receive at even 50 wpm you had to practice every day. You soon became alert to the chirp of crickets and the songs of birds, and could make out an occasional short "the" or "and" in their songs.

Cryptanalysis is something like that. The more you work at it, the easier it becomes, until you'll be surprised at the difficult messages you can crack. You might even find hidden messages in what seems to be innocuous plaintext, because that's the way many messages are sent. For instance, not all personal ads in the classified column of the newspaper read exactly as written.

Suppose you are a US Treasury agent, and your assignment is to spot the drug drop that you are sure is going to happen during the week. You watch the paper for a "different" message, since you have reason to believe that's the way the smugglers will arrange the rendezvous. Agents are trained in crypto, of course, so when the ad appears you go to work on it.

Get ready to match your wits and your CoCo's wizardry against the old Sorcerer's hidden message.

"I MISS YOU HELEN, PLEASE COME HOME. IT WAS ALL MY FAULT. ARTHUR." turns out to be a message that actually reads "DELIVERY EIGHT HOURS TWENTYFIFTH BE AT JOES WITH CASH."

Do you think this is far-fetched? It is happening day after day, month after month. Not even a tenth of the drug runners are caught. It's big business, and deadly business, and codes and ciphers are stock in trade.

It's Written in the Stars

This month's cryptograms exercise your CoCo's ciphercracking ability, as well as your own ability to analyze them. They are all simple substitution ciphers, and I've preserved the word spacings to give you a lead into the core messages—in all messages but one. Figure 5 is printed in classic crypto style, in five-letter code groups with word spacings omitted.

The caption of each Cryptogram is a clue to its plaintext content, and may or may not contain a word that you might expect to find in the text.

The crypto of the month is a bit of a challenge to all but the experienced cryptanalyst.

Take a look at the illustration at the beginning of this article. As the story goes, a wizard has used his skill to rear-

range the stars. He's plucked them from their usual positions to create a horoscope for the three persons who will work most quickly to divine the hidden message.

As a reward to the first three who avail themselves of the meaning in the stars, the wizard has arranged to award a subscription (or extension if you're already a subscriber) to *HOT CoCo*. The official rules are listed in the sidebar.

The program that laid out the star-studded cryptogram and the answer to its message will appear in a future issue

Crypto Contest Rules:

The first entrant who accurately decipheres the message in the stars will receive a year's subscription to *HOT CoCo*, or a year's extension if he or she is already a subscriber.

Mr. Andreassen will accept mailed solutions only (no phone calls) and will determine the winner according to the envelope with the earliest postmark.

Solutions must be completely accurate.

Mail your solutions to Karl Andreassen, 24750 Chianti Road, Cloverdale, CA 95425.

1—DIGRAPHS AND TRIGRAPHS ARE USEFUL IN ANALYSIS OF CRYPTOGRAMS

2—THE ANALYST WILL DO WELL TO COUNT THE FREQUENCY OF APPEARANCE OF EACH DIGRAPH

3—THE DIGRAPH TH APPEARS MOST FREQUENTLY IN THE ENGLISH LANGUAGE

4—THE AND AND ARE THE MOST FREQUENT THREE LETTER WORDS IN NEWS COPY

5—THINK CREATIVELY THINK IN OTHER CATEGORIES TO WORK AT CRYPTANALYSIS

Answers to last month's cryptograms

LMV LU GSV DZBH GL NZPV BLFI XLNKFGVI NLIV HVXFIV RH GL VMXR KSVI
RNKLIGZMG WZGZ YVULIV URORMT RG LM GZKV LI WRHP

Fig. 1. File Data Securely

GSV XLNKFGVI RH ZM RWVZO XIBKGL NZXSRMV ULI FHV ZG GSV LIRTR
MZGRMT KLRMG LU ZM VMXRKSVIVW NVHHZTV YEG FMGRÖ RG XZM YV KZ
HHVW LEVI ZH Z DIRHGDZGXS BLF NFHG PHV SFNZM UZXFQGRVH ULI H LNV
ERGO XLNFMRXZGRLMH

Fig. 2. How Small Shall Computers Be?

B DOVF GP GSF TGBIT DIZKGPBIBN TKBDFT BIF FRVBOOZ BT JNKPIGB MG BT
GSF TGBIT BMW GSF NFTTBHF NBZ MPG YF BT OPMH BT JG NBZ BG UJITG
BKKFBI

Fig. 3. A Clue for You

SPRXJ VJWSCIHK BIJ QJIW RZECIMBAM RA FIJBMAN JLLJFRMQJ JAFR
EPJIJH ZJKKBNJK MP J IJBX VJW RK EIBFMRFJ RL WCO DIJBV BM XJB KM CAJ
FIWEMCNIBZ B HBW LCI B WJBI RM SRXX DJFCZJ BXZCKM JBK W ACMJ MP J
BXZCKM

Fig. 4. The Real Key is Practice

XKXIN CVLXB QJZIV QJD XD PASCZ QNQJX TSCHF ZGXJQ ZGBXK XINHF
ZGXJD ZQJDX HSJXG JVZFS CQPHH SIJVG WQSTX UVGBS CFVCX DSOFS
GWAXCSIXOX XGWVG XXIZG ZJTSQ HDXIX CSITZ IQZGB QXXBJ DXTSS
GQSC E PHV.IX IYJDY

Fig. 5. The Stars: Our Destination

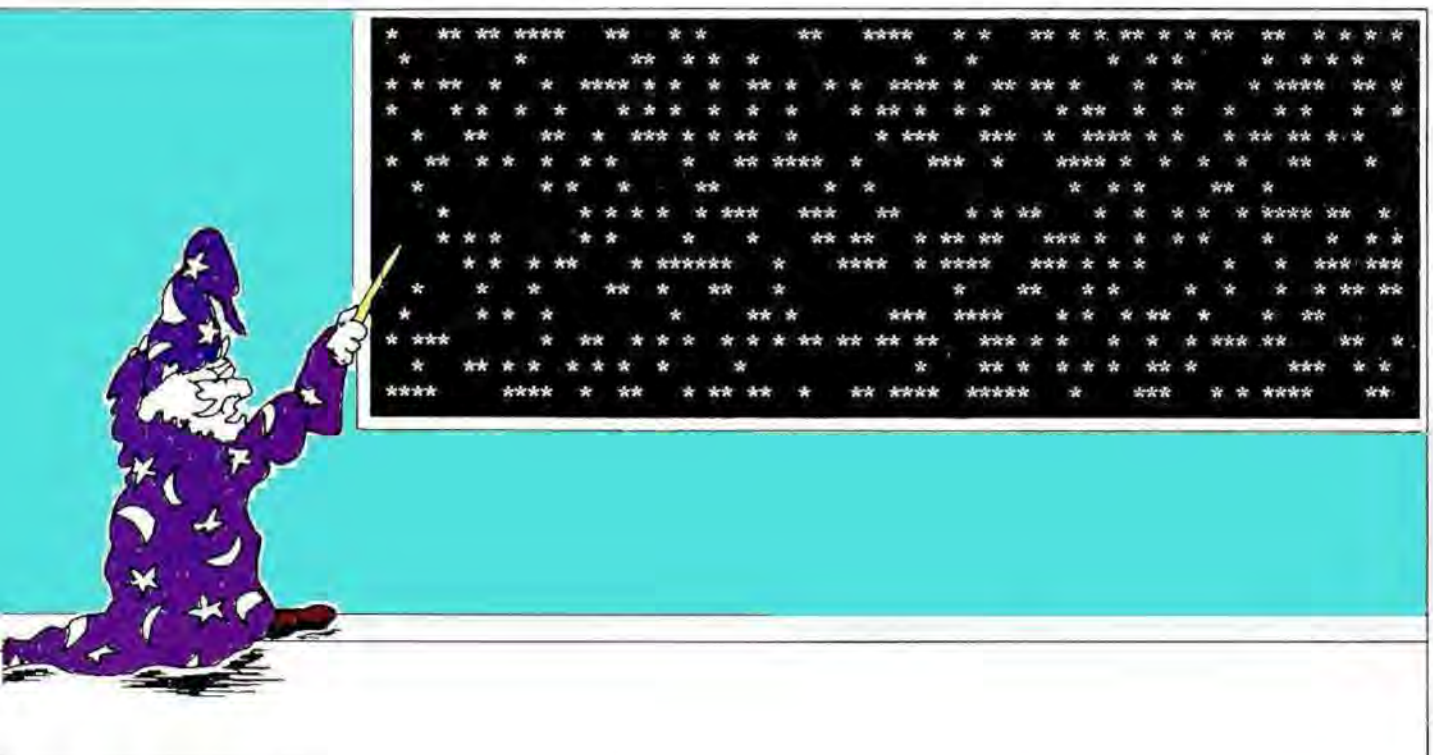
of *HOT CoCo*.

Don't give up too quickly. It is very easy, you know, once you grasp the fact that the Old Wizard arranged the stars in quite recognizable patterns. The message will fall into your lap, so to speak.

And don't feel intimidated by the fact that you are a beginner. Beginning cryptanalysts often become seasoned pros in a very short time—this is a field in which certain persons have a "knack" that is uncanny.

There are more helper programs on the way, and games and contests as well as some hard and challenging work. Get your CoCo—and your wits—ready. •

Write to Karl Andreassen at 24750 Chianti Road, Cloverdale, CA 95425.



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For additional information and programming, write to:

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Teachers! Save valuable time on scoring exams. This grading utility gets an A+ with the Coco.

obtain information about individual results.

To set up the theoretical curve (lines 200-260), the user supplies 1) the total points possible for the test, 2) the theoretical (ideal) mean, and 3) the actual number of test questions. The standard deviation is computed using a standard formula. This portion of the program lets the user determine the ideal curve for the specific situation.

After the user has set up the theoretical curve, he must determine the actual class curve (lines 280-670). Input all test scores using the raw scores (number of questions correct). These results are tabbed in Table T. Input the scores one at a time. The tally box always tells how many scores have been input. By entering 999, the user signals the program that there is no more data for input and the computer establishes an actual class curve. Table T holds a maximum of 100 test scores.

At this point, both curves are set up and the teacher can make inquiries concerning individual scores. Lines 680-1200 contain this inquiry routine.

The user inputs any raw score. The program then:

- 1) calculates the Z score
- 2) calculates the real percentage score
- 3) computes the theoretical points
- 4) outputs all of the above data

Next, you can input another score,

end the program, or look at statistics for the entire class.

This routine allows the teacher to gather all necessary data on a particular test score. Unrealistic results occur if scores are input which were not part of the real curve originally established.

Lines 1440-1620 display the group statistics, including the real curve mean, standard deviation, and the theoretical mean previously set. The computer also displays the total points possible and then returns you to the previous score screen. This routine allows the user to move back and forth between the individual score screen and the group score screen making comparisons between the two.

In actual practice, how might this program be used? Let's say the teacher gives a 50 question test, worth 200 points, and determines that the average student should get 150 points. The teacher establishes the mean as 150 and inputs the raw scores. The program does the rest. It will place each student on the ideal curve established by the teacher, based completely on that student's relative position on the real class curve. Even if the teacher decides not to grade on a curve, the program computes percentages from raw scores input. This saves time, especially if tests or exercises do not have even numbers of questions (10, 20, 25, 50, etc.), which are easily hand-calculated. •

Field Name	Description
A	Accumulator
A1	Deviation From the Mean
A2	Accumulator
B1-B8	Screen Graphics Characters
C	Counter
L	Counter
P	Points Possible
RD	Real Standard Deviation
RM	Real Mean
RP	Real Percentage Correct
RS	Raw Score
SP	Screen Position Work Field
T(100)	Table of Real Scores
TD	Theoretical Standard Deviation
TM	Theoretical Mean
TP	Theoretical Percentage
TQ	Test Questions
X	Tally of Test Scores Entered
Y	Screen Position Workfield
Z	Z Score

Table 1. Cross Reference Listing for Program Grade Calculator

System Requirements
16KRAM
Extended Color Basic

Program Listing. Grade Calculator

```
70 '-----INITIALIZATION -----
80 '
90 DIM T(100)
100 B1=142
110 B2=138
120 B3=139
130 B4=131
140 B5=135
150 B6=133
160 B7=140
170 B8=141
180 CLS
190 GOSUB 1310
200 PRINT "HOW MANY POINTS POSSI
BLE ";:INPUT P
210 PRINT "ENTER THEORETICAL MEA
N ";:INPUT TM
220 PRINT "HOW MANY TEST QUESTIO
NS ";:INPUT TQ
230 '
240 '-----SET THEORETICAL STAND
ARD DEVIATION -----
250 '
260 TD=(P-TM)/2.56
270 '
280 '-----ENTER RAW SCORES -----
290 '
300 PRINT "ENTER RAW SCORES - -"
310 PRINT@448,"WHEN FINISHED, EN
TER 999"
320 GOSUB 1660
330 C=1
340 SP=256
350 PRINT@256," "
360 FOR C=C TO C+4
370 SP=SP+32
380 PRINT@SP," ";
390 INPUT T(C)
400 IF T(C)=999 THEN 470
410 GOSUB 1660
420 NEXT C
430 GOSUB 1210
440 GOSUB 1660:C=C+1
450 GOTO 340
460 '
470 ' ---- CALCULATE ACTUAL STAT
ISTICS ----
480 '
490 ' <<< MEAN >>>
500 A=0:C=C-1
510 '
520 FOR L=1 TO C
530 A=A+T(L)
540 NEXT L
550 RM=A/C
560 '
570 ' <<< STANDARD DEVIATION >>>
580 '

```

```
590 A2=0
600 FOR L=1 TO C
610 A1=RM-T(L)
620 IF A1<0 THEN 640
630 GOTO 650
640 A1=-1*A1
650 A2=A2+A1
660 NEXT L
670 RD=A2/C
680 '
690 '---- INPUT RAW SCORES FOR
OUTPUT ----
700 '
710 CLS
720 GOSUB 1310
730 PRINT
740 PRINT "ENTER RAW SCORE";:INP
UT RS
750 '
760 ' <<< COMPUTE "Z" SCORE >>>
770 '
780 Z=(RS-RM)/RD
790 '
800 ' <<< COMPUTE REAL PERCENTAG
E >>>
810 '
820 RP=100*(RS/TQ)
830 '
840 ' <<< COMPUTE THEORETICAL PO
INTS >>>
850 '
860 TP=(Z*TD)+TM
870 '
880 ' ---- OUTPUT ----
890 '
900 CLS
910 GOSUB 1310
920 PRINT@165,"RAW SCORE"
930 PRINT@197,"PERCENTAGE"
940 PRINT@229,"Z SCORE"
950 PRINT@261,"THEORETICAL"
960 PRINT@295,"POINTS"
970 PRINT@387,"ENTER Y FOR MORE"
980 PRINT@419,"ENTER N TO END PR
OGRAM"
990 PRINT@451,"ENTER E TO SEE CL
ASS STATS"
1000 PRINT@179," ";
1010 PRINT USING "###";RS
1020 PRINT@211," ";
1030 PRINT USING "###";RP;
1040 PRINT " %"
1050 PRINT@241," ";
1060 PRINT USING "+#.##";Z
1070 PRINT@307," ";
1080 PRINT USING "###";TP
1090 PRINT@313," ";
1100 PRINT USING "###";(TP/P)*10
0;
1110 PRINT " %"
```

Listing continued

```

1120 A$=INKEY$
1130 IF A$="" THEN 1120
1140 IF A$="Y" THEN 710
1150 IF A$="N" THEN 1180
1160 IF A$="E" THEN 1190
1170 GOTO 1120
1180 CLS:END
1190 GOSUB 1470
1200 GOTO 900
1210 C=C-1
1220 Y=288
1230 FOR L1=1 TO 5
1240 PRINT@Y," " " "
1250 Y=Y+32
1260 NEXT L1
1270 RETURN
1280 '
1290 ' ---- TITLE BOX SUBROUTINE
-----
1300 '
1310 PRINT@7,CHR$(B1)
1320 FOR A1=8 TO 25:PRINT@A1,CHR
$(B7):NEXT A1
1330 PRINT@26,CHR$(B8)
1340 PRINT@39,CHR$(B2)
1350 PRINT@71,CHR$(B2)
1360 PRINT@43,"NORMAL CURVE"
1370 PRINT@73,"GRADE CALCULATOR"
1380 PRINT@58,CHR$(B6)
1390 PRINT@90,CHR$(B6)
1400 PRINT@103,CHR$(B3)
1410 FOR A1=104 TO 121:PRINT@A1,
CHR$(B4):NEXT A1
1420 PRINT@122,CHR$(B5)
1430 RETURN
1440 '
1450 ' ---- CLASS AVERAGES DISPL
AY ----
1460 '
1470 CLS
    
```

```

1480 GOSUB 1310
1490 PRINT@165,"CLASS MEAN";
1500 PRINT@179," ";
1510 PRINT USING "####.##";((RM/
TQ)*100)*(P/100)
1520 PRINT@197,"STANDARD DEV."
1530 PRINT@211," ";
1540 PRINT USING "####.##";((RD/
TQ)*100)*(P/100)
1550 PRINT@229,"THEO. MEAN"
1560 PRINT@243," ";
1570 PRINT USING "####.##";TM
1580 PRINT:PRINT " ..ABOVE BASED
ON TOTAL"
1590 PRINT " POINTS OF ";P
1600 PRINT@419,"PRESS <ENTER> TO
CONTINUE"
1610 INPUT A$
1620 RETURN
1630 '
1640 ' ---- TALLY BOX SUBROUTINE
-----
1650 '
1660 PRINT@336,CHR$(B1)
1670 PRINT@432,CHR$(B3)
1680 PRINT@368,CHR$(B2)
1690 PRINT@400,CHR$(B2)
1700 PRINT@369," ";
1710 PRINT USING "####";C;
17 20 PRINT " TESTS"
1730 PRINT@403,"ENTERED"
1740 PRINT@380,CHR$(B6)
1750 PRINT@412,CHR$(B6)
1760 FOR A1=337 TO 347
1770 PRINT@A1,CHR$(B7):NEXT A1
1780 FOR A1=433 TO 443
1790 PRINT@A1,CHR$(B4)
1800 NEXT A1
1810 PRINT@348,CHR$(B8)
1820 PRINT@444,CHR$(B5)
1830 RETURN
    
```

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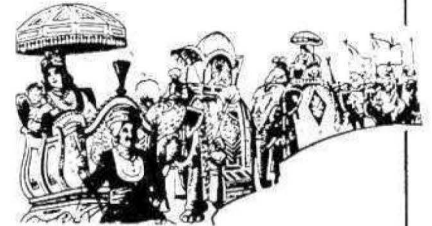
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BY MICHAEL D. POLITO

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Muff Duff is a vocabulary-builder

\vō -'kab-ys-'ler-ē, \n.
a supply of expressive
techniques or devices—
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program that will diagnose your vocabulary strengths and weaknesses and help you develop a stronger one. Once you have mastered its word list you can easily modify it to suit your needs. It contains no special theme or subject, but by changing the DATA statements, you can concentrate on your own particular interests, such as science, music, or medicine.

Muff Duff offers a choice of three exercises:

- a test on all words in the vocabulary list;
- one of five quizzes, each covering one-

fifth of the entire vocabulary list; and
• a word drill, which selects words at random from the list and repeats those words you answer incorrectly.

Each exercise is presented in a multiple-choice fashion with the vocabulary word used in a sample sentence. You receive a score and a rating during and after each exercise. If you choose the drill, the program asks you to select the number of words you want. Make it large or small, but the larger the selection, the more help it will be in correcting the words you muff.

If you have 16K RAM, you must PCLEAR1 or POKE25,6:NEW before keying in or loading Muff Duff. The program contains 80 vocabulary words. It will work with only a few DATA statements, though, because the program sizes itself. That is, it adjusts the sizes of the exercises automatically according to the amount of data.

If you want to check it before keying in the entire program, take advantage of this feature. If, for example, you enter only five DATA statements (the minimum is two), each quiz would be on one word.

You can also temporarily omit the instructions by ignoring line 30 and lines 600-640. You must, however, end the

Program Listing. MuffDuff

```

0
1 REM MUFFDUFF - A VOCABULARY BUILDER WRITTEN BY MICHAEL POLITO
11 SEA WALL LA. BAYVILLE, N.Y. 11709 - FEB. 12, 1983
10 CLEAR220:DIMA$(5):K=5:GOSUB420:A$=" HO CIGAR TENDERFOOT BUSY
BEE DEAN'S PET WHIZ KID "
20 PRINT@42,"muff"CHR$(180)CHR$(191)CHR$(191)CHR$(178)"duff";:PR
INT#102," VOCABULARY BUILDER ";:PRINT@134," WRITTEN BY "
;:PRINT@166," MICHAEL POLITO ";
30 PRINT@224," DO YOU NEED INSTRUCTIONS ";:INPUTQS:IFLEFT$(Q$,1)
="Y"THENGOSUB600
40 PRINT@256," ONE MOMENT, PLEASE":PLAY"V31T8C"
50 READQ$:IFQ$="X"THENRESTORE:GOT060ELSEFORI=1TO6:READQ$:NEXTI:T
=T+1:GOTO50
60 L=INT(T/15):IFL<1THENL=1ELSEIFL>15THENL=15
70 DIMWR(L)
80 CLS:PLAY"A":PRINT:PRINT" YOUR VOCABULARY LIST CONTAINS",T" WO
RDS. SELECT":PRINT:PRINT" (1) test ON ALL WORDS.":PRINT:PRINT
" (2) quiz ON 1/5 OF WORD LIST.":PRINT

```

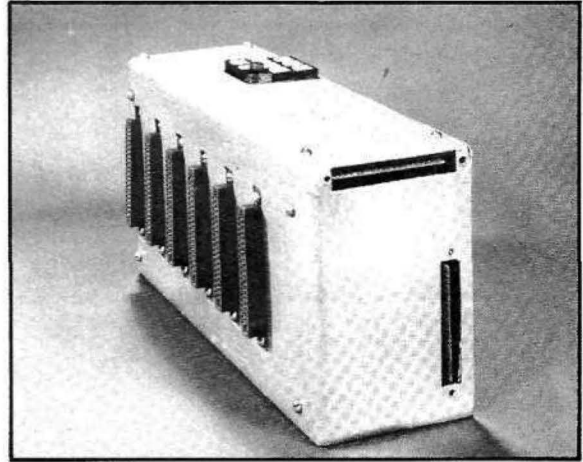
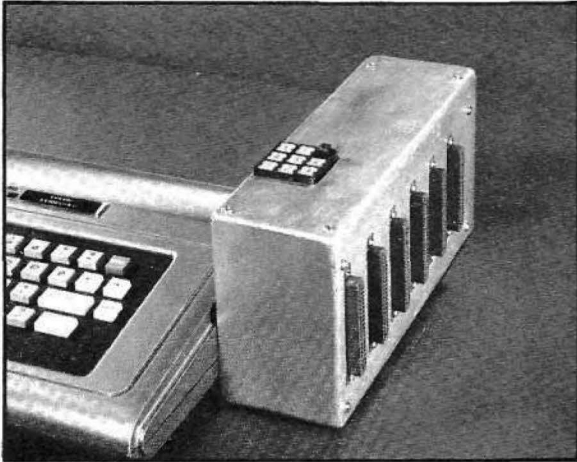
Listing continued

System Requirements
16KRAM
Extended Color Basic

EXPAND YOUR COLOR COMPUTER

USER 80C

USER SELECTABLE EXPANSION REQUIREMENTS



- Activate your disk controller, ROM or RAM cartridge, EPROM board, or any device that normally operates in the Color Computer expansion slot.
- Select any of the 6 slots with push-button keys or programming.
- Menu-driven software simplifies programming and allows the User to operate multiple slots at the same time (e.g., transfers data from one slot to one or more slots).
- Attach additional USER 80C's for more expansion slots.
- Utilize its own reset button, eliminating the need to press the reset button behind the computer.
- Protects the computer from electrical damage caused by experimental boards or by plugging/unplugging ROM cartridges or controller boards with the power on.
- Has its own on/off switch with an LED indicator.
- Gold inlay connector contacts for more reliable operation.
- An external power supply, which is independent from the computer, is supplied. It is a high efficiency, switching regulator type, which uses very little power and generates less heat.
- More to come: Analog/digital converter, parallel ports for printers, cassette recorders and joysticks. Four channel scope works with your computer and displays on your T.V. set or monitor.
- Production of experimental boards upon request (based on your schematics). Experimental boards licensed to you.

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DATA statements with a DATA X. By detecting that data element the program determines the size of the word list and adjusts the exercise accordingly. Be sure to reposition it as you expand your list with those words provided here, or your own. You might also choose a large line number for the DATA X statement and add data before it. If you are adding your own data, you need to enter it in the proper format.

There are seven data elements for each vocabulary word. The first entry is the word entered in nonreversed video. The program shows it as reversed video, but you must not enter it that way. The second element must be the correct answer. Follow this with four incorrect answers. The final element is an example sentence or definition of the vocabulary term. You can also include a pronunciation key as a part of this final element. As you key in additional DATA statements, check your work from time to time by running the program and selecting quiz number five. To ensure that all words appear during the word drill and in quiz number five, make the total number of words in your list a multiple of five.

Some younger students prefer an example sentence rather than a definition. An example might not convey all the meanings of a term but it's easier to remember, and more fun. Remember, though, that you cannot use a comma for punctuation since it is used to separate elements of data. •

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Listing continued

```

85 PRINT" (3) drill RANDOM SELECTION.":PRINT:PRINT" ENTER YOU
R CHOICE ";:INPUTQ$:QS=LEFT$(Q$,1)
90 IFQ$="1"ORQS="T"THENB=T:PLAY"F":GOTO230ELSEIFQ$<>"2"ANDQ$<>"Q
"THEN120ELSEPRINT:PRINT" ENTER QUIZ NO. (1-5)";:PLAY"E":INPUTX:I
FX<1ORX>5THEN80
100 PLAY"F":B=T/5:IFX=1THEN230
110 PRINT" ONE MOMENT, PLEASE":FORJ=1TO (X-1)*T/5:FORI=1TO7:READ
Q$:NEXTI:NEXTJ:GOTO230
120 PRINT:PRINT" HOW MANY WORD drill DO YOU WANT TO TAKE ";
:PLAY"F"
130 INPUTB:IFB<1THEN120
140 FORM=1TOB
150 H=RND(T/5)-1
160 P=P+H+1:IFP>T THENP=P-T:H=P-1:RESTOREELSE210
170 FORI=0TOL
180 IFWR(I)=0THEN200
190 P=WR(I):H=P-1:WR(I)=0:GOTO210
200 NEXTI
210 IFH=0THEN240
220 FORI=1TO H*7:READQ$:NEXTI:GOTO240
230 FORM=1TO B
240 Z$="":READQ$:V=VARPTR(QS):W=PEEK(V+2)*256+PEEK(V+3):FORI=1TO
LEN(QS):Z$=Z$+CHR$(PEEK(W+I-1)+32):NEXTI
250 X=RND(5):READA$(X)
260 FORI=1TO5
270 IFI=X THEN290
280 READA(I)
290 NEXTI
300 CLS
310 PRINT@22,"WORD";M:PRINT@8,Z$;
320 FORJ=1TO5:PRINT@32*J+1,J" "A$(J):NEXTJ
330 N=N+1:INPUT" ENTER ANSWER ";Q$:IFVAL(Q$)<1ORVAL(Q$)>5THENN=N
-1:GOTO300ELSEIFX<>VAL(QS)THENSOUND10,1:F=0:GOSUB550:PRINT" muff
"CHR$(180)CHR$(191)CHR$(178)"dutf-->"X" SCORE="Q"%":GOTO350
340 SOUNDA*7,5:SOUND23*A,8:F=1:GOSUB550:PRINTTAB(5)CHR$(175)"riq
ht"CHR$(175)" SCORE="Q"%
350 PRINT:READQ$:PRINT" "Q$":PRINT
360 PRINT@32*X,CHR(191-F*16);
370 PRINT@499,"PRESS ENTER";
380 Q$=INKEY$:IFQ$=""THEN380ELSEIFASC(Q$)<>13THEN380
390 K=INT((Q+19)/20):IFK=0THENK=1
400 GOSUB420:PRINT@523-96*K,MID$(A$,K*10-9,10):;IFK=5THENSOUND25
*A,8ELSEFORI=1TO300:NEXTI
410 NEXTM:GOTO480
420 CLS0:A=RND(4)+5:FORI=1TOK
430 J=I:IFI=5THENJ=6
440 IFJ=4THENJ=7
450 Q$=STRINGS(96,143+J*16):PRINT@480,Q$;
460 SOUNDA*K*I,1:NEXTI
470 RETURN
480 CLS:PRINT@4,"EXERCISE OVER":PRINT:PRINT" YOUR SCORE IS: ";Q;
"%":PRINT" YOUR VOCABULARY IS:":Q=Q/20.1:PRINT
490 PRINT" BELOW AVERAGE ( 0-20%)"
500 PRINT" AVERAGE (21-40%)"
510 PRINT" ABOVE AVERAGE (41-60%)
520 PRINT" EXCELLENT (61-80%)
530 PRINT" SUPERIOR (81-100%)
540 POKE1024+32*INT(Q+5),62:PRINT:INPUT" TRY AGAIN";Q$:IFLEFT$(Q
$,1)=""Y"THENRUNELSEEND
550 S=(S*(N-1)+F)/N:Q=INT(100*S):IFF=1THEHRETURN
560 FORI=0TOL
570 IFWR(I)<>0AND WR(I)<>P THEN590
580 WR(I)=P:RETURN
590 NEXTI:RETURN
600 CLS:PRINT" WELCOME TO VOCABULARY BUILDER. THE EASY AND FUN
WAY TO IN- CREASE YOUR WORD POWER. YOU ARE GIVEN A CHOIC
E OF THREE EXERCISES: A TEST ON ALL WORDS IN THE VOCA
BULARY LIST, A WORD DRILL, OR ONE OF FIVE QUIZZES."
610 PRINT:PRINT" THE WORD DRILL PROVIDES YOU WITH A RANDOM S
ELECTION FROM THE WORD LIST - YOU PICK THE NUMBER OF WORDS
FOR EACH DRILL. EACH QUIZ COVERS 1/5 OF THE ENTIRE WORD LIS
T. <ENTER>";:INPUTQ$
620 CLS:PRINT" WE SUGGEST YOU TRY THE TEST FIRST. NOTE YOUR
SCORE. THEN TAKE PRACTICE DRILLS FOLLOWED BY THE QUIZZES AN
D THE TEST AGAIN. SEE YOUR SCORE IMPROVE. EACH QUESTION OF
ERS A MULTIPLE CHOICE, PICK THE ANSWER THAT"
630 PRINT" BEST FITS THE VOCABULARY WORD. IF YOU MUFF IT, BE SU
RE TO SAY THE EXAMPLE SENTENCE ALOUD, BECAUSE -":PRINT
640 PRINT" YOUR DRILLMASTER REMEMBERS YOUR MISTAKES AND WILL REP
EAT THOSE WORDS LATER! <ENTER>";:INPUTQ$:CLS:RETURN
650 DATA ABATE,LESSEN,URGE,ENCOURAGE,CONFORM,A WRONGDOING,WHEN T
HE STORM ABATED,WE WENT TO THE MOVIES
660 DATA SOLACE,EASE SORROW,RELAXATION,VACATION,SELL,PLEASE,GIVE
SOLACE TO THE INDIGENT
670 DATA ABET,ENCOURAGE WRONGDOING,WAGER,INCREASE,MAKE DELINQUEN
T,OPPOSE,POOR RECREATIONAL FACILITIES ABETS JUVENILE DELINQUE
NCY

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tilling continued

Listing continued

680 DATA ABHOR, HATE, RELISH, ARROGANT, SERVILE, SHAMEFUL, ABHOR EVIL; CLING TO GOOD
690 DATA ERUDITE, SCHOLARLY, BURST FORTH, INCORRECT, GEMSTONE, REMOVE, AN ERUDITE SPEAKER HAS A LARGE VOCABULARY
700 DATA ARDENT, EAGER, LOVELY, INTELLIGENT, SMOOTH, DIFFICULT, IT'S A JOY TO TEACH AN ARDENT STUDENT
710 DATA PRINCIPAL, CHIEF, THEORY, BELIEF, LAW, RULE, WHEN THE PRINCIPAL BECAME ILL THE UNDERSTUDY TOOK OVER
720 DATA ASSIDUOUS, ATTENTIVE, STUPID, FAST, HUGE, CARELESS, IT'S AN ASSIDUOUS STUDENT THAT GETS THE HIGH GRADES
730 DATA CHASTISE, PUNISH, MAKE PURE, HURRY, SET FREE, TRAP, CHASTISE THAT SELFISH BRAT
740 DATA COPIOUS, PLENTIFUL, STRICT, SOUR, FULL OF HOLES, SMART, DRINK COPIOUS AMOUNTS OF WATER AFTER EATING HOT PEPPER
750 DATA DEVIATE, STRAY, PLAY, UGLY, REDUCE, ATTRACT, DON'T DEVIATE FROM THE ORIGINAL PLAN! STAN
760 DATA EMACIATED, EXTREMELY THIN, FREE, VERY HUNGRY, SICKLY, IDLE, TAKE THIS EMACIATED CHILD TO A HOSPITAL
770 DATA EXULT, REJOICE, REMOVE, ERASE, ADDED, PROPEL, EXULT IN AN UNEEXPECTED VICTORY
780 DATA GNARL, TWIST, MAKE UNTIDY, GRIND ONES TEETH, NOISE, TRAFFIC, LOOK AT THAT GNARLED OAK TREE
790 DATA AMBIVALENT, HAVING CONFLICTING FEELINGS, CONSISTING OF TWO PARTS, ABLE TO USE BOTH HANDS, UNTRAINED, YELLOWISH, HE IS AMBIVALENT ON THAT POLITICAL ISSUE
800 DATA INDEMNITY, PAYMENT FOR LOSS, DOUBLE, VERY NEEDEY, DIFFICULT TO REMOVE, SLOW, DON'T BE A DUMMY! DEMAND INDEMNITY FOR YOUR LOSSES
810 DATA INKLING, VAGUE NOTION, SMALL BLOT, PRINT, YOUTHFUL, CONNECTION, WE HAD NO INKLING OF HOW SHE FELT
820 DATA INVETERATE, CHRONIC, ENTICING, ILLEGAL, COMPLEX, EXTRA, HE'S BEEN AN INVETERATE DRINKER FOR MANY YEARS
830 DATA POIGNANT, TOUCHING, DEEP, STANDING, LOVELY, PAINLESS, THE POIGNANT SCENE BROUGHT US TO TEARS
840 DATA RECOMPENSE, RENUMERATION, OPINION, TO BORROW, RETURN, QUIT, PAY ME FAIR RECOMPENSE FOR MY LABOR
850 DATA RANCOR, ILL-WILL, NOISE, WEAK, HARD, UNSURMOUNTABLE, SHE IS FILLED WITH RANCOR OVER HIS MISTREATMENT
860 DATA SPONTANEOUS, UNPLANNED, FLAMMABLE, WET, EASY TO UNDERSTAND, WILD, THE CHILD'S SPONTANEOUS REMARK MADE ME BLUSH
870 DATA ACQUIESCE, ACCEPT WITHOUT OBJECTIONS, ATTRACT, MELT, DISAGREEABLE, SHARPEN, ACQUIESCE TO THE DEMANDS OF THE ROBBERS
880 DATA INSUPERABLE, IMPOSSIBLE TO OVERCOME, WEAKLY, WITHOUT EVIDENCE, STRONG, NOT POROUS, THAT ONE INSUPERABLE OBSTACLE LED TO MY DEFEAT
890 DATA GARRULOUS, VERY TALKATIVE, MILITARILY, ROUGH, DENSE, NEARLY WORTHLESS, I'M IMPATIENT WITH GARRULOUS OLD WOMEN
900 DATA RESPITE, REPRIEVE, REMAINDER, IRKSOME, SOFT BREATHING, SWEAT, WE GET A BRIEF RESPITE FROM THE DIFFICULT TASK AT 10AM
910 DATA ALLUDE, REFER TO, PRETTY, ATTRACT, CLEAR, GIVE HELP, DON'T ALLUDE TO ME! DUDE
920 DATA DISHEVELED, UNTIDY, FIERCE, FOOLISH, PECULIAR, UNHAPPY, MY DISHEVELED HAIR LOOKS AWFUL
930 DATA PRINCIPLE, RULE, LEADER, MAIN FIGURE, CAPITAL, CLIENT, USE A PRINCIPLE THAT WORKS NOT ONE OF CONVENIENCE
940 DATA AUDACIOUS, BOLD, USELESS, FOOLISH, CRAZY, UNNECESSARY, THE AUDACIOUS FEAT STUNNED THE CROWD
950 DATA REPROBATION, REJECTION, CALL BACK, RELEASE, RETURN PAYMENT, GUILT, STAN'S ENTIRE PLAN FACED REPROBATION WHEN HE ADDED ONE ITEM
960 DATA SUPERSEDE, TAKE THE PLACE OF, ENFORCE, REPEAL, CONTINUE, SPECIFY PENALTIES FOR, THIS WEATHER REPORT SUPERSEDES THE LAST ONE
970 DATA VACILLATE, WAVER, AVOID, INJECT, TREAT, SCOLD, CHOOSE ONE; DON'T VACILLATE
980 DATA ANTIPATHY, HOSTILITY, STAGE FRIGHT, SUSPENSE, FRIENDLINESS, BASHFULNESS, A TRUCE ENDED THEIR ANTIPATHY
990 DATA SYCOPHANTIC, BOOTLICKING, SURPRISING, CONTEMPTIBLE, UNBELIEVING, SNEERING, HE'S A SYCOPHANT (SIK'-O-FANT) AROUND THE BOSS
1000 DATA CACOPHONY, HARSH-SOUNDING, POLITICAL GROUP, CROWDED CONDITION, CULTURAL ADVANTAGE, FOUL ODORS, A CACOPHONY OF SOUND CAME FROM THE FRESHMAN BAND
1010 DATA CONSUMMATE, PERFECT, REPENTENT, PUNISHED, VICIOUS, UNREFORMABLE, IT'S BEEN A CONSUMMATE DAY
1020 DATA EGREGIOUS, OUTSTANDINGLY BAD, SLIGHT, BEYOND REPAIR, HUMOROUS, UNNECESSARY, MY BLIND DATE WAS AN EGREGIOUS ERROR
1030 DATA GREGARIOUS, COMPANY-LOVING, UNTRUSTWORTHY, VICIOUS, SELF-SACRIFICING, CALM, I'M GREGARIOUS; HE'S A LONER
1040 DATA PHEGMATIC, EMOTIONALLY CALM, IRRITATING, HIGHSTRUNG, ANNOYING, SATISFIED, JOAN'S PHEGMATIC ATTITUDE MAKES HER SEEM DULL
1050 DATA AMBIGUOUS, UNCERTAIN, TOO LARGE, EXTENSIVE, OVERWORKED, LOSS, HIS DIRECTIONS WERE SO AMBIGUOUS WE DIDN'T KNOW WHICH WAY TO GO
1060 DATA ASCETIC, SELF-DENYING, SOUR, RISING, STARLIGHT, STERLING, HE'S NOT THE ASCETIC TYPE; HE LIKES HIS LUXURIES
1070 DATA PANDER, CATER TO EVIL, SELL, GIVE GRUDGINGLY, OFFER FREELY, BEG, THE RUTHLESS RULER PANDERED TO THE LOWEST INSTINCTS OF THE

Listing continued

Coming Next Month

If you use your Color Computer to help you with your money matters, whether for personal or business use, the January *HOT CoCo* will be invaluable to you. Next month we'll feature a number of articles that will help you play the stock market, follow your investments, do loan analyses, and, if you are a salesman, let you keep track of your accounts.

James Barbarello is a familiar name to *HOT CoCo* readers, and his stock-transactions tracker is just one reason his name keeps appearing in this magazine. This program lets you see how your stocks are doing and how they might fare in the future.

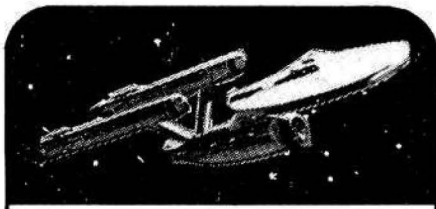
Charles Levinski's "Active Negotiations" article resulted from frustration. His company needed a way to keep track of sales accounts—their potential value, the likelihood of a sale, and so on. When they couldn't get anyone to program their IBM mainframe to do this within a reasonable amount of time, Charles sat down and wrote the program on his CoCo.

For home use, we'll have Richard Tucker's loan-analysis program. This 4K Color Basic program will show you how the interest and principal change over the course of a loan. Also, Carl Christensen's "Computing Your Future" will tell you how to manage your money so you'll have what you need for retirement.

For the small-business person, Mike Charlton has a good payroll program. Also, Gerald Sprouse will provide a mailing-list program.

If you are a FLEX user, you'll appreciate the return of Re: FLEX. Scott Norman will take over the reins of the column with a user approach. FLEX opens up many possibilities for business use on the CoCo, and Scott has much familiarity with the system. This column will appear every other month.

We'll even have some room left for games, utilities, and maybe a hardware project. So, pick up January's *HOT CoCo* and learn how to make your Color Computer pay for itself. •



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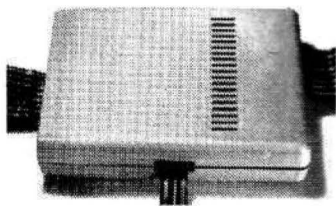


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Listing continued

MOB

1080 DATA EaPIATE, MAKE AMENDS FOR, PASS AWAY, DISINTER, CALL OFF, BR EATHE OUT, EXPIATE YOUR SINS! GIVE YOUR SISTER BACK HER LOLLIP OP

1090 DATA DEPRICATE, DISAPPROVE OF, EMBRACE EVIL, DECREASE IN VALUE, INSULT, TEASE, DON'T DEPRICATE MY COMPUTER; IT CAM TEACH US MUCH
1100 DATA GESTICULATE, GESTURE, EAT, FORM AN OPINION, HESITATE, SURRO UND, MAKE YOUR POINT - GESTICULATE

1110 DATA ALTRUISM, INTEREST IN OTHERS, THUTHFULNESS, BEING THOROUGH, BRAVERY, THE ART OF FLYING, SHE'S AN ALTRUIST; SHE LIKES HER WORK AT THE WELFARE DEP'T

1120 DATA PEDANT, EDUCATED SHOWOFF, NECK JEWELRY, FOOT OPERATED, SLOW TO GRASP, WORKHORSE, THAT PEDANT EXPECTS US TO DOT ALL OUR I'S AND CROSS ALL OUR T'S

1130 DATA COQUETTE, A FLIRT, YOUNG CHICKEN, LAWN GAME, SMALL MORSEL, VALVE HANDLE, I THINK THAT COQUETTE'S GOT HER EYE ON YOU

1140 DATA MEGALOMANIA, DELUSIONS OF GRANDEUR, AFRAID OF CROWDS, FEAR OF LOUD NOISES, EXPERT AT ONE THING, HYSTERIA, THIS MEGALOMANIAC THINKS HE'S NAPOLEON

1150 DATA TACIT, UNSAID BUT IMPLIED, SILENT BUT DEADLY, SMALL BUT OBVIOUS, UNLIKELY BUT POSSIBLE, NECESSARY AND SUFFICIENT, I THOUGHT DAD'S NOD MEANT TACIT APPROVAL SO I BORROWED THE CAR

1160 DATA VITRIOLIC, CORROSIVE, IMPORTANT, FAR REACHING, MADE OF CLAY, CONE SHAPED, HIS VITRIOLIC SATIRE MADE A LASTING IMPRESSION ON ME

1170 DATA DOGMATIC, AUTHORITATIVE, UNSOCIAL, DIFFICULT TO DEAL WITH, STALE, PRE-ARRANGED, I WISH HE WOULD KEEP HIS ARRO-CANT DOGMATIC OPINIONS TO HIM-SELF

1180 DATA SARDONIC, INSINCERE AND DERISIVE, MADE WITH FISH, ARCHAIC, QUESTIONING, COURSE IN STRUCTURE, BY HIS SARDONIC SMILE I KNEW HE THOUGHT MY POEM WAS CHILDISH

1190 DATA COMMENSURATE, EQUAL TO, SHORT, ESTABLISHED, AWARD, SAD, PAY ME COMMENSURATE WITH MY ABILITY

1200 DATA CIRCA, OF APPROXIMATE DATE, A TROPIC BEETLE, GREEK GODDES S, ENCIRCLE, WIDESPREAD, THE AUTHOR OF THIS BOOK DIED CIRCA 1640

1210 DATA DICHOTOMY, DIVISION IN TOO PARTS, BLUNT, DRYING PROCESS, S TOMACH ULCER, STUDY OF DIGESTION, WE HAVE HERE A DICHOTOMY OF VALUES - GOOD AND EVIL

1220 DATA VITUPERATIVE, ABUSIVE, SIGNIFICANT, INSIGNIFICANT, BOILING, HEALTHY, HIS VITUPERATIVE CRITICISM MADE THE GIRL CRY

1230 DATA CABAL, A SMALL GROUP, HANDWRITTEN NOTE, TELEGRAPH MESSAGE, BEACH HUT, NEWSPAPER, A CABAL OF FOREIGNERS IS PLOT-TING TO OVERTHROW MONACO

1240 DATA ARCANE, SECRET, OBSOLETE, SWEET, PASSAGE, OLD, THIS MEDICINE IS MADE FROM AN ARCANE FORMULA

1250 DATA TENUOUS, FLIMSY, TEMPORARILY, AHEAD OF, STRONG, SUBSTANTIAL, THE STORY HAD A TENUOUS PLOT

1260 DATA SERENDIPITY, LUCK, VENOMOUS, MUSICAL, THINNESS, SWIFTNESS, HE DIDN'T RELY ON SERENDIPITY FOR HIS SCIENTIFIC DISCOVERY

1270 DATA RETICENT, SILENT, SORRY, CLOSED, REVERSED, SLENDER, SHOW OFF YOUR VOCABULARY; DON'T BE RETICENT

1280 DATA STRIDENT, LOUD AND SHRILL, WIDE, FORCEFUL, EASILY UNDERSTOOD, DISTASTEFUL, YOU CALL IT DULCET; I CALL IT STRIDENT

1290 DATA INDOLENT, LAZY, POOR, IN DEBT, DULL, WITHOUT HUMOR, HE IS TOO INDOLENT TO STUDY HIS VOCABULARY LESSON

1300 DATA ENERVATE, DEVITALIZE, INVERT, CLEAN, EXERT PRESSURE, STING, HER STUDIES COMPLETELY ENERVATED HER

1310 DATA BENIGN, KINDLY, SAFE, SMALL, LOCAL, LEAST, THE BENIGN OLD LADY WAS A HIT AT THE PARTY

1320 DATA IMPLACABLE, RELENTLESS, DENSE, RARE, DIFFICULT, UNSTEADY, HE'S AN IMPLACABLE FOE OF NUKE POWER

1330 DATA INVIDIOUS, UNFAIR DISCRIMINATION, EVIL, GRADUAL, IMPOSING, UNWELCOME, TO LIKEN MEN TO BEASTS IS AN INVIDIOUS COMPARISON

1340 DATA MORIBUND, DYING, GATHERED, ANTISOCIAL, UNYIELDING, IDLE, THE MORIBUND AGENCY IS BEING TERMINATED

1350 DATA INCONGRUOUS, INAPPROPRIATE, PROTRUDING, OVERWORKED, UNEVEN, IN COMMITTEE, SNEAKERS ARE INCONGRUOUS WITH A TUXEDO

1360 DATA ENNUI, BOREDOM, HINT, SHORT CUT, AS A GROUP, OBTUSE, HER EMP TY LIFE FILLED HER WITH ENNUI (ON'-WEE)

1370 DATA ESOTERIC, CONFINED TO A SELECT FEW, DIFFICULT TO UNDERSTAND, UNFIT, EXPENSIVE, APART, OUR GENETIC ENGINEERING DEPARTMENT HAS AN ESOTERIC PLAN

1380 DATA INTREPID, FEARLESS, ANGRY, SLEEPY, AWARE, WITH ESTEEM, JOHN IS AN INTREPID SOLDIER

1390 DATA CATHOLIC, UNIVERSAL, SEVERE, OPTIMISTIC, NARROW MINDED, RIGOROUS, MARY'S VIEWS ARE CATHOLIC. SHE CAN TALK INTELLIGENTLY ON ANY SUBJECT

1400 DATA UBIQUITOUS, WIDESPREAD, OILY, AROMATIC, WORTHWILE, USELESS, THE UBIQUITOUS CONCERN IN THE SEVENTIES WAS THE PRICE OF OIL

1410 DATA DUCILE, OBEDIENT, LOVABLE, HONEST, STUPID, WEAK, DOCILE CHILDREN ARE EASY TO TEACH

1420 DATA FLAGRANT, SCANDALOUS, HUGE, PETTY, IMPORTANT, ANGRY, HIS FLAGRANT DISREGARD FOR THE LAW ENDED IN JAIL

1430 DATA LATENT, HIDDEN, REGISTERED, TARDY, IGNORANT, LACKING, A CHILD OFTEN HAS LATENT ABILITIES

1440 DATA CREDIBLE, RELIABLE, REGRETTABLE, WORTHY OF AWARD, FULL, EMP TY, A CRIMINAL IS HARDLY A CREDIBLE WITNESS

1450 DATA X

1460 END

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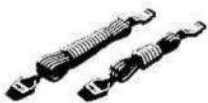
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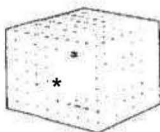


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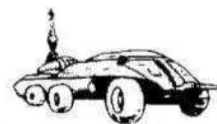


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CHECKSUM

After you've typed in a long listing, how would you like a simple way to tell you at a glance exactly which program lines have errors in them? You can use this program for the Color Basic or Extended Color Basic CoCo to produce a checksum value for each numbered line. By comparing this value with what it ought to be, you can tell immediately if there is an error in that program line.

Currently, there is no standardized way of computing checksums for popular Basic programs and listings, nor is there an efficient way to distribute correct checksum values. It would be a good idea to print checksum values right in a program listing, as it's published in a magazine, as long as the readers know how to use and compare these values.

Program Listing 1 computes and displays a single checksum value for each line in the main program by adding up the ASCII value of the contents of each memory location associated with that program line. In addition, it computes and displays the sum

Here's a fast, efficient way to catch errors in those program listings you type from magazines.

of all checksums in each successive block of 10 program lines.

The main program lines can contain multiple statements separated by a colon, but must all be numbered less than 63000. You can then compare the checksum value produced to the author's values. This should clearly show the correct and incorrect program lines, assuming there are not two or more self-cancelling errors in any line.

The following directions show how authors can generate checksums for each program line:

- Debug the main program.
- Type in (append) Listing 1.
- RUN 63000.
- Make a copy of the checksum values for each program line and the block checksums as they appear on the screen.
- Edit each program line that is not a DATA statement, adding an apostrophe and the checksum value to each line. Then add additional remarks if appropriate.

Publishers could then print the entire listing, including the checksums for each program line. They could also print block and DATA statement checksums as a separate table.

Readers who wish to type in the

System Requirements

**4KRAM
Color Basic**

```
63000 CL=PEEK(25)*256+PEEK(26)
63010 CLS: BN=BN+1:BT=0: PRINT " LINE", "CHECKSUM":PRINT
63020 FOR I=1 TO 10:CS=0:LN=PEEK(CL+2)*256+PEEK(CL+3)
63030 IF LN<63000 THEN PRINT LN, :NL=PEEK(CL)*256+PEEK(CL+1):ELSE
  I=11:GOTO 63060
63040 FOR J=CL+2 TO NL-1:IF PEEK(J)=58 AND PEEK(J+1)=131 THEN J=
NL:ELSE CS=CS+PEEK(J)
63050 NEXT J:PRINT CS:CL=NL:BT=BT+CS
63060 NEXT I:PRINT:PRINT"BLOCK:";BN,BT:PRINT:IF LN>62999 THEN EN
D
63070 INPUT-PRESS ENTER TO CONTINUE";BT:GOTO 63010
```

Program Listing 1. Checksum Listing for Authors or Readers. Running 63000 displays the checksum of each program line.

listing from the magazine would perform the following steps:

- Type in the entire main program listing, less the checksums.
- Type in (append) Listing 1 (Checksum).
- RUN 63000.
- Do a line-by-line comparison of the checksums generated by your manually-entered listing and those provided by the author at the end of each of his program lines. Proceed through the entire program listing, copying down those line numbers which do not agree.
- Correct any errors you find.
- Repeat steps 3-5 until no errors remain.

Having both the printed program and checksums before you gives you a much better chance of debugging long listings. I intend to provide checksums for all my Basic programs, and encourage others to adopt Checksum, or to provide a similar, more efficient method. •

Address correspondence to Howard Batie, 12002 Cheviot Drive, Herndon, VA 22070.

- CL = Location of first byte of the Current Line
- NL = Location of first byte of the Next Line
- LN = Line Number of the current line
- BN = Block Number
- BT = Block Total
- CS = Checksum for current program line
- I = Loop variable
- J = Loop variable

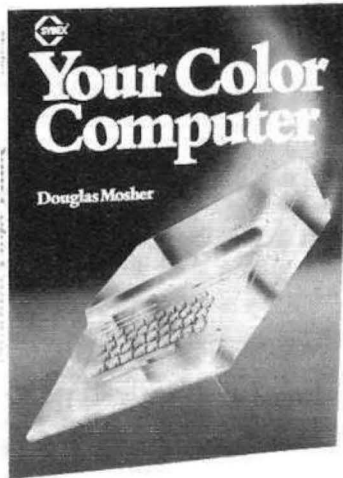
Table 2. Variables for Program Listing 1.

Line	Checksum
100	1478
110	4213
120	3078
130	4166
140	983
150	1482
160	2781
170	3437
180	982
190	1483

BLOCK 1 24083
PRESS ENTER TO CONTINUE?

Table 1. An example of what you'll see when you add Checksum to a listing and execute RUN63000.

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LANDSCAPE DEFENSE

Landscape Defense consists of flying a yellow space ship over a landscape to shoot down enemy craft flying at you. Pushing the fire button causes a blue laser blast to instantly flash the width of the screen. This is accomplished with string graphics. For a demonstration of the speed that is possible, type and run `CLS0:PRINT@130,STRNG$(27,163);CLS0` on your CoCo.

In developing this game, I learned some new techniques for creating computer graphics. So, if you run this program and observe what's going on, you might see some new methods for giving the impression of movement or for displaying a colorful graphic message.

The Illusion of Movement

Your ship appears to move to the right because the ground moves to the left. It took a lot of work to get the ground movement smooth.

Originally, I shifted the landscape one `PRINT@` position each time it moved, but the result was very jumpy. I realized that to smooth out the graphics, the land could shift only half a `PRINT@`

There are a couple of nice video effects that you can learn from studying this arcade-type game.

position each time it moved.

Moving the land in this way required two different sets of graphic strings. The ground in the program is two `PRINT@` positions high. This means that the movement of the land required four strings.

Figure 1 is a miniature example of the problem of moving my landscape. My solution of using two separate strings may not be the only, or even the best way, but it is effective.

The last 32 positions of the ground must match the first 32 positions. This allows the ship to fly indefinitely without appearing to jump into hyperspace. The ground is continuous. Every time the program goes through its main loop (lines 690-830), the landscape makes two shifts. Each shift is one-half a `PRINT@` position.

The enemy ships move to the left two

`PRINT@` positions each time the program passes through the main loop. Therefore, the enemy is moving toward you faster than the land is. This adds more realism.

The enemy's running lights flash from white to orange. I like lots of color; that's why I often use low-resolution graphics.

Playing Instructions

Your extra ships are printed at the top of the screen. Each time you lose a ship, a replacement comes down, until you run out of ships and thus end the game.

There are two ways to lose your ship. If you fail to destroy an enemy craft, and it rams yours, both ships are destroyed. Or once 10 enemy ships get past you, it costs you one of your ships.

Even if an enemy ship rams yours, the record of enemies that have passed you remains in effect. For example, if eight enemy ships get away and the next one rams yours, two more enemies passing across the screen will cause your second ship to explode.

This procedure makes the game more challenging. It makes you try for those close calls that you might otherwise let pass by.

The enemy is sometimes impossible to stop. One coming in low, followed by



ASCII codes 183, 178, 177, 191, 178



ASCII codes 187, 176, 183, 187, 176

1/2 `PRINT@` shift to the left

Fig. 1. Example of the Technique Used to Move the Landscape

System Requirements

16K RAM

Extended Color Basic

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one flying high, makes it impossible to blast both. Your ship won't jump from the bottom to the top of the screen in a single bound. The craft operates within realistic climbing and diving limitations.

If the joystick is pushed up or down, your ship moves one PRINT@ position in the corresponding direction each time the program goes through the main loop. This makes for smooth, believable video. The PLAY command creates the rapid sounds. You score 10 points for each enemy craft you destroy.

The Squadron Leader Display

At the end of most video games, the screen displays the top 10 players' initials in descending order. But my grandest visual to date results in the

"But my grandest visual to date results in the display that rewards the high scorer of those 10."

20	reserves string space, protects memory locations for two machine-language subroutines and a low-resolution graphics display.
40	defines entry addresses for two machine-language subroutines.
50-310	sets up low-resolution graphics display in high memory.
330-340	(machine-language subroutine) moves low-resolution graphics display to video monitor.
350-360	(machine-language subroutine) rotates colors on video monitor.
380	creates strings for enemy ships. E\$(1) is all buff, E\$(2) has orange running lights.
390	creates strings to display explosions.
400	starts game with three ships.
420	creates graphics for your ship.
430-590	sets up strings for ground movement.
600-640	creates instructions.
650	displays extra ship at top of screen.
660	displays ground below moving landscape.
670	initializes ground position.
680	initializes ship's position.
690	determines if fire button has been pushed; determines if enemy has been hit.
700	determines if enemy ship has rammed yours.
710	determines if enemy ship flew by without being hit.
730	creates explosion after 10 enemy ships have passed you by.
740-760	provides up and down movement of your ship.
770	prints moving ground.
780	positions enemy ship.
790	moves enemy across screen.
800-810	prints enemy ship.
820	moves ground.
840-930	is data for landscape.
940	displays graphic reward if last score is highest.
980	resets program to play again.
990	calls machine-language subroutine to transfer picture stored in high memory to video.
1000-1020	calls machine-language subroutine to rotate colors on video.
1040-1080	displays top 10 scores in descending order.

Table 1. Line Description

display that rewards the high scorer of those 10. I've relisted the two subroutines that create this as Program Listings 2 and 3.

In the line description (Table 1), notice that lines 50-310 POKE values into the top of memory. These values are the ASCII codes for graphics characters. They create a title when transferred to video memory.

Lines 330 and 340 POKE a machine-

language subroutine into memory. (This is the Basic translation of Listing 2.) This subroutine transfers the contents of memory positions 15872-16383 into video memory, locations 1024-1535. The picture has a four-color border and the multicolor graphic message, "Squadron Leader."

Lines 350 and 360 POKE another machine-language subroutine (Listing 3) into memory. This program rotates

the colors. Green changes to yellow, yellow to blue, and so on through the eight colors by adding 16 to the ASCII code. By subtracting 112, you change

"Of course, only the best player is given the title Squadron leader."

an orange area, ASCII greater than 239, back to green.

These subroutines are called in lines 990 and 1000. They only appear when a score is the highest of the ten nonpermanent scores. Of course, only the best player is given the title of Squadron Leader. ■

Write to James Wood c/o HOT CoCo, Pine St., Peterborough, NH 03458.

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Program Listing. Landscape Defense

```

5 PCLEAR1
20 CLEAR3000,15829
30 CLS0:PRINT@10,"PREPARING FOR
---";
40 DEFUSR0=15852:DEFUSR1=15829
50 REM BORDER
60 POKE15872,142:POKE15903,141:P
OKE16352,139:POKE16383,135
70 FORA=15873TO15902:POKEA,140:P
OKEA+480,131:NEXTA
80 POKE15905,158:POKE15934,157:P
OKE16321,155:POKE16350,151
90 FORA=15906TO15933:POKEA,156:P
OKEA+416,147:NEXTA
100 POKE15938,174:POKE15965,173:
POKE16290,171:POKE16317,167
110 FORA=15939TO15964:POKEA,172:
POKEA+352,163:NEXTA
120 POKE15971,190:POKE15996,189:
POKE16259,187:POKE16284,183
130 FORA=15972TO15995:POKEA,188:
POKEA+288,179:NEXTA
140 FORA=15904TO16320STEP32:POKE
A,138:POKEA+31,133:NEXTA
150 FORA=15937TO16289STEP32:POKE
A,154:POKEA+29,149:NEXTA
160 FORA=15970TO16258STEP32:POKE
A,170:POKEA+27,165:NEXTA
170 FORA=16003TO16227STEP32:POKE
A,186:POKEA+25,181:NEXTA
180 FORA=16004TO16027:POKEA,128:
POKEA+224,128:NEXTA
190 REM LETTERS
200 FORA=16036TO16059:READ D1:PO
KEA,D1:NEXTA
210 DATA 254,252,248,238,236,234
,218,128,218,206,204,202,190,187
,128,174,172,162,158,156,154,139
,128,138
220 FORA=16068TO16091:READ D1:PO
KEA,D1:NEXTA
230 DATA252,252,250,234,226,234,
218,128,218,206,204,202,186,183,
184,174,174,128,154,128,154,138,
137,138
240 FORA=16100TO16123:READ D1:PO
KEA,D1:NEXTA
250 DATA 252,252,248,236,237,232
,220,220,216,200,128,200,188,184
,128,168,164,128,156,156,152,136
,128,136
260 FORA=16132TO16155:READ D1:PO
KEA,D1:NEXTA
270 DATA128,128,128,218,128,128,
206,204,200,190,188,186,174,171,
128,158,156,152,142,140,130,128,
128,128
280 FORA=16164TO16187:READ D1:PO
KEA,D1:NEXTA
290 DATA 128,128,128,218,128,128
,206,204,128,190,188,186,170,167
,168,158,156,128,142,142,128,128
,128,128

```

```

300 FORA=16196TO16219:READ D1:PO
KEA,D1:NEXTA
310 DATA 128,128,128,220,220,216
,204,204,200,184,128,184,172,168
,128,156,156,152,136,132,128,128
,128,128
320 REM MACHINE LANGUAGE SUBROUT
INES
330 FORA=15852TO15871:READ D1:PO
KEA,D1:NEXTA
340 DATA 142,62,0,16,142,4,0,166
,132,167,160,167,128,16,140,6,0,
38,244,57
350 FORA=15829TO15851:READ D1:PO
KEA,D1:NEXTA
360 DATA 142,4,0,166,132,129,239
,47,4,128,112,32,2,139,16,167,12
8,140,6,0,38,237,57
370 CLS0:SOUND100,1:PRINT@70,"LA
NDSCAPE DEFENSE";
380 E$(1)=CHR$(196)+CHR$(195)+CH
R$(200)+STRING$(4,128):E$(2)=CHR
$(244)+CHR$(195)+CHR$(248)+STRIN
G$(4,128)
390 FORA=1TO10:EX$(A)=CHR$(RND(1
27)+128)+CHR$(RND(127)+128)+CHR$(
RND(127)+128)+CHR$(RND(127)+128
)+CHR$(RND(127)+128):NEXTA
400 PLAY"04L255":FS=3
410 CLS0:PRINT@198,"STAND BY FOR
BATTLE";
420 SP$(1)=CHR$(155)+CHR$(155)+CHR$(
147)
430 FORA=1TO67:READ D
440 IF D>100 THENA$(1)=A$(1)+CHR
$(D) ELSE READ DA:A$(1)=A$(1)+ST
RING$(D,DA)
450 NEXTA
460 CLS2:SOUND120,1
470 A$(1)=A$(1)+LEFT$(A$(1),31)
480 FORA=1TO108:READ D
490 IF D>100 THENA$(2)=A$(2)+CHR
$(D) ELSE READ DA:A$(2)=A$(2)+ST
RING$(D,DA)
500 NEXTA
510 CLS3:SOUND140,1
520 A$(2)=A$(2)+LEFT$(A$(2),31)
530 FORA=1TO66:READD
540 IF D>100 THENB$(1)=B$(1)+CHR
$(D) ELSE READ DA:B$(1)=B$(1)+STR
ING$(D,DA)
550 NEXTA:B$(1)=B$(1)+LEFT$(B$(1
),31)
560 CLS4:SOUND160,1
570 FORA=1TO108:READD
580 IF D>100 THENB$(2)=B$(2)+CHR
$(D) ELSE READ DA:B$(2)=B$(2)+STR
ING$(D,DA)
590 NEXTA:B$(2)=B$(2)+LEFT$(B$(2
),31)
600 CLS0:PRINT@39,"LANDSCAPE DEF
ENSE";:PRINT@98,"YOUR SHIP"+CHR$(
128)+SP$;:PRINT@130,"USE RIGHT
JOYSTICK TO CONTROL";:PRINT@161,

```

Listing continued

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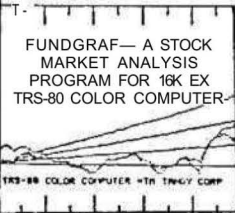
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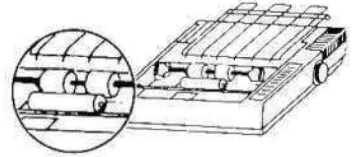
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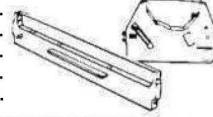
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```

"HEIGHT AND FIRE LASER.";
610 PRINT@226,"THE ENEMY"+CHR$(1
28)+LEFT$(E$(2),4)+"WILL FLY ACR
OSS";:PRINT@257,"FROM RIGHT TO L
EFT. IF YOUR";:PRINT@288,"SHIP C
OLLIDES WITH HIS, YOU LOSE";:PRI
NT@321,"A SHIP. IF TEN ENEMY SHI
PS FLY";:PRINT@353,"BY WITHOUT B
EING SHOT, THEY";
620 PRINT@385,"WILL DESTROY ONE
OF YOURS.";:PRINT@421,"YOUR EXTR
A SHIPS ARE AT";:PRINT$456,"THE
TOP OF THE SCREEN.";:PRINT@481,"
<PRESS ANY KEY TO START GAME>";
630 IK$=INKEY$
640 IK$=INKEY$:IF IK$=""THEN640
650 CLS0:SOUND180,1:PRINT@3,SP$;
:PRINT@8,SP$;:PRINT@14,"SCORE";
660 PRINT@480,STRING$(31,191);:P
OKE1535,191:PRINT@448,STRING$(32
,191);
670 P=1
680 SP=130:PRINT@SP,SP$;
690 FI=PEEK(65280):IF FI=126 OR
FI=254 THEN PRINT@SP+3,STRING$(2
7,163);:PLAY"CDEFG":PRINT@SP+3,S
TRING$(27,128);:IF EP-SP<30 AND
EP>SP THEN FORA=1TO3:PRINT@EP,EX
$(RND(10));:PLAY"CCCC":NEXTA:PR
INT@EP,STRING$(5,128);:E=0:TP=TP
+10:PRINT@20,TP;:GOTO780
700 IF ABS(EP-SP)<=2 THEN FORA=1
TO3:PRINT@SP,EX$(RND(10));:PLAY"
AFBG":NEXTA:E=0:PRINT@SP,STRING$
(6,128);:FS=FS-1:IF FS=2 THEN PR
INT@8,STRING$(3,128); ELSE IF FS
=1 THEN PRINT$3,STRING$(3,128);
ELSE GOTO 940
710 IF EP/32=INT(EP/32) THEN PRI
NT@EP,STRING$(3,128);:E=0:FB=FB+
1:IF FB=10 THEN 730 ELSE GOTO780
720 GOTO740
730 FB=0:FORA=1TO3:PRINT@SP,EX$(
RND(10));:PLAY"CBBC":NEXTA:FS=FS
-1:PRINT@SP,STRING$(5,128);:IF F
S=2 THENPRINT@8,STRING$(3,128);
ELSE IF FS=1 THEN PRINT@3,STRIN
G$(3,128); ELSE IF FS=0 THEN GOTO
940
740 J0=JOYSTK(0):J1=JOYSTK(1)
750 IF J1>40 AND SP<330 THEN PR
INT@SP,STRING$(3,128);:SP=SP+32:
GOTO770
760 IF J1<20 AND SP>45 THEN PRIN
T@SP,STRING$(3,128);:SP=SP-32
770 PRINT@SP,SP$;:PRINT@384,MID$
(A$(1),P,32);:PRINT@416,MID$(A$(
2),P,32);:PRINT@384,MID$(B$(1),P
,32);:PRINT@416,MID$(B$(2),P,32)
780 IF E=0 THEN EP=RND(11)*32+28
:PRINT@EP,E$(1);:L=0:E=1:GOTO820
790 EP=EP-4:IF E=1 AND L=1 THEN

```

GOTO810

```

800 PRINT@EP,E?(2);:L=1:GOTO820
810 PRINT@EP,E$(1);:L=0
820 P=P+1:IFP>224THENP=1
830 GOTO690
840 DATA2,128,183,178,177,178,4,
128,2,179,9,128,3,179,11,128,177
,178,32,128,177,183,3,191,178,28
,128,177,183,178,183,178,25,128,
179,2,191,178,183,2,128,178,15,1
28,178,14,128
850 DATA 177,178,2,128,177,178,3
,128,183,178,128,183,178,4,128,1
77,187,5,128,177,178,183,191,178
,3,128,179,3,128,183,179,3,128,1
77,191,178,4,128,177,179,178,128
860 DATA128,183,4,191,2,179,2,18
3,2,191,187,178,5,128,177,183,3,
191,187,8,128,177,179,2,191,178,
4,128,177,179,183,187,178,13,128
,2,179,5,128,179,183,6,191,4,128
,179,178,5,128,179,183,187,178,1
77,183,187,178,2,128
870 DATA177,183,191,178,128,177,
183,9,191,179,15,128,177,2,179,7
,191,187,183,191,178,128,183,191
,178,6,128,179,4,191,187,179,183
,187,179,6,128,183,187,177,2,191
,178,177,2,191,178,177,183,2,191
,183,2,191,4,179,5,191,178,177,5
,191
880 DATA2,179,3,191,178,183,2,19
1,187,179,183,2,191,187,178,128,
177,183,2,191,187,128
890 DATA128,177,187,128,179,4,12
8,177,179,178,8,128,177,2,179,17
8,11,128,179,33,128,179,3,191,18
7,29,128,179,187,177,187,25,128,
177,183,191,187,177,186,128,177,
15,128,177,15,128,179,3,128,179,
3,128,177,187,128,177,187,5,128,
183,178,5,128,179,177,191
900 DATA187,3,128,177,178,2,128,
177,187,178,3,128,183,187,5,128,
2,179,2,128
910 DATA177,4,191,187,2,179,187,
3,191,179,6,128,179,4,191,178,8,
128,179,183,191,187,5,128,2,179,
191,179,13,128,177,179,178,4,128
,177,179,6,191,186,3,128,177,179
,5,128,177,179,191,179
920 DATA128,179,191,179,3,128,17
9,191,187,2,128,179,9,191,187,17
8,15,128,2,179,183,7,191,179,191
,187,128,177,191,187,6,128,177,1
83,4,191,2,179,191,179,178,5,128
,177,191,178
930 DATA183,191,187,128,183,191,
187,128,179,2,191,187,2,191,187,
3,179,183,4,191,187,128,183,4,19
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1,2,179,3,191,179,2,128,179,3,19
1,178,128

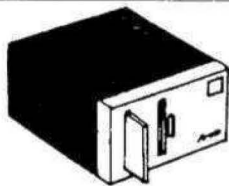
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Listing continued

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940 CLS3:PRINT@200,"FINAL SCORE:
";TP;:FORT=1TO600:NEXTT:CLS0:IF
TP>HI THEN HI=TP:GOSUB990:GOSUB1
040 ELSE GOSUB1040
950 PRINT@480,"PLAY AGAIN? (Y/N)
"
960 IK$=INKEY$
970 IK$=INKEY$:IF IK$=""THEN970
ELSE IF IK$="N" THEN END ELSE IF
IK$<>"Y" THEN970
980 FB=0:TP=0:FS=3:E=0:EP=0:GOTO
600
990 X=USR0(0)
1000 FORA=1TO50:FORT=1TO50:NEXTT
:X=USR1(0)
1010 PLAY CHR$(RND(7)+64)
1020 NEXTA
1030 RETURN
1040 CLS:IF TP>TP(10) THEN INPUT
"THREE INITIALS";NA$ ELSE RETURN
1050 FORA=1TO10
1060 IF TP>TP(A) THEN FOR B=10 T
O A+1 STEP-1: TP(B)=TP(B-1):NA$(
B)=NA$(B-1):NEXTB:TP(A)=TP:NA$(A
)=NA$:GOTO1080
1070 NEXTA
1080 FORA=1TO10:PRINTA;" "+LEF
T$(NA$(A),3),TP(A):NEXT
1090 RETURN

```

```

3DEC 00100 ORG 15852
3DEC 8E 3E00 00110 START LDX #15872
3DEF 108E 0400 00120 LDY #1024
3DF3 A6 84 00130 SCREEN LDA ,X
3DF5 A7 A0 00140 STA ,Y+
3DF7 A7 80 00150 STA ,X+
3DF9 108C 0600 00160 CMPLY #1536
3DFD 26 F4 00170 BNE SCREEN
3DFF 39 00180 RTS
0000 00190 END
00000 TOTAL ERRORS

SCREEN 3DF3
START 3DEC

```

Program Listing 2.

```

3DD5 00100 ORG 15829
3DD5 8E 0400 00110 START LDX #1024
3DD8 A6 84 00120 SCREEN LDA ,X
3DDA 81 EF 00130 CMPA #239
3DDC 2F 04 00140 BLE OKAY
3DDE 80 70 00150 SUBA #112
3DE0 20 02 00160 BRA LOOP
3DE2 8B 10 00170 OKAY ADDA #16
3DE4 A7 80 00180 LOOP STA ,X+
3DE6 8C 0600 00190 CMFX #1536
3DE9 26 ED 00200 BNE SCREEN
3DEB 39 00210 DONE RTS
0000 00220 END
00000 TOTAL ERRORS

DONE 3DEB
LOOP 3DE4
OKAY 3DE2
SCREEN 3DD8
START 3DD5

```

Program Listing 3.

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Instant CoCo

by Ameer Eisenberg

I know. You love our magazine, but typing the programs takes so long. Well, we've got the answer: Instant CoCo, a cassette of our featured programs.

Instant CoCo will be published monthly starting in January. "But what about 1983?" you ask. We're doing a "best of edition that includes the programs listed in the index below.

If you've used Color Load 80 from 80 Micro magazine, you know the theory behind Instant CoCo. Our cassettes come with about 10 programs and an index that directs you to the corresponding *HOT CoCo* article.

Using Instant CoCo is as easy as one, two, three.

ONE: Read the article in *HOT CoCo*. Make sure you understand how the program runs. Check the system requirements box before you load a program to ensure that it runs on your computer.

TWO: Plug in the tape recorder and cue the tape to the beginning of a program. (My experience shows that using your ears to find the beginning of a program works more reliably than the index numbers.) For Basic programs, type "CLOAD" and press enter. When the "Ready" prompt reappears, check how well the program loaded by typing "LIST" and pressing enter. Is it all there?

For Assembly-language programs, type "CLOADM" and press enter. You can check the listing before running it using an editor/assembler. Otherwise, just type "EXEC" and press enter. The program should execute. You do not need an editor/assembler to use the Assembly listings on Instant CoCo.

THREE: Run the program according to the author's instructions.

This column will support Instant CoCo. I'll answer questions, fix errors (very few, I hope), point out any

new Instant CoCo developments, and feature the cassette's index. If you have any comments or questions regarding Instant CoCo, write to me here (c/o *HOT CoCo*, 80 Pine St.,

Peterborough, NH 03458). I'll try to help. If your question relates to subscriptions, please address your correspondence to Lori Eaton at the same address. •

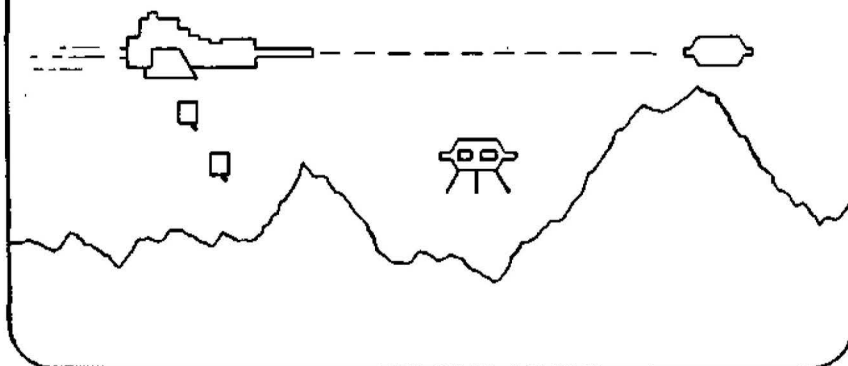
Index. The Best of'83

SIDE A FILE	ARTICLE	MONTH/PAGE	SYSTEM
TITLE	----	----	All
EDIT	CoCo Word Processor	June/36	16KExt
AUTHOR	" " "	" "	(("
CAVE	Cavehunt	June/44	16K
PHYCOLOR	Phycolor	June/90	16KExt
LENSES	(c	" "	a a
VERBS	Vive Le CoCo	July/104	16KExt
ANTONYMS	" " "	" "	ii ii
SYNONYMS	" " "	(i (<	ii ii
HANGMANA	" " "	44 (4	ti ii
HANGMANB	" " "	44 11	ii <i
TRANSLAT	" " "	" "	" "
PRODRIVE	Pers. Prop. Inven.	Aug/100	32K Disk
PERSPROP	" n a	44 "	it (i
MELMAS	Melody Master	Sept/118	16KExt
CANTMIS (m)	Linkage Editor	Sept/96	16KExt
LINKED	44 a 44	44 "	" "
DRIVESUB	" " ie	ii ti	a a
FINAL	11 11 11	" it	ti a
CHROUT (m)	Add Character to CoCo	Sept/104	32K
ATTACKER	Attacker	Oct/82	16KExt
SDDEB			
CHECKS	Expansion w/a Twist	Oct/112	32KExt
1 ONI	1 On 1 Hockey	Nov/52	16KExt
GEOJOG	GeoJogger	Nov/60	16KExt
DRAGRACE	Dragrace	Nov/68	16KExt
BANNER	Banner Printer	Nov/89	16KExt
SUBSIM	Submarine Simulation	Nov/100	16KExt
JACKPOT	Hit the Jackpot	Nov/38	16KExt
SLOT (m)	44 44 11	(("	16KExt
DISPLAY	11 44 "	a ti	16KExt
CAPITOLS	A Capital Suggestion	Dec/81	16K
12-DAYS	The 12 Days of Christmas	Dec/68	16KExt
MUFFDUFF	Muff Duff	Dec/98	16KExt
HEAR	Hear Here!	Dec/62	16K

(m) next to a file name indicates a machine-language program. Use CLOADM to load. Unless otherwise indicated, all programs are in Color Basic.

Ext under the System column indicates Extended Color Basic is used.

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The Educated Guest

Welcome to The Educated Guest. In this column I deal with the educational uses of the Color Computer, so it is designed especially for those who want to use their CoCo as a tool in the learning process: teachers, students, parents, or anyone else interested in the computer as educational enrichment.

My aim is to interact with you, the readers, and build a library of challenging ideas and helpful programs for home and school use.

What kind of programs and ideas are truly useful in the educational process? My challenge is to those who sell educational software. I would like to see programs with the appeal of an arcade game, but with real educational value. Too often you get one or the other, but not both.

Educators develop programs with sound content, but woefully lacking in pizzazz and creativity. On the other hand, the ability to maneuver a joystick in 128 positions can only take a person so far in life. We need more machine-language programs for education. Programmers, I call for proof that content gives valuable skills.

With this in mind, let me attack a sacred cow in educational computer use. While I believe that problem-solving and explorational programs are interesting and challenging, I need hard evidence that these problem-solving techniques have a real-life application. I refer to Logo.

One researcher shows that learning-disabled individuals willingly spent more time on a computerized math drill than on an equally rated pencil drill. Positive evidence? Or, is the pencil-and-paper method more efficient because it achieves the same rate of correct responding in less time?

Okay, readers, here is your chance. Don't let me go unchallenged as I ramble on without giving specific guidelines for what we need in educational programs. Over the next few months I will compile your ideas on the subject so program buyers and developers have ideas for that next program. By the way, I have my guidelines ready

WHAT'S IN AN EDUCATION PROGRAM?

by Charles H. Santee

for print, so if I don't hear from you you'll have to take mine as gospel.

I challenge you to prove that educational programs can be interesting while they develop practical skills. If you use educational programs and have evidence that people do learn new skills, let me know about it. I am especially interested in success with Logo.

Now for a practical example. Each month I plan to include a sample program demonstrating a different technique and content in educational programming. The first few will be content oriented, dealing with program flow and content areas such as math, reading, and social studies. (Don't look for too much pizzazz.)

In the later months I'll give some techniques for adding zip including ways to add music, sound effects, and a graphic page generator. Future articles will explore other computer languages such as Logo, Pilot, and (shudder, choke) Assembly language.

Here is a program that generates math problems (Program Listing 1). There are several methods that you can use in presenting material with several levels of difficulty. These include:

1. Sequential (The program begins with the easiest and progresses to the hardest.)
2. Menu selection (The student or teacher is given a menu to select from.)
3. Branching (The program interprets the student's responses and branches to the level that is appropriate.)

Next month I will discuss techniques for writing a branching program. Listing 1 falls under the second category.

The user selects a level and type or types of problem and the program generates a random set of problems.

How to Use the Program

In this math-problem generator, the first thing to come on the screen is the title page. Press enter to continue. Next, you see a menu of options to select a type. Use the up or down arrows to move to the type of problem you want (such as addition or subtraction). Press the space bar. A small black square remains in front of that selection. If you make a mistake, press the space bar again and the square disappears. Move and select all types you want included, and then press enter. The program then asks you to enter the largest value. This is the largest value used in the problems.

For example, if you select five, the largest problems will be $5 + 5$ for addition, $10 - 5$ for subtraction, 5×5 for multiplication, and $25 \div 5$ for division. For subtraction and division the limit to the largest number applies to the answer, so there is a parallel between addition and subtraction or multiplication and division.

Next, enter the smallest value. For example, if you select two, the smallest problems will be $2 + 2$, $4 - 2$, 2×2 , and $4 / 2$. The largest value can be no larger than 9,999 and cannot be zero, and must be larger than the smallest value. If you do not follow this limitation, the program gives an error message and asks you to enter both values again.

Next, it asks you to verify your selections by responding to the following message: "Have you entered correctly? Press Y for yes or N for no. This screen disappears and you specify the number of problems you want. I suggest using 10 problems the first time to learn what the program does.

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The Educated Guest

The program then randomly selects a problem within the parameters you have defined and displays it on the screen. A cursor appears where the first digit computed for the answer goes. You proceed to answer the problem by entering I hat digit. Press one number and continue until you have entered all digits. If you make a mistake, the program tells you to try again.

When you have completely entered the answer, you receive a message to continue by pressing the space bar. The computer generates the next problem. Repeat these procedures to answer all questions.

For multiplication problems you must enter all intermediary computations. For example, arrows below point to the values you must enter.

$$\begin{array}{r}
 21 \\
 \times 32 \\
 \hline
 - 42 \\
 - 63 \\
 \hline
 672
 \end{array}$$

In this example the first digit you press is the 2 in 42. This effectively takes the student through all steps needed to solve the problem. For division you enter only the answer, not the intermediary steps.

Improving the Program

There are a number of things you can do to this program to add new features. I'll make some suggestions here, and I would like your ideas for making this program more flexible, fun, and useful.

First, you can add a score to monitor student progress. One method might be to set a flag or counter to one before presenting a problem, and to reset the counter if any wrong key entry is made. The counter could be summed across all problems to determine the number correct. Divide the total count by the number of problems and multiply by 100 to determine the percent correct. After the program presents all problems, display the percent correct or other messages depending on the percent correct. This is a good task for a beginning programmer.

Second, you can generate the intermediary values for division and display them as with multiplication. You find all the methods you need in other

Lines 10-30 print the title page. Line 30 contains a short routine to center text and increment the line on which text is printed.

Lines 60-280 print the menu and allow selection of the types and ranges of problems. Line 120 allows you to select one type of problem such as addition or multiplication, or to erase that selection by pressing the space bar.

Lines 290-390 generate two numbers for a problem. Line 300 finds the difference (DF) between the largest and the smallest number used. Adding one to this value makes DF the number of values possible with a definite low and high value.

Lines 310-320 generate the numbers.

Line 360 generates a random number to point to a problem type. If the problem type has not been selected the program goes back and generates a new type pointer (TP).

Lines 370-380 send the program to the appropriate lines to compute the answer and print the problem on the screen.

Lines 400-440 compute an answer for addition. The program adds the two previously generated numbers, indicates the plus sign, and branches to print the addition problem on the screen.

Lines 450-500 make the subtraction problems directly parallel the difficulty level of the addition problems by adding the two numbers generated previously. The sum of the two numbers is the top number in the subtraction problem. For example:

$$\begin{array}{r}
 A \\
 + B \\
 \hline
 C
 \end{array}
 \qquad
 \begin{array}{r}
 2 \\
 + 3 \\
 \hline
 5
 \end{array}
 \text{ is converted to }
 \begin{array}{r}
 C \\
 - A \\
 \hline
 B
 \end{array}
 \qquad
 \begin{array}{r}
 5 \\
 - 3 \\
 \hline
 2
 \end{array}$$

Lines 510-890 compute and show multiplication. The procedure is similar to the addition routines except that it computes and shows each intermediate step for multiplication. In lines 630-640 the first digit of the multiplier (bottom number in the problem) is extracted and multiplied by the multiplicand (top number in the problem). The program extracts the digits from this answer and places a cursor where these values should be displayed (lines 670-730). This repeats for all digits on one line. After generating an answer for one line of the intermediate step, the program adds 31 to the location of the cursor and moves it down one line and over one space for the next intermediate step.

Lines 890-1060 show addition or subtraction. The answer converts to a string in line 910. Lines 920-940 print the problem. Lines 950-1020 step backwards through the answer string presenting a cursor where that digit should appear in the answer. Each digit (DS) is extracted from the answer (CS) and printed if the keyboard entry matches the digit.

Lines 1100-1300 compute and show division. The program multiplies the two values initially generated and rearranges the numbers to form a division problem. This is similar to how you derive a subtraction problem by addition. The digits from the solution to the problem are picked out from left to right (rather than right to left) since you solve the division problem in this manner.

Table 1. Math Generator Line Descriptions

portions of the present program. Beginners beware; this is not as easy as it sounds.

Third, the method of display and response for this program forces the student to go through a particular sequence of steps to solve the problem. Some students might have alternative problem-solving styles (algorithms). Perhaps you can use graphics to indicate where numerals should go. The student could move a cursor to any of these positions and enter a response in any order.

To do this you can set a two-dimensional array of values contained in any position in a response area. As the program generates a problem you can fill the array with values that answer the problem (including any intermedi-

ate step). When the student presses a key, the key entry appears if it matches the array value for that position.

Finally, for the advanced programmer, put the whole program together using the graphic screen to show the problem. If the student gives an incorrect response, show a number line (or other graphic) that aids in solving the problem. You might even make this into a game like "The Invasion of the Number Snatcher." I will be sharing a graphic-page generator that includes a machine-language character generator in a later column. •

Contact Charles Santee c/o HOT CoCo, 80 Pine St., Peterborough, NH 03458.

The Educated Guest

Program Listing. Math Problem Generator

```
10 ##### PRINT TITLE AND WAIT #
###
20 CLS:A$="A MATH PROBLEM GENERA
TOR":GOSUB 30:A$="BY":GOSUB 30:A
$="DR. CHARLES H. SANTEE":GOSUB
30:B=B+2:A$="PRESS enter TO CONT
INUE":GOSUB 30:INPUT X$:GOTO 50
30 A=INT(32-LEN(A$))/2:B=B+1:PRI
NT@B*64+A,A$;:RETURN
40 ##### INITIALIZE VARIABLES A
ND DIMENSION NUMBERS #####
50 SP=1:P$="T8L8P8":DIM P$(50)
60 ##### PRINT INSTRUCTIONS
#####
70 CLS:PRINT"USE UP OR DOWN arro
ws TO MOVE PRESS space bar TO
SELECT PRESS space bar AGA
N TO ERASE PRESS enter WHEN DO
NE _____SELECT TYPE(S) 0
F PROBLEMS"
80 PRINT" addition":PRINT" SUB
TRACTION":PRINT" multiplication
":PRINT" DIVISION"
90 X$=INKEY$:PRINT@SP*32+160,CHR
$(128);:PLAY P$:PRINT@SP*32+160,
" ";:PLAY P$:IF X$ = "" THEN 90
100 IF X$=CHR$(94) AND SP>1 THEN
SP=SP-1:GOTO 90
110 IF X$=CHR$(10) AND SP<4 THEN
SP=SP+1:GOTO 90
120 IF X$=CHR$(32) THEN SI(SP)=A
BS(SI(SP)-1):PRINT@SP*32+161,CHR
${108*SI(SP)+32};:GOTO 90
130 IF X$<>CHR$(13) THEN GOTO 90
140 FG$="":FOR A=1 TO 4
150 IF SI(A)=1 THEN FG$="ON"
160 NEXT A
170 IF FG$="" THEN 90
180 ##### SLELCT LARGEST/SMAL
LEST VALUE#####
190 PRINT@320,STRING$(32,"-");:I
NPUT"ENTER THE LARGEST VALUE";X$
200 LN=VAL(X$):PRINT@376,LN
210 INPUT"ENTER THE SMALLEST VAL
UE";X$
220 SN=VAL(X$)
230 IF LN<SN OR LN>9999 OR (SN=0
AND LN=0) THEN PRINT@416,"THAT
WIL NOT WORK - TRY AGAIN":PLAY "
L2T2O3EGC":PRINT@320,STRING$(128
," ");:GOTO 190
240 PRINT@416,STRING${32,"-"};"H
AVE YOU ENTERED CORRECTLY P
RESS y FOR YES OR n FOR NO";
250 X$=INKEY$:PRINT@486,"Y";:PRI
NT@499,"N";:PLAY P$:PRINT@486,"y
";:PRINT @ 499,"n";:IF X$="Y" OR
X$="y" THEN 260 ELSE IF X$="N"
OR X$="n" THEN 60 ELSE 250
260 CLS
270 INPUT"NUMBER OF PROBLEMS";NP
$
280 NP=VAL(NP$):IF NP=0 THEN 260
290 ##### GENERATE NUMBERS ####
300 DF=LN-SN+1
310 PP=DF*DF:IF PP>NP THEN PP=NP
320 PX=PP
330 FOR N=1 TO NP
340 A=RND(DF)+SN-1
350 B=RND(DF)+SN-1
360 PT=RND(4):IF SI(PT)=0 THEN 3
60
370 ON PT GOSUB 410,460,520,1110
380 NEXT N
390 RUN
400 ##### COMPUTE ADDITION ###
####
410 C=A+B
420 S$="+"
430 GOSUB 900
440 RETURN
450 ##### COMPUTE SUBTRACTION
####
460 T=A+B
470 C=A
480 A=T
490 S$="-"
500 GOSUB 900:RETURN
510 ##### COMPUTE AND SHOW MULTI
PLICATION#####
520 C=B*A:CLS
530 C$=STR$(C):C$=RIGHT$(C$,LEN(
C$)-1):LC=LEN(C$)
540 IF B>A THEN T=B:B=A:A=T
550 TP=LEN(STR$(A))-1
560 B$=STR$(B):B$=RIGHT$(B$,LEN(
B$)-1):L=LEN(B$)
570 PRINT@170,USING"#####";A
580 PRINT@201,"X";:PRINTUSING"##
##";B
590 PRINT@233,STRING$(5,131)
600 LE=269
610 LV=LE
620 FOR M = L TO 1 STEP -1
630 N1=VAL(MID$(B$,M,1) )
640 N1=N1*A:N$=STR$(N1):N$=RIGHT
$(N$,LEN(N$)-1)
650 IF N$="0" THEN N$=STRING$(TP
,"0")
660 LT=LEN(N$)
670 FOR V=LT TO 1 STEP -1
680 V$=MID$(N$,V,1)
690 X$=INKEY$:PRINT@LV,CHR$(191)
;:PLAY P$:PRINT@LV," ";:PLAY P$:
IF X?="" THEN 690
```

Listing continued

```

700 IF X$<>V$ THEN PRINT@64,"TRY
AGAIN":PLAY "V5L4T4GC":PRINT@64
," "":GOTO 690
710 PRINT@LV,V$;
720 LV=LV-1
730 NEXT V
740 LE=LE+31:LV=LE
750 NEXT M
760 IF L=1 THEN 860
770 LV=(L)*32+266:PRINT@LV-1,STR
ING$(5,131)
780 LV=LV+35
790 FOR D=LC TO 1 STEP -1
800 D$=MID$(C$,D,1)
810 X$=INKEY$:PRINT@LV,CHR$(191)
;:PLAY P$:PRINT@LV," ";:PLAY P$:
IF X$="" THEN 810
820 IF X$<>D$ THEN PRINT@64,"TRY
AGAIN":PLAY"V5L4T4GC":PRINT@64,
"
" ":GOTO 810
830 PLAY"L8T8CEG":PRINT@LV,D$;
840 LV=LV-1
850 NEXT D
860 PRINT@64,"VERY GOOD":PLAY"T4
L804CEGCEGCEG":PRINT"PRESS sp
ace bar TO CONTINUE"
870 X$=INKEY$:IF X$="" THEN 870
880 RETURN

```

```

890 '##### SHOW ADDITION/SUBTR
ACTION#####
900 CLS
910 C$=STR$(C):C$=RIGHT$(C$,LEN(
C$)-1):LN=LEN(C$)
920 PRINT@170,USING "####";A
930 PRINT@201,S$;:PRINTUSING "##
##";B
940 PRINT@233,STRING$(5,131)
950 LV=269
960 FOR D=LN TO 1 STEP -1
970 D$=MID$(C$,D,1)
980 X$=INKEY$:PRINT@LV,CHR$(191)
;:PLAY P$:PRINT@LV," ";:PLAY P$:
IF X$="" THEN 980
990 IF X$<>D$ THEN PRINT@64,"TR
Y AGAIN":PLAY"V5L4T404GC03GC":PR
INT@64," "":GOTO 980
1000 PLAY"L8T8CEG":PRINT@LV,D$;
1010 LV=LV-1
1020 NEXT D
1030 PRINT@64,"VERY GOOD"
1040 PLAY "T4L804CEGCEGCEG"
1050 PRINT"PRESS space bar TO CO
NTINUE"
1060 X$=INKEY$:IF X$="" THEN 106
0 ELSE RETURN
1070 CLS
1080 C=A*B
1090 PRINT@170,A;"");C
1100 '##### COMPUTE AND SHOW DI
VISION #####
1110 CLS
1120 IF A=0 THEN T=A:A=B:B=T
1130 PRINT@170,CHR$(142);STRINC$(
8,140):PRINT@202,CHR$(138)
1140 A$=STR$(A):A$=RIGHT$(A$,LEN
(A$)-1):LA=LEN(A$)
1150 PRINT@202-LEN(A$),A$;
1160 B$=STR$(B):B$=RIGHT$(B$,LEN
(B$)-1):LB=LEN(B$)
1170 C=A*B:C$=STR$(C):C$=RIGHT$(
C$,LEN(C$)-1):LC=LEN(C$)
1180 PRINT@204,C$;
1190 LV=140+LC-LB
1200 FOR W=1 TO LB
1210 D$=MID$(B$,W,1)
1220 X$=INKEY$:PRINT@LV,CHR$(191
);:PLAY P$:PRINT@LV," ";:PLAY P$
:IF X$="" THEN 1220
1230 IF D$<>X$ THEN PRINT@64,"TR
Y AGAIN":PLAY "T2L2GEC":PRINT@64
," "":GOTO 1220
1240 PRINT@LV,D$;
1250 LV=LV+1
1260 PLAY"T16L803CEGCEG"
1270 NEXT W
1280 PRINT@32,"VERY GOOD":PLAY "
T8L8CEGCEGCEGCEG":PRINT"PRESS en
ter TO CONTINUE"
1290 X$=INKEY$:IF X$="" THEN 129
0
1300 RETURN

```

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Reader's Forum

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Bug in EDTASM +

I would like to point out a frustrating bug in EDTASM+. Two-byte instructions that have an operand of a symbol plus a constant will assemble correctly, but cause a "Multiply Defined Symbol" error at all subsequent definitions. For example:

```
LDY#COCOBD+1
"
"
"
MULTIPLY DEFINED SYMBOL
LOOP1 CLRA
```

The following instructions cause "Multiply Defined Symbol" errors: LDY, LDS, CMPD, CMPS, CMPU, CMPY, STS, STY, and all long branches.

The problem in the example above can be avoided with:

```
LDEWCOCOBD+1
TFRD.Y
```

I haven't needed to work around the others but I'm sure the problems can be solved.

*John Fitch
Alliance, OH*

Copy Files Without Using the BACKUP Command

Have you ever wanted to copy a single file from one disk to another without doing a total back-up or LOAD"file name/ext", then shuffling disks and SAVE"file name/ext", or worse, LOADM"file name/ext", then change disks and SAVEM"file name/ext"?

Try this solution. Just use the available but undocumented (at least for one-drive owners) COPY command.

Insert your source disk in drive 0, then type "COPY file-

name/ext" where the file name is the name of the file you want to copy and ext is the extension.

After you hit enter, the disk chums a moment and the screen reads: "Insert destination diskette and press enter." At that point remove your source disk and reinsert your destination disk. Press enter, wait for the disk drive to stop, type "DIR" and you have a new copy on another disk.

*Tony Demase
Pittsburgh, PA*

Print Out a Disk Directory

I wrote Program Listing 1 to print out a disk directory to a printer. After running the program you can laminate the list or simply tape it to the storage envelope for a reference when searching for the particular disk and program you want.

*Chris Petit
Luling, LA*

```
10 CLS: CLEAR 1000
20 PRINT "HIT ANY KEY WHEN READY
... "
30 IF INKEY$="" THEN 30
40 FOR I=3 TO 11: DSKI$ 0,17,I,A$
,B$
50 FOR Z=1 TO 128 STEP 32: C$=MID
$(A$,Z,11): IF ASC(LEFT$(C$,1)) O
R ASC(LEFT$(C$,1))=255 THEN NEXT
Z ELSE D$=MID$(C$,1,8): E$=RIGHT$
(C$,3): F$=D$+" "+E$: PRINT#-2,F$:
NEXTZ
60 IF A$=B$ THEN NEXT I ELSE A$=
B$: GOTO 50
70 PRINT#-2,"FREE(0)=";FREE(0)
80 PRINT"FINISHED...": GOTO 20
```

Program Listing 1. Routine to Print Out a Disk Directory

Flasher

Program Listing 2, Flasher, sets two string statements, one with the word printed normally and the other with the

Readers Forum

word printed in reverse. The program randomly clears the screen to a color, and prints the normal word. A timer holds it, then the program prints the reverse word right over the top of the normal word.

Steve Schweitzer
Sewell, NJ

```
10 A$="HOT COCO"
20 B$="hot COCO"
30 X=RND(9)-1
40 CLS(X):PRINT;236,A$;
50 FOR X=1 TO 300:NEXT X
60 PRINT@236,B$;
70 FOR X=1 TO 300:NEXT X
80 GOTO 30
```

Program Listing 2. Flasher

```
1000      REM *** LINE INDENTA
TION--METHOD 1 ***
1010      REM
1020 PRINT"NUMBER";TAB(10);"SQ. R
OOT"; TAB(20);"N[2"
1030 PRINT
1040      REM
1050 FOR N=1 TO 10
1060      S=INT(SQR(N)*100+.5)/100
1070      C=INT(N[2])
1080      PRINT N;TAB(10);S;TAB(20)
;C
1090 NEXT N
1100      REM
9999 END
```

Program Listing 3. Line Indentation Method 1

Indenting Statements

Although the Basic language in the Color Computer is far superior to the Basic languages found in many other computers, it has a serious flaw. If you type any spaces between the line number and the first statement on the line, the computer deletes them, allowing only one space after the line number. Programs become much more legible if statements in a FOR...NEXT loop are indented. Likewise, nonexecutable statements such as REM statements do a much better job segmenting the program if they are indented as well.

There are two methods I know of that give more than one space after the line number. The first method requires Extended Basic. You can insert spaces after a line number by using the Edit function. Refer to page 89 of *Going Ahead with Extended Color Basic* for instructions on how to insert in the edit mode.

The second method for creating spaces after a line num-

ber does not require Extended Basic. You can type a colon directly after the line number without interfering with the program's execution. After the colon, the computer does not delete any unnecessary spaces.

Look at Program Listings 3, 4, and 5 and decide for yourself which is the easiest to read.

Tony Dunn
San Francisco, CA

```
1000 :      REM *** LINE INDENTA
TION--METHOD 2 ***
1010 :      REM
1020 PRINT"NUMBER";TAB(10);"SQ.
ROOT";TAB(20);"N[2"
1030 PRINT
1040 :      REM
1050 FOR N=1 TO 10
1060 :      S=INT(SQR(N)*100+.5)/100
1070 :      C=INT(N[2])
1080 :      PRINT N;TAB(10);S;TAB(20)
);C
1090 NEXT N
1100 :      REM
9999 END
```

Program Listing 4. Line Indentation Method 2

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```

1000 REM *** NO INDENTATION ***
1010 REM
1020 PRINT"NUMBER";TAB(10);"SQ.
ROOT";TAB(20);"N[2"
1030 PRINT
1040 REM
1050 FOR N=1 TO 10
1060 S=INT(SQR(N)*100+.5)/100
1070 C=INT(N[2)
1080 PRINT N;TAB(10);S;TAB(20);C
1090 NEXT N
1100 REM
9999 END
    
```

Program Listing 5. No Line Indentation

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*Kenneth F. McKinnon
Brant Rock, MA*

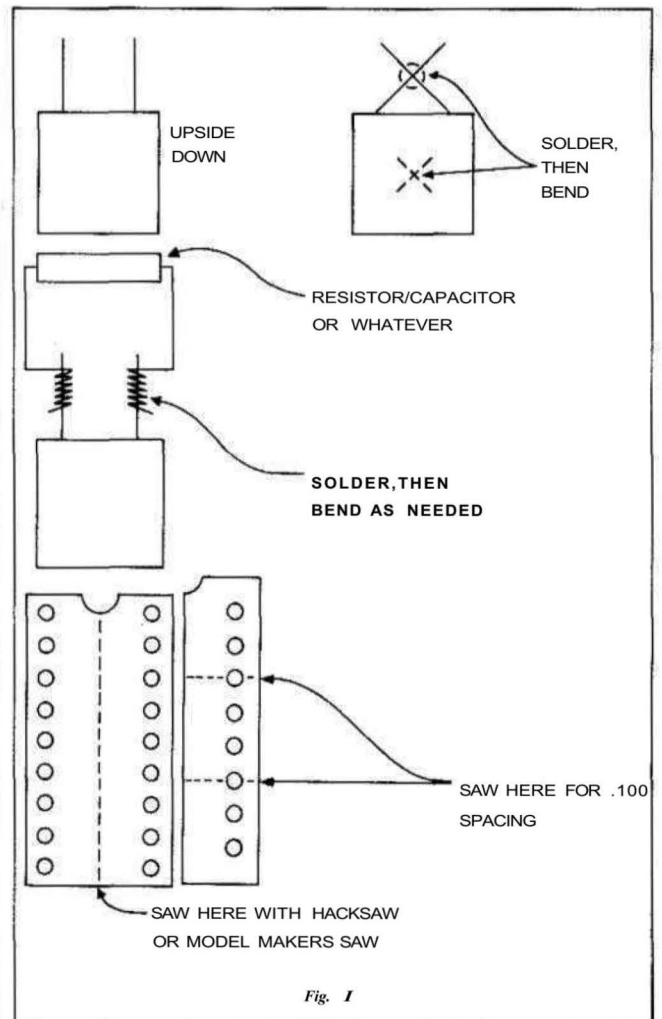


Fig. 1

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Q. I was excited to find the article "64K Modification" in the July 1983 *HOT CoCo*, p. 44. At the end, however, there were some unanswered questions:

How do I know if I have "found an error" in my Basic ROM?

How do I customize Basic?

What do you mean when you say that the code in ROM is patchable?

What monitor code doesn't use part of the Basic interpreter I'm patching?

What program pack might I find an error in?

*Jeffrey Latham
Seattle, WA*

A. It would be difficult for a hobbyist to find an error in the Basic ROM. It would require a complete disassembly and a good understanding of the resulting code. The 1.1 ROM does have some minor bugs, which were fixed with the 1.2 version. With your 1.1 ROM code in RAM, these fixes can be loaded in.

A good example of a customized Basic appeared in "40K Color Basic," *80 Micro*, May 1983, p. 212. In that article, after the ROM code was transferred to RAM, Extended Basic was disabled and the Basic ROM's code was patched to use an additional 8K of RAM.

What I mean by patched is that I replaced some bytes of existing machine-language code with an equal number of bytes of new code.

When patching, you must be careful not to patch code that is being executed at the time. For example, you would not try to patch the keyboard-entry routine while you are typing in patches to change it. Instead, you would write a program to do it for you so that at the time the patching takes place, the keyboard routine is not being used.

Q. When I use the GOSUB with the RETURN statement in some of my programs, I receive an OM (out of memory) error in one of my program lines after it has run for a while. I discovered that I lost most of my 16K RAM even with the shortest programs. Run this program to see what I mean:

```
10 CLS(4)
20? MEM
30 GOSUB 10
40 RETURN
```

*David Ermish
Wilkes-Barre, PA*

A. You are using the GOSUB and RETURN statements improperly. Whenever the Basic interpreter encounters a GOSUB statement, it notes where it is by placing a 7-byte pointer onto the system stack. The system stack is located at the top of Basic's work space. If you successively execute GOSUB statements without executing RETURN statements, the system stack will keep growing, eventually using all your memory.

When the computer encounters a RETURN statement, it unloads a 7-byte pointer from the system stack. If the computer executes a GOSUB and then its corresponding RETURN, the net result is that the stack is the same size as before these statements were executed. Run the corrected version of your program below:

```
10CLS4
20?"BEFORE GOSUB, MEM=";MEM
30 GOSUB 60
40?"AFTER RETURN, MEM=";MEM
50 END
60?"DURING GOSUB, MEM=";MEM
70 RETURN
```

Q. When I looked for the type of board on my CoCo, I found no alpha character after the numbers. I believe the number was 8709285. I've since had Radio Shack upgrade my machine to 32K. When I got it back, it looked as though my 285 board was gone and replaced with a board numbered 113999.

What board do I have?

A. The "F" board is what "CoCo Nuts" have christened Radio Shack's numbered-only boards, and it appears that is what you have. You do not need a further mod to 64K because you already have 64K!

Q. I purchased a CoCo to use in my electronics supply business. I want to make price lists, bills of material, parts breakdowns, and cross-references. In short, I want to tabulate and sort. Can you direct me to a source of tabulate and sort software for my CoCo?

*John P. Stowe
San Francisco, CA*

A. Since you want these programs for business purposes, I suggest that you go the FLEX route. FHL currently has the most extensive catalog of FLEX software including a sort/merge package. I would suggest that you send \$3 for their catalog to Frank Hogg Laboratory, 770 James St., Syracuse, NY 13203.

Doctor ASCII

Q. Having bought my CoCo about 20 months ago, and having got into its 4K guts with an upgrade to 32K, I decided to splurge and get a disk setup.

I have a good number of ROM packs. Is there any way I can transfer such ROMs to my new disk system? I also have a good number of CLOADM-type cassette programs that will not work with my disk.

*Hilary W. Szymanowski
Murrysville, PA*

A. If you went the piggyback route to 32K, throw away those 16K chips and get yourself some 64K ones. "64K Modification" in July's *HOT CoCo* will supply the information you need.

If you already have 64K, all you need to transfer those programs to disk is the software from "Disk Utilities" in September 1983's *HOT CoCo*, p. 134.

Q. I have some questions about EXECing. First, sometimes when I do a CLEAR, I get an OM error even though I ask for a low start address. Second, I keep getting an FC error when I type EXEC. A typical sequence might be CLEAR 28,800.. EXEC 8001.

*Jim Lyons
Austin, TX*

A. It is possible to do a CLEAR too low as well as too high. For example, in a 32K/64K disk system, you cannot go lower than CLEAR 0,9790 on power-up or CLEAR 0,5182 following a PCLEAR1.

If you tell the computer to EXEC a machine-language program that has not been loaded from tape or disk without supplying an address, you will get a FC error. If you have POKEd a machine-language program into memory and you want to EXEC it, you must type EXEC followed by the EXEC address of that particular routine.

You also must carefully read machine-language program instructions to determine whether the addresses are in decimal or in hexadecimal. For example, EXEC 8000 and EXEC &H8000 will not EXEC the same routine. The former refers to an address in decimal and the latter in hexadecimal.

Q. The "Disk Utilities" article in July's *HOT CoCo* refers to the cartridge-select land. Would you please clarify.

The book *6809 Assembly-Language Programming*, by Lance Leventhal, is not available in the Radio Shack store. I have encountered several Assembly-language programs in magazines, but I do not have an assembler and I would like to enter them in by hand. Can you give a simple example?

*Robert Freedman
Pittsburgh, PA*

A. Hold the ROM-pack cartridge with slot toward you and the label facing up. The cartridge-select land will be the left-most land. You should put a piece of cellophane tape or equivalent on the top and bottom of this land, being careful not to cover any of the adjacent lands.

```
1 '* MACHINE LANGUAGE MONITOR *
2 ' BY RICHARD ESPOSITO
10 CLS: DIM I$(4)
20 PRINT "COMMAND>"; : FOR I=0 TO 4
30 I$(I)=INKEY$: IF I$(I)="" THEN 30
40 PRINT I$(I); : NEXT I: PRINT
50 IF I$(0)+I$(1)+I$(2)+I$(3)+I$(4)="" BASIC THEN END
60 FOR I=1 TO 4
70 IF I$(I)>="0" AND I$(I)<="9" OR I$(I)>="A" AND I$(I)<="F" THEN 80 ELSE 20
80 NEXT I
90 N=VAL("&H"+I$(1)+I$(2)+I$(3)+I$(4))
100 IF I$(0)="D" THEN 140
110 IF I$(0)="G" THEN 180
120 IF I$(0)="M" THEN 200
130 GOTO 20
140 PRINT USING "% %"; HEX$(N); : PRINT " : ";
150 FOR I=N TO N+8: PRINT USING "% %"; HEX$(PEEK(I)); : NEXT I
160 X$=INKEY$: IF X$="" THEN 160
170 IF X$<>"/" THEN 20 ELSE N=N+9: GOTO 140
180 EXEC N
190 GOTO 20
200 PRINT USING "% % "; HEX$(N);
210 Q=PEEK(N)
220 IF Q<16 THEN PRINT "0";
230 PRINT HEX$(Q); " ";
240 FOR I=0 TO 1
250 I$(I)=INKEY$: IF I$(I)="" THEN 250
260 IF I$(0)="/" THEN 310
270 IF I$(I)>="0" AND I$(I)<="9" OR I$(I)>="A" AND I$(I)<="F" THEN 280 ELSE PRINT: GOTO 20
280 PRINT I$(I); : NEXT I
290 M=VAL("&H"+I$(0)+I$(1))
300 POKEN, M: N=N+1: PRINT: GOTO 200
310 PRINT "/": N=N+1: GOTO 200
```

Program Listing 1. A Simple Monitor

The Leventhal book is not a Radio Shack product. It is published by Osborne/McGraw-Hill. You can order it from your local bookstore or from one of the advertisers in this magazine. There is, however, a new book entitled *Color Computer Assembly-Language Programming*, product number 62-2077, for \$6.95 at your Radio Shack store.

If you do not want to invest in an assembler, you can enter machine-language programs with the monitor in Program Listing 1. I must caution you, however, that hand assembly of even short programs is a lot of work.

The monitor has only four commands, but it does the job. The commands are:

- BASIC returns you to the Basic interpreter.
- D##### displays 8 bytes on the screen in hex starting at address #####, where ##### is whatever address you specify. The address must be expressed in hex and leading zeros are required. After 8 bytes of data have been displayed, you

HOT CoCo

Index to Advertisers

Reader Service Number	Page Number	Reader Service Number	Page Number	Reader Service Number	Page Number
107	Aardvark Ltd.17	159	Electronic Specialties60	188	Prickley-Pear Software63
60	Aieph Unlimited102	392	Elite Software31	80	Program Store103
195	Arcade Animations, Inc.119	283	Endcott Software60	562	Programmers Pipeline142
499	Armadillo Int'l Software22	23	Eng System Laboratories61	425	Qualitech123
563	ATCSOftware142	565	Eng System Laboratories144	518	Quasar Animations90
208	Avalon Hill Game Company11	417	Foxfire Software73	519	Quasar Animations.....117
551	Backup80142	560	Flexible Computer Solutions140	555	Questron142
248	Basic Technology.....95	262	Frank Hogg Laboratory IncCIV	296	Rainbow, The65
307	BettingLine94	379	Gamester Software22	478	S & N Enterprises97
397	Bill Cole Enterprises.....111	300	General Systems Consulting54	70	Sa q u a r o Software.....113
*	bitCards73	*	Gimix Inc146	447	Saturn Electronics29
574	bitCards142	564	Global140	554	Saturn Electronics140
140	Bumblebee Software143	9	H&E Computronics.....CIII	510	Scott Tasso Associates34
566	Byewriter140	440	HJLProducts4	*	Silverware83
335	Cer-Comp95	359	Homebase Computer Systems77	531	Skyline Marketing14
*	Chart Scan73	*	HOT CoCo	62	Soft Shop127
158	Chattanooga Choo Choo52		* HOT CoCo Subscript ions.....18	300	Softcore Software Company22
415	ChesstechUd73		* HOT CoCo Christmas90	128	Softlaw Corporation35,36,37
461	Chroma-Systems Group115		* Foreign Dealers52	173	Software Factory126
*	Chromasette Magazine83		*Instant CoCo27,116	567	Software Factory140
333	Classical Computing70		*Subscription Problems94	327	Software Support71
308	CoCoPro73	464	Inter + Action54	10	Spectro Systems96
121	Cognitec21	198	Intracolor Communications48,143	524	Spectrum Projects78
512	ColorQuest87	101	J & M Systems42	525	Spectrum Projects127
17	Colorware66,67	279	J-Nor Industries99	553	Spectrum Projects140
455	Compukit61	407	JarbSoftware108	432	Star-Kits127
116	Computer Island78	190	JBMGroup57	144	SugarSoftware97
18	Computer Plus15	275	JohnWiley&Sons53	575	SugarSoftware142
134	ComputerShack139	253	K&KComputerware123	285	Sun Hesearch Inc133
507	ComputerSystem Center55,107	221	Karr-Tech73	456	Sunlock Systems145
223	Computer System Consultants60	68	Kelco International Corp58	374	Superior Graphics Software96
558	Computer System Consultants140	395	KRTSoftware100	66	Sybex105
393	Computer Systems Distributors3	472	Leading Edge Products IncCII	568	Sybex142
255	Computerhouse96	515	Magnum Distributing91	174	Syracuse R&D Center94
369	Computerware131	92	Maple Leaf Systems61	236	T&DSoftware45
573	Computerware142	*	Mark Data Products39,41,43	400	Tampa Instructional34
181	Computize Inc23	571	MB International Inc145	291	Tano Corporation47
182	Computize Inc64	561	MNH Services140	389	TCE Programs Inc145
105	Coosol Inc72	96	Micro Management Systems143	444	Teksym Corporation34
536	Cybertron102	125	Micro Works80	238	Thundersoft Inc122
213	Data-Comp48	39	Micro-Ed95	177	Tom Mix Software141
*	Dataman55	559	Microdeal140	263	Triple-C Software138
313	Deft Systems25	203	Micronix Systems Corp33	77	Unatron52
*	Derringer Software110	231	Mitronix91	113	Universal Data Research Inc55
556	Dialogue Systems140	150	Mr. R's Software113	46	Virginia Company77
557	Digital Equipment Corp144	272	MSCompany28	*	Wayne Green Inc.
412	Double Density Software114	288	Oelrich Publications Inc125		Rainbow Quest59
27	Dragon User111	298	Ozone Engineering16		BookShelf91
72	Dynamic Electronics Inc133	550	P&PProgramming145		NanosCards123
216	EAP Company113	320	Parsons Software111		Shelf Boxes110
5	Edugames54	20	PBH Computer Products45		Manuscript84
154	Elgen Systems97	124	Perry Computers90	572	The Word Merchant144
569	ElectroStandards Lab140	552	Personal Computer Products144	156	York 10 Computerware115

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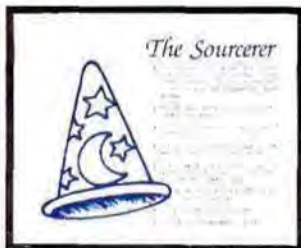
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can get the next 8 bytes by pressing the slash key. If you hold it down, you can continuously dump memory. If you hit any key other than a slash, you will return to the command mode.

- `G####` executes a machine-language program that starts at address `####`.
- `M####` displays the contents of byte `####` and waits for you to type a 2-digit hex number to replace the contents of that byte. If you respond with a slash, the contents of that byte will remain unchanged and it will display the next byte. After entering the new contents for a byte, the next byte will also be displayed. If you attempt to enter an illegal code, you will return to the command mode.

This program requires Extended Basic. If you want to put a program in low memory, execute a `PCLEAR#`, where `#` is a number between 1 and 8. Each `#` reserves 1,536 bytes that are out of the way of Basic. The lowest address to use is hex 0600 (or 0600 if you are using disk). If you want to put a program in high memory, I recommend using the `CLEAR200,&H####- 1`, where `####` is the starting address of your machine-language program.

Q. Since most machine-language programs seem to load at the top of memory, what is the procedure for combining into one program two different machine-language programs? How do I go about protecting memory so that each does not interfere with the other or Basic?

*James Edmonds
North Canton, OH*

A. One of the programs needs to be offset loaded so that both machine-language programs do not try to occupy the same space in memory at the same time. This can only be done if the program being offset loaded is written in position-independent code. A `CLOADM` or `LOADM` instruction cannot take a negative argument but you can load a program with a negative offset by typing `CLOADM "filename",&HFFFF- <offset- 1>` or `LOADM "filename",&HFFFF- <offset- 1>`. You must `CLEAR` enough space to accommodate all your machine-language programs, being careful to leave enough space for Basic as well.

Q. I recently had my 16K Extended Basic CoCo upgraded to 64K. A man at a local hobby shop upgraded it for me with Computerware's 64K chips. I asked him how fast my chips were, and he told me that they were 250-nanosecond chips. My friend also had him install 64K chips in his CoCo, but his chips were 100-nanosecond chips. He also purchased his chips from Computerware. I want to know if the man cheated me by giving me something other than what I paid for. Also, does the speed of the chips make any difference? Can you please explain what nanoseconds are?

*Mike Baker
Hopkinsville, KY*

A. Dynamic RAM memories are evaluated by their capacity and response times. Dynamic RAM capacity is expressed in terms of kilobits, where 1 kilobit is 1,024 bits. Response

times are measured in nanoseconds, where 1 nanosecond is one-billionth of a second. The lower the number the higher the speed of the chips. Unless you paid a premium for the faster 100-nanosecond chips, you received exactly what you paid for, 64K of memory. Your friend probably received the faster chips due to a temporary shortage of the 250-nanosecond chips.

Q. After my 64K CoCo has been running for a while, I get garbage on the screen. If at this point I cycle power rapidly, the problem goes away and doesn't return until the machine heats up again. I have just purchased a Radio Shack disk drive and now the problem is worse than ever.

*Albert Wallace
Charlotte, NC*

A. From your description, it sounds like you have at least one temperature-sensitive chip in your machine. You can check your RAMs by running a program that is included free with Frank Hogg Labs' catalog. Other likely candidates are the 6883 (SAM chip), the 6847 (VDG chip), and the 6809 (CPU chip). The best way to test these chips is by substituting replacement chips that are known to be good. If you are not adept at this type of work, you should return the machine to your local Radio Shack store for service.

Q. I have an earlier model (D board) CoCo, which I have upgraded to 64K myself. I am experiencing the disk interference problem outlined in the disk manual. In the manual, it says to bring the machine in for additional grounding connections at no charge. If I do so, I am afraid that the Radio Shack technicians will have a field day unmodifying my machine. What does their grounding procedure consist of?

*Kenton Fifield
Fort Frances, Ontario*

A. Radio Shack installs two clips that attach to the two outer flanges of the disk controller. They also add a grounding shield under the keyboard. If you instruct your Radio Shack store to do only the additional grounding, they shouldn't alter your modification. If they object, try another location (some are more cooperative than others).

Q. Where can I find a book that describes how the CoCo operates that is understandable by a beginner like me?

How do Gther disk drives such as the ones by Amdek and Tandon compare with Radio Shack drives for the CoCo?

How does Disk Basic compare with Extended Basic?

Why would I buy a program on disk when I could buy it cheaper on cassette? Can't I just transfer the cassette program to disk?

Is there any difference between Radio Shack's 64K and other upgrades?

*Rick Moncauskas
San Diego, CA*

A. Your local Radio Shack store carries a book, *The Color Computer Technical Reference Manual*, product number 26-2109, \$9.95. This book is *not* written for the novice. A good introductory book on microcomputers is put out by Osborne/McGraw-Hill, entitled *An Introduction to Microcomputers, Volume I: Basic Concepts*. However, it does not deal specifically with the CoCo, so you will need them both.

Radio Shack drives use only 35 tracks while Tandon's use 40. Disk Basic does not use the additional five tracks, but alternate operating systems such as FLEX do. The Amdek drives might be excellent, but since Radio Shack does not currently issue software on 3-inch disks, software availability could be a problem.

Disk Basic simply adds disk I/O (input/output) commands to Extended Basic. The disk drives do speed up I/O operations significantly.

Some programs have additional features such as disk I/O when purchased on disk. Most cassette programs can indeed be easily transferred from tape. Others require modification, which, in some instances, can be quite extensive.

As long as you have fully active 64K dynamic RAMs, you have the same capability no matter what upgrade you buy. The one major difference is that Radio Shack, in some cases, might refuse to service a modified machine. •

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Graphically Speaking

GRAPHS Or POLAR EQUATIONS

by Delmar E. Searls

Polar equations are equations whose variables are polar coordinates such as (R,A) , where R is the length of a line from the given point to the origin and A is the angle the line makes with respect to the positive X-axis. (See Fig. 1.)

In my June 1983 column, I mentioned that converting polar coordinates to rectangular coordinates is quite easy: $X=R*\text{COS}(A)$ and $Y=R*\text{SEN}(A)$. These conversions are necessary because the high-resolution graphics screen uses only rectangular coordinates. When graphing polar equations it is helpful to use a polar-coordinate grid (Fig. 2). This type of grid consists of a series of concentric circles, which measure R , with straight lines radiating out from the center, to measure A .

Program Listing 1 draws a polar-coordinate grid. It follows this basic outline:

- I. Draw the grid
 - A. The circles
 - B. The lines
- II. Label the grid
 - A. Store the strings for the DRAW command
 - B. Label the circles
 - C. Label the lines
- III. Draw the graph

The subroutine at line 10 was developed in a previous column and simulates a plotter. This lets you convert your programs for use with a plotter with a minimum number of changes. The scale factor requested in line 1 should be .95 if the screen display is going to be printed on a Radio Shack Line Printer. For a video display,

choose a value that generates true circles on your television. A value of 1.25 is appropriate in my case, and I have made this the default value. You might have to use a slightly different value for your television set.

The short subroutine in lines 20-23 draws ellipses with a horizontal axis 2 by $R1$ units long, and a vertical axis of length 2 by $R2$ (Fig. 3). If $R1=R2$, then the figure will be a circle.

To fully understand how this subroutine works, consider Fig. 4. The points on the ellipse are determined by using the X coordinate of a point on a circle of radius $R1$, while the Y coordinate comes from a point on a circle of radius $R2$. The resulting point will lie somewhere between the two circles as illustrated.

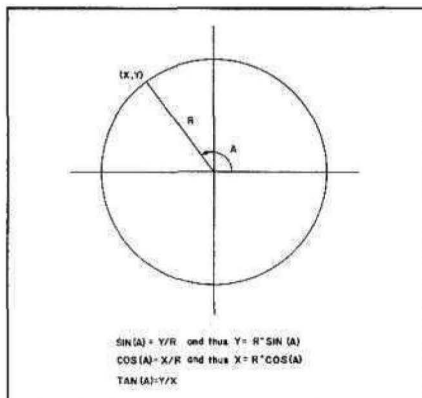


Fig. 1. The polar coordinates of a point are R , the distance from the origin to the point, and A , the angle with a terminal side that passes through the point. The definitions of the sine and cosine functions lead directly to the formulas for converting polar coordinates to rectangular coordinates.

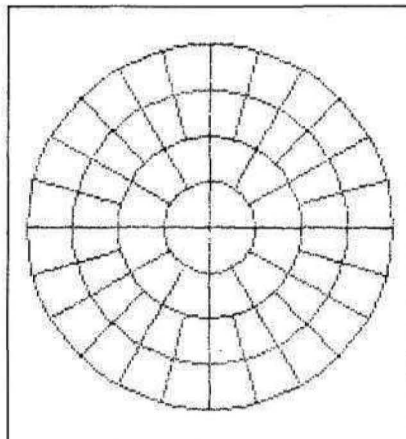


Fig. 2. Polar coordinate graph paper has a grid composed of a series of concentric circles (to measure R) with lines radiating from the center (to measure the angle A). Not all of these lines actually extend to the center because of the overcrowding that would result.

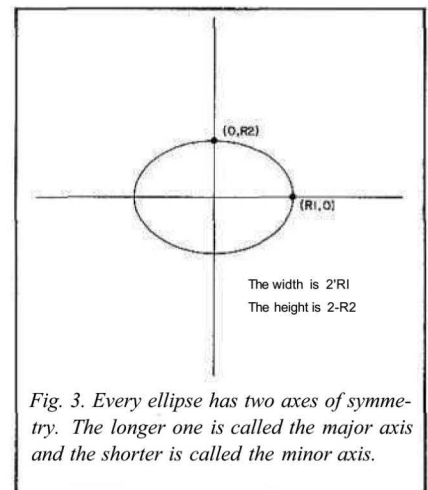


Fig. 3. Every ellipse has two axes of symmetry. The longer one is called the major axis and the shorter is called the minor axis.

System Requirements
16KRAM
Extended Color Bask
Color Graphic Printer or
LP VII (optional)

Graphically Speaking

Notice that the angle A is a true measure of the angle for points on the two circles, but not for points on the ellipse. Program Listing 2 details the logic of this subroutine and, along with Fig. 4, clarifies the ideas involved. The subroutine can be entered at two different places. If entered at line 20 with R given, a circle of radius R is drawn. If entered at line 21 with

R1 and R2 given, the appropriate ellipse is drawn.

Line 1000 (Listing 1) lets you choose to print out the grid with the default choice being "NO." When you are using a TV screen as your output device, exercise care when drawing the grid. You must avoid too much clutter. This is especially true at the center of the grid where all the straight lines

crowd together. I chose to use four circles (representing R= 1, 2, 3, and 4) and straight lines that radiate out at increments of 15 degrees. In order to reduce the crowding in the middle, only the horizontal and vertical lines actually extend all the way through the center of the circles. Lines at angles that are multiples of 30 degrees extend only to the first circle, while the re-

```

0 PI=3.141592:GOSUB1:GOTO1000
1 INPUT"SCALE FACTOR <1.25>";SF:
  PMODE4,1:PCLS:IF SF=0 THEN SF=1.
  25
2 X0=128:Y0=96:X=0:Y=0:M=-1:GOSU
  B10:RETURN
7 :
8 REM **** PLOT SUBROUTINE ****
9 :
10 XX=INT(SF*X+.5):YY=INT(Y+.5):
  IFABS(M)=2THENSX=SX+XX:SY=SY-YY:
  GOT012
11 SX=X0+XX:SY=Y0-YY
12 IFSX<0THENSX=0ELSEIFSX>255THE
  NSX=255
13 IFSY<0THENSY=0ELSEIFSY>191THE
  NSY=191
14 P$=STR$(SX)+" "+STR$(SY):IFM<
  0THENDRAW"H"+P$ELSEDRAW"BM"+P$
15 IFM=-3THENX0=SX:Y0=SY
16 RETURN
17 :
18 REM **** ELLIPSE SUBROUTINE *
  ***
19 :
20 R1=R:R2=R
21 X=R1:Y=0:M=-1:GOSUB10:DD=PI/2
  5:AA=0
22 FORII=1TO50:AA=AA+DD:X=R1*COS
  (AA):Y=R2*SIN(AA):M=1:GOSUB10:NE
  XTII
23 RETURN
997 :
998 REM **** GRAPHING POLAR FUNC
  TIONS ****
999 :
1000 CLS:PRINT@10,"POLAR GRAPH":
  PRINT:INPUT"COORDINATE GRID <N>"
  ;A$
1005 SCREEN1,1:IF A$<>"Y" THEN 3
  000
1007 :
1008 REM **** DRAW THE GRID **
  **
1009 :
1010 FOR R=20 TO 80 STEP 20:GOSU
  B 20:NEXT R : REM - DRAW 4 CIRCL
  ES
1017 :
1018 REM DRAW THE RADIATING LI
  NES
1019 :
1020 D=-15:DA=15 : REM - SET INI
  TIAL ANGLE (D) AND ANGULAR INCRE
  MENT
1027 :
1028 REM ENTER LINE-DRAWING LO
  OP
1029 :
1030 FOR I=1 TO 12
1040 : D=D+DA:A=D*PI/180 : REM
  - INCREMENT ANGLE & CONVERT TO R
  ADIANS
1050 : X=80*COS(A):Y=80*SIN(A):
  M=-1:GOSUB 10 : REM - BLANK MOVE
  TO 1ST POINT
1057 :
1058 : REM - CHECK FOR VERTICAL
  OR HORIZONTAL LINE
1059 :
1060 : IF D/90=INT(D/90) THEN 1
  090
1066 :
1067 : REM - IF ANGLE IS A MULT
  IPLE OF 30 THEN DRAW TO FIRST CI
  RCLE
1068 : REM - OTHERWISE DRAW TO
  SECOND CIRCLE
1069 :
1070 : IF D/30=INT(D/30) THEN X
  =X/4:Y=Y/4 ELSE X=X/2:Y=Y/2
1080 : M=1:GOSUB 10
1087 :
1088 : REM - ADJUST VALUE OF AN
  GLE AS YOU CROSS THE CENTER
1089 :
1090 : D=D+180:IF D>360 THEN D=
  D-360
1100 : A=D*PI/180 : REM - CONVE
  RT TO RADIANS
1107 :
1108 : REM - CHECK FOR VERTICAL
  OR HORIZONTAL LINE AGAIN
1109 :
1110 : IF D/90=INT(D/90) THEN 1
  130
1117 :
1118 : REM - JUMP CENTER AND CO
  Mplete LINE
1119 :
1120 : X=-X:Y=-Y:M=-1:GOSUB 10
1130 : X=80*COS(A):Y=80*SIN(A):
  M=1:GOSUB 10
1140 NEXT I
1195 :
1196 REM **** DRAW LABELS ****
1197 :
1198 REM - STORE STRINGS FOR DRA
  W COMMAND
1199 :
1200 FOR I=0 TO 9:READ N$(I):NEX
  T I
1201 DATA "BM-2,-3R4D6L4U6"
1202 DATA "BM+0,-3D6"
1203 DATA "BM-2,-3R4D3L4D3R4"
1204 DATA "BM-2,-3R4D3NL4D3L4"
1205 DATA "BM-2,-3D3R4NU3D3"
1206 DATA "BM+2,-3L4D3R4D3L4"
1207 DATA "BM+2,-3L4D6R4U3L4"
1208 DATA "BM-2,-3R4D6"
1209 DATA "BM-2,-3R4D6I,4U3NR4U3"
1210 DATA "BM-2,3R4U6L4D3R4"
1227 :
1228 REM - DRAW LABELS FOR CIRCL
  ES
1229 ;
1230 FOR I=2 TO 4
1240 : X=16+(I-1)*20:Y=-4:M=-1:
  GOSUB10 : REM - MOVE TO POSITION
1250 : DRAW N$(I) : REM - DRAW
  DIGIT
1260 NEXT I
1267 :
1268 REM - DRAW LABELS FOR RADIA
  TING LINES
1269 :
1270 FOR I=2 TO 22 STEP 2
1280 : D=15*I:A=D*PI/180 : REM
  - FIND ANGLE & CONVERT TO RADIAN
  S
2086 :
2087 : REM - FIND STARTING POIN
  T JUST BEYOND CIRCLE
2088 : REM - AND MAKE CORRECTIO
  NS FOR LABELS LEFT OF CENTER
2089 :
2090 : X=85*COS(A):Y=85*SIN(A):
  IF X<-.01 THEN X=X-12
2100 : IF D=270 THEN X=X-6 : RE
  M - ADJUST FOR ANGLE OF 270
2110 : M=-1:GOSUB 10
2117 :
2118 : REM - DRAW LABEL
2119 :
2120 : A$=STR$(D):N=LEN(A$) : R
  EM - CONVERT ANGLE TO STRING & F
  IND LENGTH
2127 :
2128 : REM - DRAW DIGITS ONE AT
  A TIME
2129 :
2130 : FOR J=2 TO N
2140 : DRAW N$(VAL(MID$(A$,J,
  1)))
2150 : X=6-Y:Y=0:M=-2:GOSUB 10
  : REM - MOVE TO POSITION OF NEXT
  DIGIT
2160 : NEXT J
2170 NEXT I
2195 :
2196 REM **** DRAW GRAPH OF FUN
  CTION ****
2197 :
2198 REM - FUNCTION DEFINED IN L
  INE 3000
2199 :
3000 DEF FN R(A)=2*COS(A)-4*SIN(
  2*A)
3007 :
3008 REM - SET # OF LINE SEGMENT
  S, ANGULAR INCREMENT, & INITIAL
  ANGLE
3009 :
3010 N=90:DA=2*PI/N:A=0
3020 X=20*FN R(A):Y=0:M=-1:GOSUB
  10 : REM - BLANK MOVE TO 1ST PO
  INT
3027 :
3028 REM - MAIN DRAWING LOOP
3029 :
3030 FOR I=1 TO N
3040 : A=A+DA : REM - INCREMENT
  ANGLE
3050 : R=20*FN R(A) : REM - CAL
  CULATE VALUE OF R
3060 : X=R*COS(A):Y=R*SIN(A):M=
  1:GOSUB 10 : REM - DRAW LINE
3070 NEXT I
3077 :
3078 REM - LET USER KNOW GRAPH I
  S DONE AND WAIT FOR A RESPONSE
3079 :
3080 SOUND 150,5
3090 A$=INKEY$:IF A$<>" " THEN 31
  10
3100 FOR I=1 TO 50:NEXT:GOTO3080
3110 GOTO 3110

```

Program Listing 1. Graphs of polar equations can be drawn accurately on the PMODE4 graphics screen. The polar grid is optional.

Graphically Speaking

maining lines extend only to the second circle (Fig. 2). This produces a grid with a minimum of clutter and yet with enough circles and lines to be useful.

Line 1010 draws the four circles at evenly spaced intervals. Lines 1020-1140 draw the radiating lines. The logic is somewhat complicated because most of the lines do not go all the way through the center. Line 1060 detects the horizontal and vertical lines, which are then drawn all the way from edge to edge. Line 1070 detects which of the remaining lines are at angles that are multiples of 30 degrees.

If this is the case, the line is drawn from the outer (or fourth) circle to the first (line 1080). A blank move is then performed across the center to the corresponding point on the opposite side of the first circle (line 1120). From there the last portion of the line is drawn to the outer circle (line 1130). Note that as you cross the center of the grid the angle increases by 180 degrees (lines 1090-1110).

For those lines with angles that are not multiples of 30 degrees, a similar process is followed except that the lines go to the second circle, jump the center, and continue from the second circle to the fourth.

A second complicating factor is my attempt to minimize the length of blank moves. When one line is finished, a blank move is made 15

degrees along the circle and the next line is drawn in the opposite direction as the preceding one.

Labeling the grid comes next. Such labeling must be kept to a minimum because of the relatively low resolution of your display. In lines 2000-2019 the digits zero through nine are stored as strings for the DRAW

"While pretty, the graphs in the second column are not really accurate..."

command. They are drawn referenced to a point at the center of a 5-by-7 array of dots (or pixels). Lines 2030-2060 label the four circles in a straightforward manner.

Labeling the radiating lines at multiples of 30 degrees is more challenging. Lines 2090-2110 determine the coordinates of the center of the first digit and perform a blank move to

```
1005 SCREEN1,1:PMODE3,1:IF A$<>"
Y" THEN 3000
1006 COLOR 3
2090 : X=85*COS(A):Y=85*SIN(A):
IF X<-.01 THEN X=X-14
2100 : IF D=270 THEN X=X-7
2150 : X=7:Y=0:M=-2:GOSUB 10
3005 COLOR 4
```

Table 1. By inserting these changes, Listing 1 can be modified to draw a while graph on a red (or blue) grid.

that spot. Line 2120 converts the numeric label into a string of length N. The digits are printed out one at a time in lines 2130-2160. This loop starts at J=2 because the first character in a string representation of a number is reserved for the sign. If the number is positive, the character is a space (i.e., blank). If the number is negative, the first character is the minus sign. In this program you know ahead of time that none of your labels will be negative.

The polar function is defined in line 3000. In line 3020 a blank move is made to the first point of the graph followed by 90 short line segments that draw the graph. In this program the function is evaluated every four degrees, the results are then converted to rectangular coordinates, and a short line segment is drawn from the previous point to the newly calculated point.

Enter Listing 1 and run it. Responding with a Y for the grid point results in a graph that includes the grid. The only problem with this program is that it is sometimes difficult to distinguish the graph from the grid (Photo 1 and Fig. 5a). One solution is to carefully follow the printed graph with a black pen, causing it to stand out (Fig. 5b).

You can improve the screen display by inserting the changes found in Table 1. These six changes produce a white polar graph with the grid and numbers in red. The PMODE3,1 in line 1005 follows the PMODE4,1 command in line 2 of Listing 1. This results in a four-color, 128-by-192 display with a black background.

The three other colors are blue, red, and white. Line 1006 selects red for the

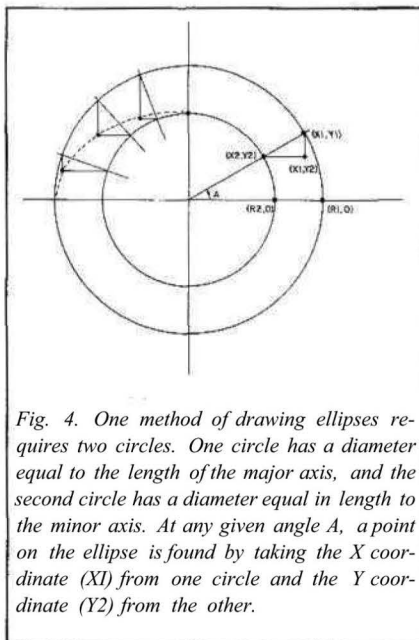


Fig. 4. One method of drawing ellipses requires two circles. One circle has a diameter equal to the length of the major axis, and the second circle has a diameter equal in length to the minor axis. At any given angle A, a point on the ellipse is found by taking the X coordinate (X1) from one circle and the Y coordinate (Y2) from the other.

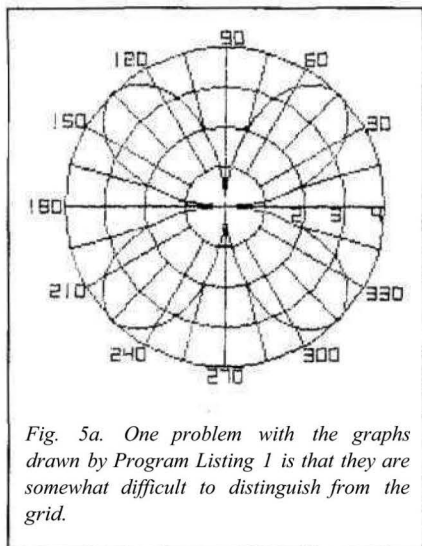


Fig. 5a. One problem with the graphs drawn by Program Listing 1 is that they are somewhat difficult to distinguish from the grid.

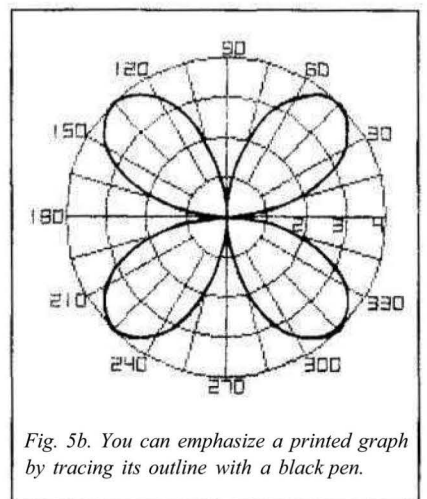


Fig. 5b. You can emphasize a printed graph by tracing its outline with a black pen.

Graphically Speaking

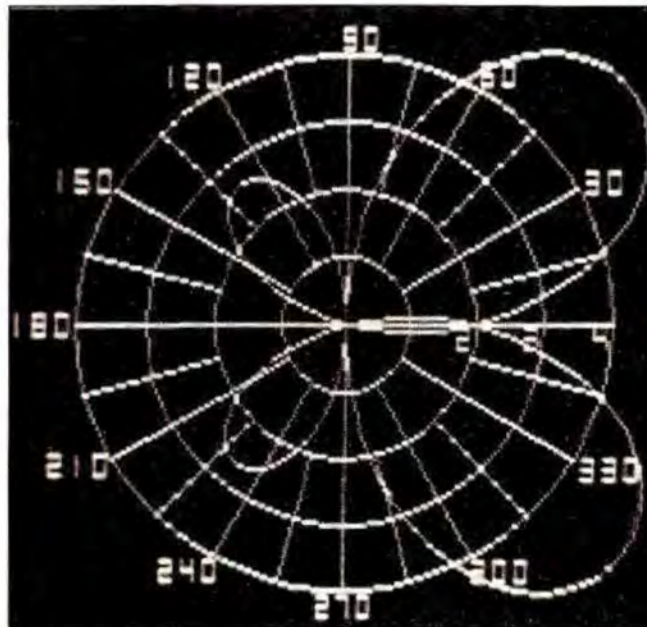


Photo 1. This is a polar equation graphed on the PMODE4 graphics screen. Notice that the graph is a little hard to distinguish from the grid.

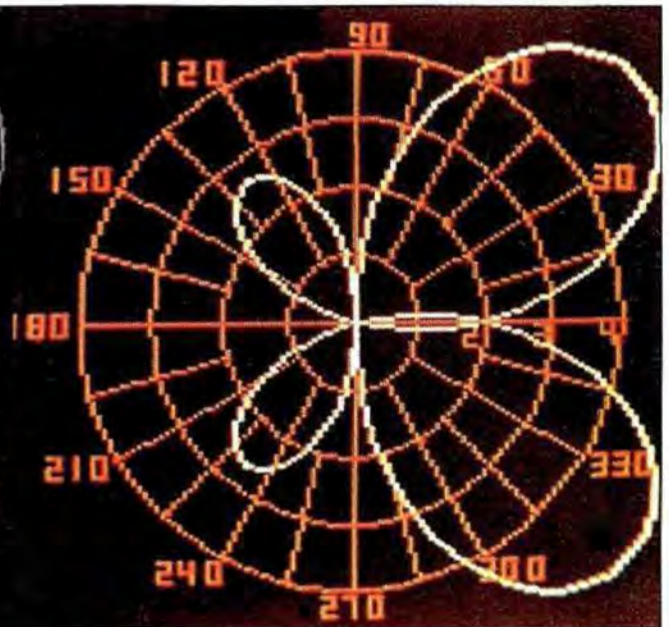


Photo 2. By using a PMODE3 graphics screen a white graph can be drawn on the colored grid. The resolution is not as fine, but the graph is easier to see.

grid and labeling. (Actually it is only sometimes red. Occasionally the computer will generate a blue grid. This can sometimes be cured by pressing the reset button. Otherwise change the COLOR in line 1006 from 3 to 2.)

The changes in lines 2090, 2100, and

```

195 REMARK LINE NUMBERS HAVE BEEN MULTIPLIED BY TEN TO ALLOW FOR REMARKS.
196 '
197 REMARK FOR A CIRCLE R1 AND R2 ARE THE SAME. R IS ASSIGNED IN THE MAIN
198 ' PROGRAM.
199 '
200 R1=R:R2=R
206 '
207 REMARK ENTRY AT LINE 21 GENERATES AN ELLIPSE WITH R1 AND R2 ASSIGNED
208 ' BY THE MAIN PROGRAM
. PERFORM BLANK MOVE TO FIRST POINT, SET VALUE OF ANGULAR INCREMENT, AND SET INITIAL ANGLE TO ZERO.
209 '
210 X=R1:Y=0:M=-1:GOSUB10:DD=PI/25:AA=0
217 '
218 REMARK DRAW THE ELLIPSE (OR CIRCLE) USING 50 SHORT LINE SEGMENTS.
219 '
220 FOR I=1 TO 50:AA=AA+DD:X=R1*COS(AA):Y=R2*SIN(AA):M=1:GOSUB10:NEXT I
227 '
228 REMARK RETURN TO MAIN PROGRAM
229 '
230 RETURN
    
```

Program Listing 2. This commented version of the ellipse subroutine in Listing 1 should help you understand the basic ideas involved. See the text and Fig. 4 for additional details.

$R=A/2$ (ARCHIMEDEAN SPIRAL)		$R=4*\text{COS}(20*A)$	
$R=2.5*\text{COS}(A)+1.5$ (LIMACON OF PASCAL)		$R=4*\text{COS}(36*A)$	
$R=4*\text{COS}(A)*\text{COS}(3*A)$		$R=4*\text{COS}(46*A)$	
$R=4*\text{COS}(2*A)$ (4-LEAVED ROSE)		$R=4*\text{COS}(48*A)$	
$R=4*\text{SIN}(3*A)$ (3-LEAVED ROSE)		$R=4*\text{COS}(50*A)$	

Table 2. The graphs on the left are based on fairly simple polar equations. The graphs on the right are examples of the beauty that can result from a combination of mathematics and computers.

Graphically Speaking.

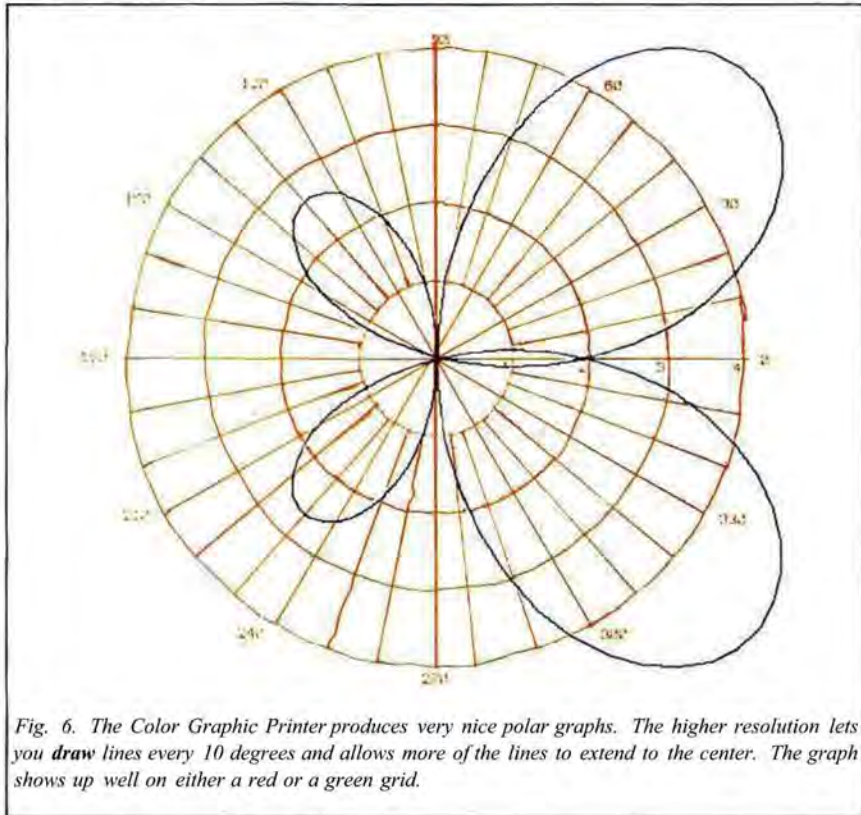


Fig. 6. The Color Graphic Printer produces very nice polar graphs. The higher resolution lets you draw lines every 10 degrees and allows more of the lines to extend to the center. The graph shows up well on either a red or a green grid.

2150 space the digits farther apart in the angle labels. Finally, line 3005 changes the color to white for drawing the actual graph of the function. Using these changes you will lose a little in resolution, but I think you will find the results quite pleasing (Photo 2).

Program Listing 3 is a version of this program for the Color Graphic Printer (Fig. 6). It uses the same logic

with the exception of the labeling routine. With the graphic printer, which acts like a plotter, you can draw labels with one simple command: PRINT -2, "P"; A\$ (or PRINT -2, "P"; N).

In this command A\$ is a string variable previously defined as the desired label (or N as the number). In my program I used the second method since all the labels were given numbers. The alphanumeric characters are printed starting at the lower left corner of the character position. That is, if you move to a specified point and print a character, that character will be printed above and to the right of the specified point. The main function of the labeling routine is to find the correct starting point for each label.

Line 0 initializes the plotter and resets the origin at the middle of the paper. Lines 20-23 contain the ellipse/circle subroutine rewritten for the plotter. The variable RC in line 1008 determines the radius of the first (and smallest) circle. The largest circle will have a radius four times as large. If you want the plotted graph to take up less space on the paper, reduce RC to a smaller value. Practical values for RC range from 20 to 50, though lines will be crowded on the smaller graphs.

The lines of the grid are drawn every 10 degrees (lines 1020, 1030) rather

```

0 PI=3.141592:PRINT#-2,CHR$(17):
PRINT#-2,CHR$(18);"M240,-240":PR
INT#-2,"I"
1 GOTO 1000
19 :
20 R1=R:R2=R
21 X=R1:Y=0:PRINT#-2,"M";X;",";Y
:DD=PI/25:AA=0
22 FOR I=1 TO 50:AA=AA+DD:X=INT(R1
*COS(AA)+.5):Y=INT(R2*SIN(AA)+.5
):PRINT#-2,"D";X;",";Y:NEXT I
23 RETURN
24 :
1000 CLS:RC=50:PRINT@10,"POLAR G
RAPH":PRINT:INPUT"COORDINATE GRI
D <N>";A$
1005 IF A$<>"Y" THEN 3000 ELSE P
RINT#-2,"C3"
1010 FOR R=RC TO 4*RC STEP RC:GO
SUB 20:NEXT R
1020 D=-10:DA=10
1030 FOR I=1 TO 18
1040 D=D+DA:A=D*PI/180
1050 X=INT(4*RC*COS(A)+.5):Y=INT
(4*RC*SIN(A)+.5):PRINT#-2,"M";X;
",";Y
1060 IF D/30=INT(D/30) THEN 1090
1070 X=INT(X/4+.5):Y=INT(Y/4+.5)
1080 PRINT#-2,"D";X;",";Y
1090 D=D+180:IF D>360 THEN D=D-3
60
1130 A=D*PI/180
1110 IF D/30=INT(D/30) THEN 1130
1120 X=-X:Y=-Y:PRINT#-2,"M";X;",";
Y
1130 X=INT(4*RC*COS(A)+.5):Y=INT
(4*RC*SIN(A)+.5):PRINT#-2,"D";X;
",";Y
1140 NEXT I
1999 :
2000 PRINT#-2,"S0"
2005 FOR I=1 TO 4
2010 PRINT#-2,"M";RC*I-13;",";-1
0
2020 PRINT#-2,"P";I
2030 NEXT I
2060 FOR I=0 TO 22 STEP 2
2070 D=15*I:A=D*PI/180
2080 X=INT((4*RC+5)*COS(A)+.5):Y
=INT((4*RC+5)*SIN(A)+.5)-5:IF X<
0 THEN X=X-30
2090 IF D=90 THEN X=X-10:Y=Y+2 E
LSE IF D=270 THEN X=X-15:Y=Y-2
2100 PRINT#-2,"M";X;",";Y
2110 PRINT#-2,"P";D
2120 NEXT I
2999 :
3000 DEF FN R(A)=4*COS(20*A)
3005 PRINT#-2,"C0"
3010 N=90:DA=2*PI/N:A=0
3020 X=INT(RC*FN R(A)+.5):Y=0:PR
INT#-2,"M";X;",";Y
3030 FOR I=1 TO N
3040 A=A+DA
3050 R=RC*FN R(A)
3060 X=INT(R*COS(A)+.5):Y=INT(R*
SIN(A)+.5):PRINT#-2,"D";X;",";Y
3070 NEXT I
3080 PRINT#-2,"A"
3090 SOUND 150,5
3100 A$=INKEY$:IF A$<>" " THEN 31
20
3110 FOR I=1 TO 50:NEXT:GOTO3090
3120 GOTO 3120
    
```

Program Listing 3. This is a version of Listing 1 written for the Color Graphic Printer. Some pretty designs can be drawn using this program (see Table 2).

than every 15 degrees as before. In addition, lines at multiples of 30 degrees cross through the center (lines 1060, 1110) while the remaining lines stop at the first circle (lines 1070, 1080). These changes are possible because of the far

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Graphically Speaking

better resolution of the plotter as compared to the graphics screen.

Notice how much shorter the labeling section is now that you don't have to store strings for the DRAW command. Lines 2005-2030 label the circles and lines 2060-2120 label the radiating lines. The initial starting point of the label is determined first (lines 2010 and 2080-2100) and the label is then printed (lines 2020 and 2110 respectively).

One note of caution about the Color Graphic Printer. When it receives numeric data, it truncates all values (drops any fractions), so round data off to the nearest integer. (See lines 22, 1050, 1070, 1130, 2080, 3020, and 3060.) If this is not done, you might be disappointed in the results.

Using Program Listing 1, experiment by changing the definition of the polar function in line 3000. Experiment with various combinations of sums, differences, and products of sine and cosine functions. If you get a graph that you like, you can get a printout in one of two ways. First, you can redraw the graph using a scale factor of .95 in line 1 of Listing 1 and send the screen display to your printer (assuming you have an LP VII or some similar device). Your other option is to use the plotter program by inserting the desired polar function into line 3000 of Listing 3.

In Table 2 you will find some examples of polar graphs. The first column includes graphs of simple functions. The second column demonstrates the beauty that can result from a combination of mathematics and computers. While pretty, the graphs in the second column are not really accurate because I incremented the angle A four degrees at a time. This is far too coarse a sampling rate to draw an accurate graph but the results are quite interesting, nevertheless.

Looking Ahead

Having looked at graphs of polar coordinates, it seems logical to next consider graphs of equations using rectangular coordinates. Next month my discussion will include the concepts of scaling and translation. ■

Address correspondence to Delmar E. Searls, c/o HOT CoCo, Pine St., Peterborough, NH 03458.

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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.

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The Software Factory has three new games for the Color Computer: *Psiconn*, *Invasion*, and *U.F.O.*

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Reader Service # 567

CoCo Sleuth

CoCo Sleuth is a collection of three programs that enable you to examine or modify binary program files on disk or in memory on Tandy TRS-80 Color, TDP-100, or similar computers with at least 32K bytes of memory and at least one disk drive.

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program. You can alter programs in ROM or on disk and save them on a disk file which can be used to program a new ROM.

The three programs, *Sleuth*, *CHGNAM*, and *XREF* (the disassembler, name-changer, and label cross-reference generator) are supplied as 6809 object-code files. The processors that can be analyzed are 6800, 6801, 6802, 6803, 6805, 6808, 6809, and 6502.

CoCo Sleuth is available for \$49 from Computer Systems Consultants Inc., 1454 Latta Lane, Conyers, GA 30207. 404-438-1717/4570.

Reader Service # 558

Bytewriter Printers

Bytewriter has added two new printer/typewriters to their line and are selling interface kits as well. Now, owners of a *Praxis* typewriter can install the interface themselves to get letter-quality printing.

The interfaces are available for the *Praxis* 30, 35, and 40 typewriters and are prewired and tested at a retail price of \$165.

The *Praxis* 30 *Bytewriter*, at \$495, is the first letter-quality printer to retail below \$500, and it's a typewriter too.

The *Praxis* 35 and the new *Praxis* 40 office machine are also now available as complete printer/typewriters, priced at \$545 and \$645, respectively. The interface is a parallel interface and requires a converter for the *CoCo* available from *Bytewriter*. Contact *Bytewriter* at 125 Northview Road, Ithaca, NY 14850.

Reader Service # 566

Backgammon For Dragon 32

Aimed at the more serious game player, this program combines the intrigue and strategy of the tradi-



Bytewriter Printer

tional game board with today's technology.

With full-color, high-resolution graphics, optional sound, auto or manual dice throw, and nine levels of difficulty, *Backgammon* allows you to play a friend or the computer, or to watch the computer play against itself.

Microdeal's Backgammon can be played via the keyboard or through the use of the *Microdeal Light Pen*.

Backgammon is available from *Microdeal Ltd.*, 41 Truro Road, St. Austell, Cornwall PL25 5JE.

Reader Service # 559

New from Saturn Electronics

The *Saturn Printer Interface* for the TRS-80 Color Computer interfaces with most Centronics parallel-type ports. It requires no power supply and has a user-adjustable baud rate from 300 cps to 960 cps. Attractively styled to match the *CoCo*, this interface is manufactured in the U.S. and comes with a one-year unlimited warranty. Complete with user manual and all cables and connectors, it retails for \$70.

Newly designed, the *Intronics EPROM Programmer* plugs di-

rectly into the ROM-pack port and will program 2500, 2700, and 68200 series EPROMs. It uses tape-based software, is software controlled (requiring no personality modules), and has the option of on-board ROM. This programmer has a high-quality, zero insertion force EPROM socket (*Textool* by 3M), and gold-plated contacts. The price is \$140.

Both products are available from *Saturn Electronics Company Inc.*, 57-61 Cloverdale Blvd., Bay-side, NY 11364. 212-423-4626.

Reader Service # 554

CoCo Speaks Out

The *Voice-Pak-CoCo Voice Synthesizer* can add voice to any *Basic* program. A single line in *Basic* produces a full sentence using the *Votrax SC01* phoneme synthesizer. *Voice-Pak* features unlimited vocabulary, automatic inflection, voice editor, and four programmable pitch levels, and is cost effective in education, robotics, speech therapy, games, aid to handicapped, and security.

It comes complete with users' manual and software cassette, fully assembled and tested, ready to plug in and talk.

Priced at \$69.95 (\$3 shipping and handling), *Voice-Pak* has a 90-day warranty. For informa-



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.

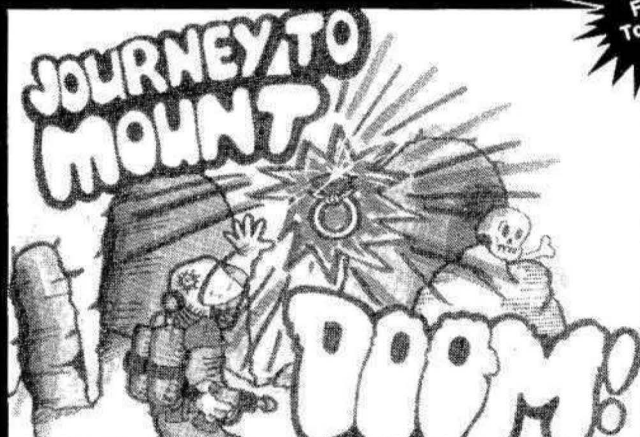
32K Extended Basic
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By
 Ken Kalish

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.

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PRODUCT NEWS

don, contact Spectrum Projects, 93-15 86th Drive, Woodhaven, NY 11421.212-441-2807.

Reader Service c 553

Merry Christmas from Chartscan Data Inc.

The bitCard is a customized gift and a personal greeting card for your friends and relatives who have access to a microcomputer. Designed as text/graphic adventures relating to a specific holiday or event, bitCards can be ordered custom-programmed so the recipient finds personal references to himself in the course of the adventure.

The first bitCard, "A Christmas Adventure," is now available for Christmas gift-giving for \$16.95. Orders and information from bitCards, 120 South University Drive, Suite F, Plantation, FL 33317.

Reader Service v 574

Color Geography

Color Computer and TDP-100 owners can learn more about the United States with this new educational game from Sugar Software. The Great U.S.A. teaches abbreviation, capital, official nickname, bird, tree, and flower for each of the 50 states.

A single cassette includes 16K and 32K versions, with the 32K version including two colorful maps of the country from which students can learn shapes, locations, and relative sizes of states.

It sells for \$19.95 plus \$1 shipping from Sugar Software, 2153 Leah Lane, Reynoldsburgh, OH 43068.

Reader Service v 575

Colorbowl Football And Junior's Revenge

- Be a part of the football season with your own CoCo football team. Colorbowl Football comes on cassette and disk for the Color Computer and lets you pit player against player, or test your skills against the computer. You have eight defensive and nine offensive plays, and a large selection of formations, all in full-color graphics. The game requires 32K of memory and sells for \$26.95 on cassette or \$29.95 on disk (plus \$2 shipping).

- In Junior's Revenge, the star

character (a young ape) must overcome four screens of obstacles to rescue his father, the King. He traverses the jungle and the swamp, climbs vines, fights attackers, and finally overcomes all the challenges to free King from Luigi. It sells for \$28.95 on cassette or \$31.95 on disk (plus \$2 shipping).

Both games require 32K of memory and are available from Computerware, Box 668, 4403 Manchester Ave., Suite 103, Endinitas, CA 92024.

Reader Service v 573

Questron Preview

Looking for a new way to see what a program looks like, or what it does, before you buy? The Questron Software Catalog is available on tape and loads into your Color Computer to give you actual displays of most of their software.

Program categories include business, utility, education, games, graphics, and music. Also included on the tape is a free game, utility, or art demonstrator program (choice by category).

The catalog is set up to be entertaining as well as informative, and is available for only \$2 from Questron, P.O. Box 576, So. Holland, IL 60473.

Reader Service v 555

BackUp-80

BackUp-80 provides on-location setup, training, special application assistance, and troubleshooting for TRS-80 owners. The group also offers a subscription telephone assistance program at low, quarterly rates.

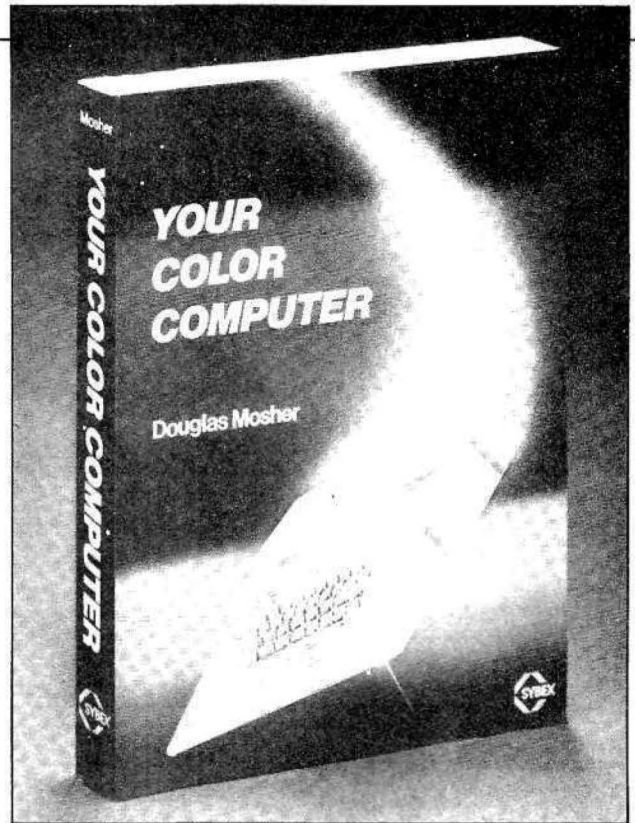
For further information phone or write BackUp-80, 160 North Main St., Randolph, MA 02368. 617-963-2280.

Reader Service v 551

Getting Acquainted With Your CoCo

Your Color Computer, by Doug Mosher, guides you through all aspects of Color Computer ownership. This book highlights the value of your computer and the range of its possible uses.

Patience and humor guide you through purchasing, setting up, programming, and using the Radio Shack TRS-80/TDP Series 100 Color Computer. Cartoons, dia-



New Sybex Publication

grams, photos, and a Basic thesaurus and command reference section make this book a complete introduction for you.

It also offers sections on available software and peripherals for the computer user who isn't interested in just programming.

Your Color Computer sells for \$12.95. For more information, contact Sybex Inc., 2344 Sixth St., Berkeley, CA 94701.

Reader Service v 568

Programmers' Pipeline

Programmers' Pipeline provides a common meeting ground for those who own software and want to sell or lease it, and those who are looking for software to market commercially.

For more information, contact Programmers' Pipeline, P.O. Box 666, Glendora, CA 91740. For a free pamphlet entitled "Checklist for Program Authors" send a self-addressed, stamped envelope.

Reader Service v 562

Sell Your Software Creations

Programmers—ATC Software announces a new manual that tells

you how to sell your own software creations.

This manual tells how to obtain national directory listings, how to price a new software product, how to locate and qualify a new advertiser, how to write a user's manual, and how to operate a successful mail-order fulfillment service.

The 80 page manual is available for \$20 from ATC Software, Route 2, Box 448, Estill Springs, TN 37330.

Reader Service v 563

Guide to Computer Literature

If you are tired of wading through all the computer-information literature on the market, you will be interested in *The Computer NEWSletter*.

Published 10 times per year, this guide to microcomputer information is a directory of recent periodical literature, and lists major articles from over 50 publications, including *HOT CoCo*.

Each reference includes title and author, name, volume, date, page, description of contents, name of computer language involved, and a signal indicating presence of program listings. The two categories of listings, computer-specific and general-interest articles, are di-

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COMMUNICATIONS 198

PRODUCT NEWS

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Reader Service ✎ 561

Computers in Education

Teachers, administrators, parents, and anyone concerned with the growing use of computers in education—this handbook offers a look at both modern concepts and the history of computer-based education.

Available without charge from Digital Equipment Corporation, "Introduction to Computer-Based Education" is a 142-page publication that contains background information to prepare educators and administrators to make intelligent decisions about

computer-based education products.

The handbook was prepared with the assistance of Indiana University, Bloomington Academic Computing Services, and Dr. William H. Sanders, coordinator of the University's Workshop for Computer-Based Instructional Support.

Divided into two parts, the handbook first describes in layman's terms the origins of computer-based education and educational projects leading to recent developments in the field. It includes an overview of education applications in instruction, research, and administration, and offers recommendations for incorporating computers into instruction.

You will also find guidelines for designing and producing computer-based education materials, and a discussion of available software tools. Part I concludes with a section on current trends in instructional technology.

Free copies of "Introduction to Computer-Based Education," publication number EB-25005-87, can be ordered from Digital Equipment Corporation, Printing and Circulation Services, 10 Forbes Road, Northboro, MA 01532.

Reader Service ✎ 557

Keyboard Beeper Cartridge

The ESL Beeper gives your CoCo a feature found on professional terminals and word processors. Requiring no software or hardware modifications, it chirps only when the computer accepts valid key input. Your typing speed and accuracy improve and your program entry tension decreases since you don't have to constantly look at the screen.

The Beeper is housed in a ROM pack for plug-in installation and functions with programs using the Radio Shack ROM operating system.

The ESL Beeper has a gold-plated connector that plugs into the computer mid a lubricated tin-lead expansion connector into which you can plug another device.

Additional features include three power lamps and a switch to control the carl ridge interrupt line. This switch enables you to power up with a program pack installed in the extension cable and still access Basic. In addition, there is a more accessible Reset switch.

The ESL Beeper is \$59.95 plus shipping and handling from Ling Systems Laboratories, 8203 Springfield Village Drive, Springfield, VA 22152.

Reader Service ✎ 565

RS-232 Analyzer

Personal Computer Products has released the RS-232 Analyzer, a product that allows diagnosis, monitoring, and connection of any device or computer that uses the RS-232 interface. The analyzer monitors nine RS-232 signals and displays their status using bi-colored LEDs. It monitors inactive, high and low, and changing signals, and has one LED that can be tied to monitor any RS 232 line.

Tire analyzer has switches that allow for I lie interconnection of the most common computer-to-computer interface, and tie ability to cross-wire any connection necessary to connect devices. Its plug-in type adapter simplifies the task of hooking up RS-232 devices such as lettei-quality printers. This product can be left permanently wired in any circuit and comes with a manual containing detailed examples of its uses.

The package sells for 1149.95 from Personal Computer Products, 1400 Coleman Ave., Suite C-18, Santa Clara, CA 95050.

Reader Service ✎ 552

Color Computer Genealogy

Genealogy is now available for the Radio Shack Color Computer with 32K of memory and Extended Color Basic. "Family" maintains 11 data elements on up to 255 ancestors in eight generations. The data base includes dates and places of birth, marriage, and death as 'veil as place of burial, name, reference number, and number of children.

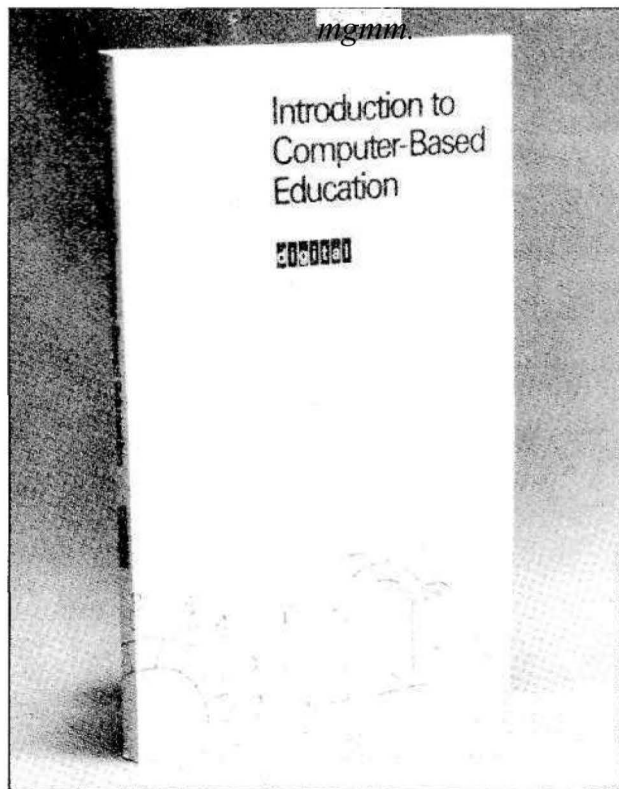
The companion iamprint creates three genealogical charts from the "family" (data base. A reference number index, shows you the names in your record and their number. The live-generation pedigree charts use standard genealogical notation, while the family group chart shows all filed data on each husband and wife group.

Both programs are available on tape for \$9.95 postpaid from TWM, P.O. Box 232, Lititz, PA 17543.

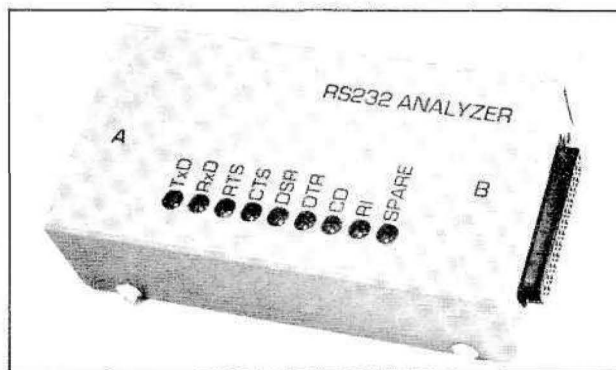
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Introduction to Computer-Based Education



The PCP RS-232 Analyzer

PRODUCT NEWS

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The Diskaddy adjusts to accommodate a maximum of 22 disks per unit and is designed to stand upright for shelf access, or lie flat for briefcase and drawer storage.

Retail prices range from \$7.99 to \$21.99 from MB International Inc., 701 B St., Suite 1300, San Diego, CA 92101.

Reader Service # 571

CoCo Vocals

Color Voice is a hardware device that plugs into your joystick jack and lets you input sound from tape or disk into your programs.

It requires no external power, comes with input software on tape (transferable to disk), and works with any Extended Basic ROM.

Color Voice is available for \$29.95 plus \$1.25 shipping, from P and P Programming, Waterhole Road, Colchester, CT 06415.

Reader Service # 550



Diskaddy



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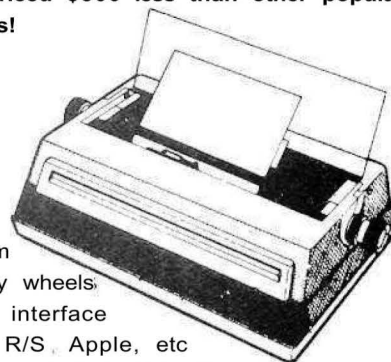
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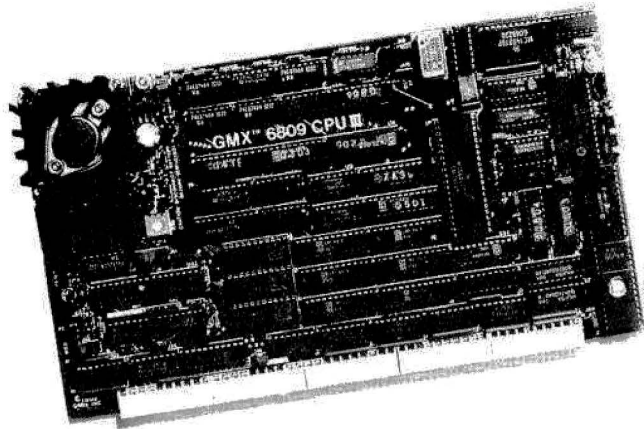


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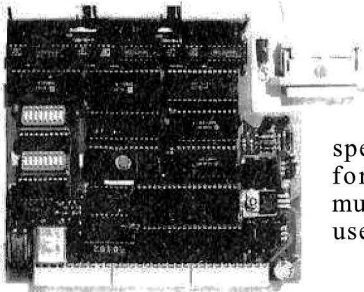
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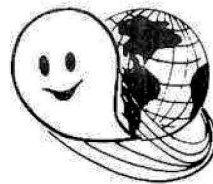
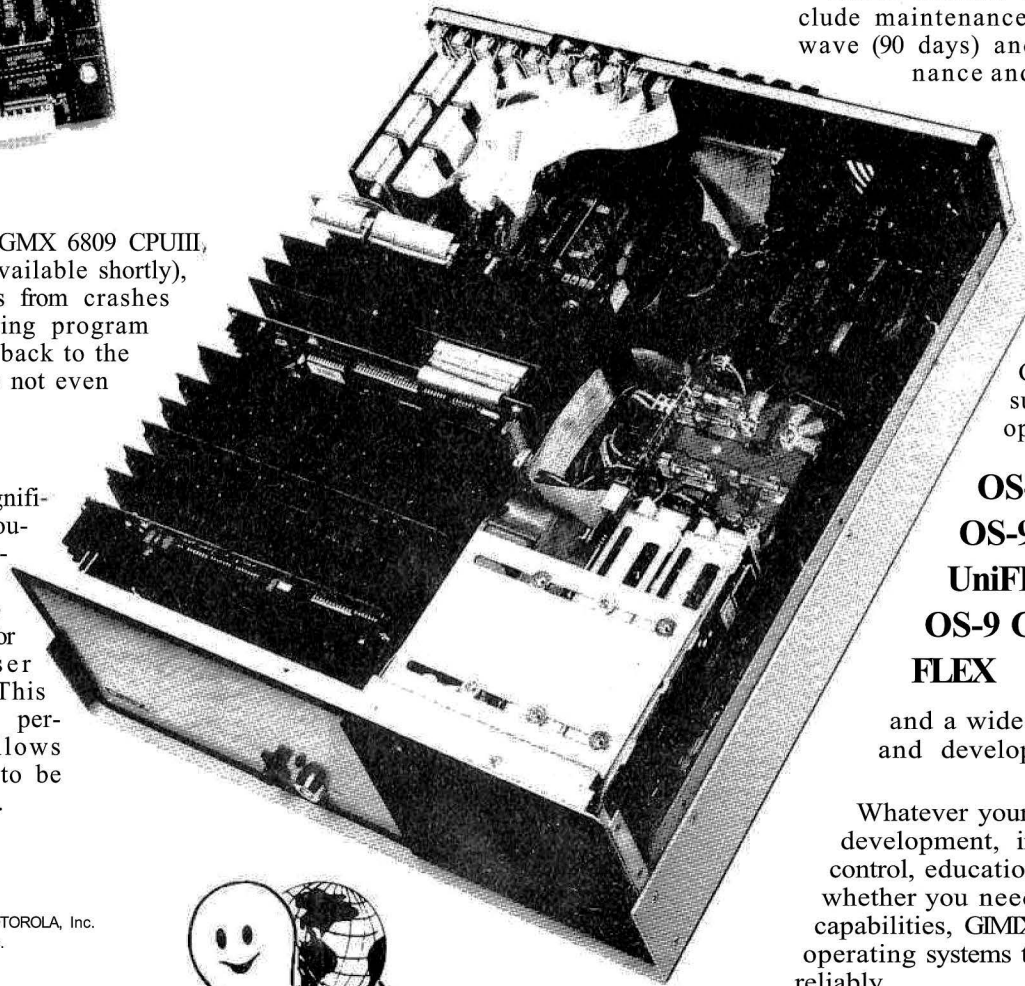
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All programs are menu-driven and allow add/change/delete. Each file and statement can be listed to screen or printer, and saved to cassette or diskette. **THE COLOR ACCOUNTANT** also comes with 40 pages of documentation that leads you step-by-step through the entire package. The TRS-80 COLOR Ext. Basic requires 16K for this package.

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