

THE Color Computer^{*} MAGAZINE

December

1983

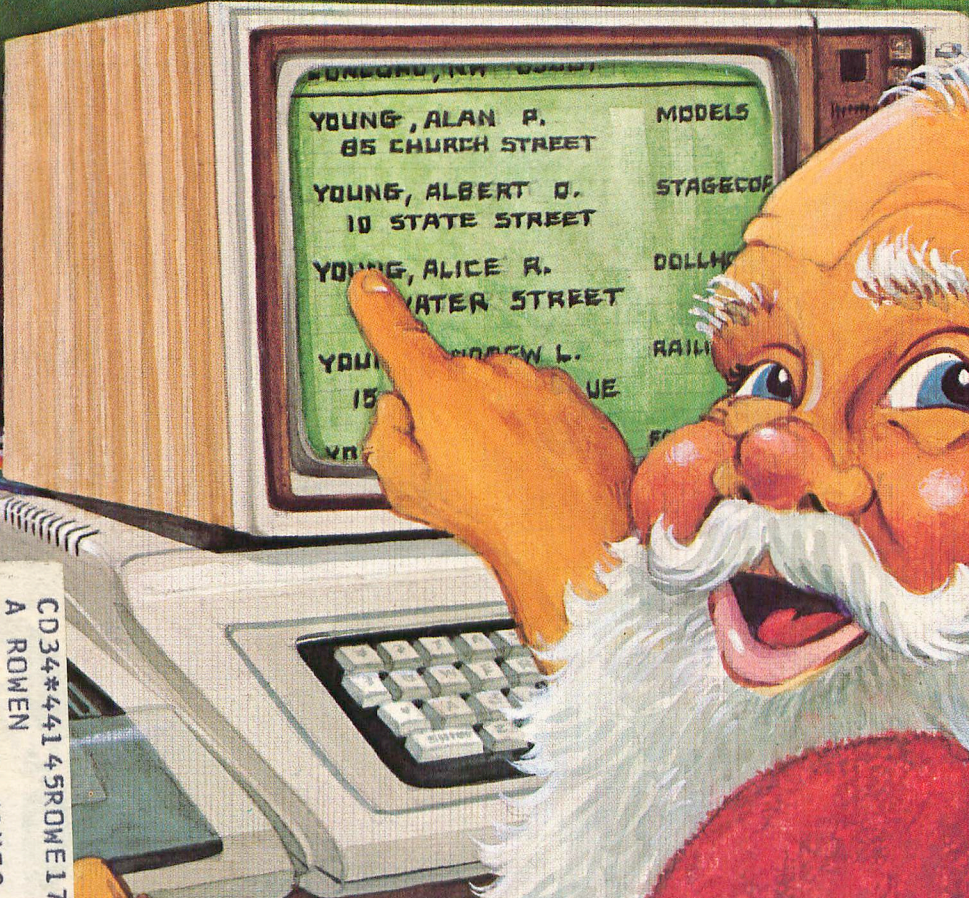
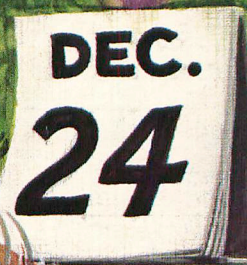
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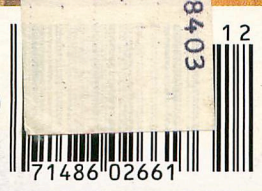
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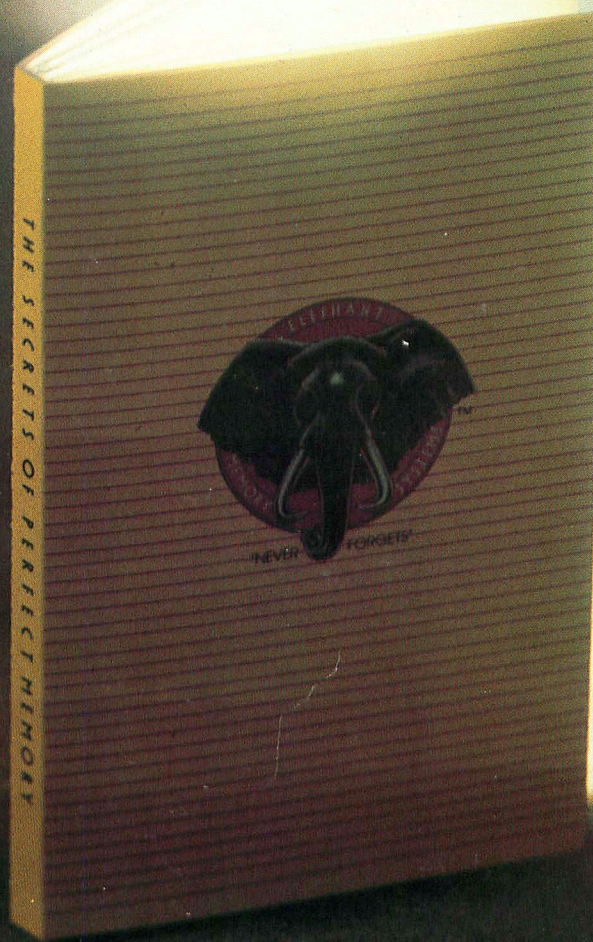
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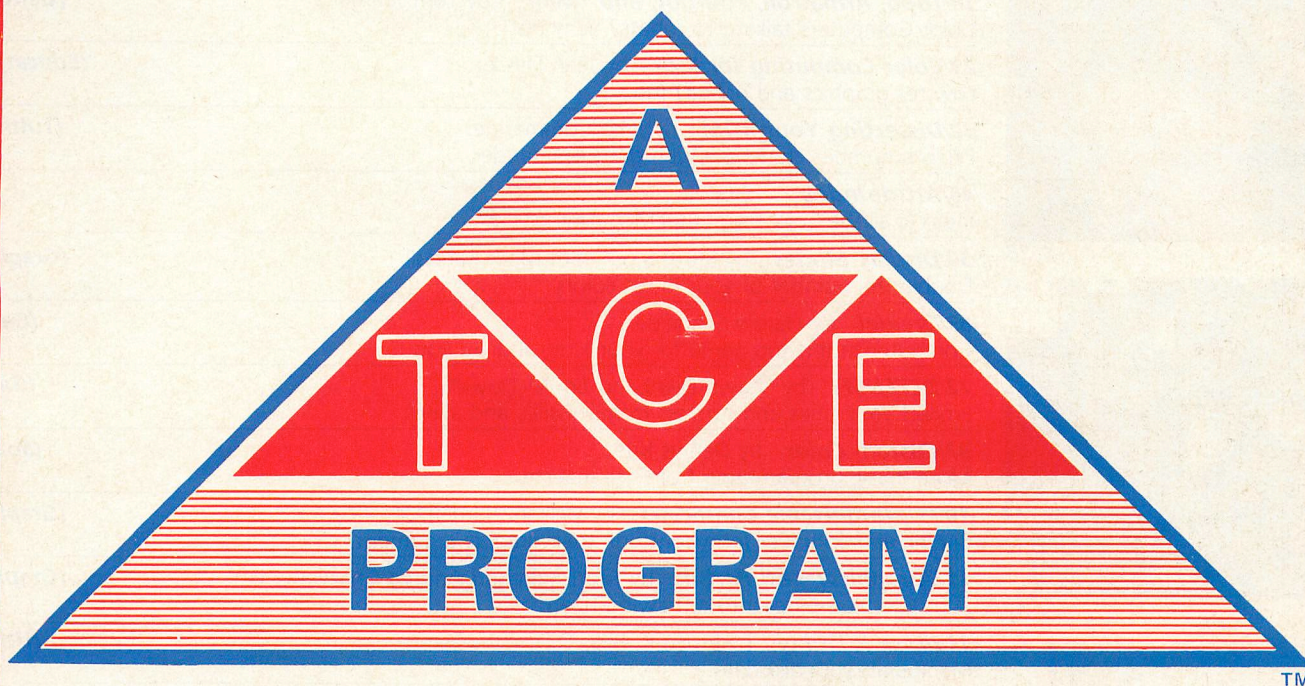
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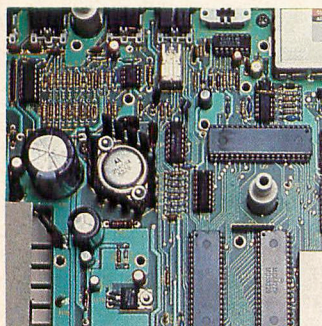
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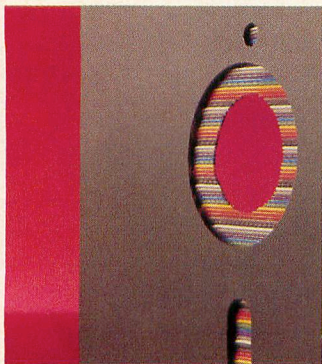
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- 18/Topo, Armatron, Poorbot, and "Mim"** by Tom Juergens (General)
Color Computers talking to robots? Why not!
- 23/Color Computing for Kids** by Jean Plesser (Education)
Low-res graphics and holiday fun.
- 32/Dissecting Your ROM** by Jake Commander (Tutorial)
Explore number crunching with the Commander.
- 46/Article Index**
Index to all The Color Computer Magazine articles.
- 50/Display Modes** by Steve Bjork with Mark Randall (Graphics)
Double the number of your hi-res colors.
- 63/Dreidel** by Harold Schneider (Game)
Computerize this top game for your kids, and for you.
- 72/DEFENSE!** by Shawn Diehl and Jim McDowell (Game)
Protect your cities and fortress from missiles and aliens.
- 82/Custom Color** by Dennis Kitsz (Sound)
More music programming from the maestro.
- 100/Unforgettable Characters** by William Barden, Jr. (Graphics)
Big Bill and Engineer John conclude their graphic argument.
- 112/Graphics? Yes! Part III** by Scott Bain and Andrea Chartier (Graphics)
Turn your computer into a drawing board.
- 119/Disk-X Utility** by Bruce K. Bell, O.D. (Utility)
Manipulate your disk data.
- 123/Summer Programming Project Up-date** (General)
Here's what's going on in the programming contest.
- 124/Country Cousin** by John C. Grier (General)
Geographically isolated? Here's how to contact the outside computing world.

DEPARTMENTS

4/PEEK (12,83)

12/INKEY\$

30/DEFUSR

44/GOTO SCHOOL

126/REVIEW\$

Bar Zapper, The Switcher, Color Math, Shaft, and more.

139/NEW:PRODUCT\$

144/FOR...NEXT

144/END OF FILE

Cover

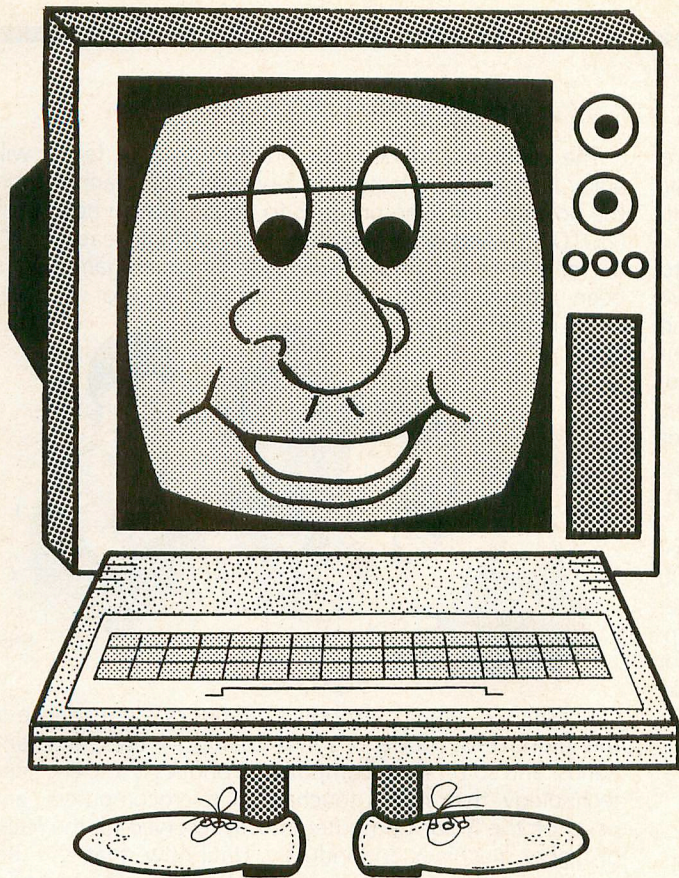
Santa's Data by Peter Hall

ABC membership applied for.

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QUESTION

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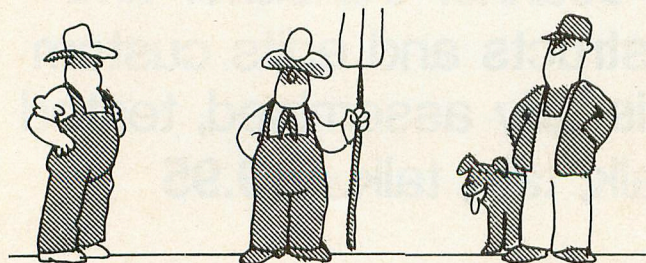
December is a cold and dark month, but we have warm feelings for it, and lots of games and music and graphics to brighten your holidays and help you while away the last short, cold days of the year. Here on the Maine coast things begin to look very different than they did a few short months ago; we look out our office windows at the overcast grey skies and shiver, then huddle up a little closer to our computers, comforting hum of printers clacking away in the background. During the warm weather of earlier seasons we sometimes wondered what foolishness provoked us to tie ourselves down to an indoors machine, but in the cold grey winter we can think of no better place to be — and with a Color Computer to add some sparkle to the dullness, at that!

We expect you will feel much the same when you see what's packed into this month's issue. To begin, GOTO 100 to discover whether Bill Barden won his bet with Engineer John, and spent last August at a California Computer Camp. As you remember, Engineer John dared Bill to bring his Color Computer graphically up to snuff with John's latest digital toy...



Then GOTO 32 to discover what Jake Commander (home from England for the holidays) has discovered in the fifth section of Color Computer ROM. Nine more sections to explore!

GOTO 124 to discover how to keep on top of the technological field when you're the only one in your circle (of farmers, farmers' spouses, and farmer's children) who recognizes the word "field" to mean something other than a large area planted in corn. It can be tough — but there are ways to tap into the latest information.



The children and new computerists in your family will enjoy Jean Plesser's lesson on low resolution graphics, and the holiday treats she provides to go along with her lesson (GOTO 22). And while you're enjoying holiday treats, GOTO 63 for a holiday game. Dreidel is a Hanukkah game that's been updated for the computer, but loses none of its charm or fun in the change.

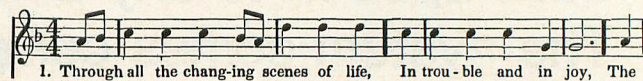


Robotics — what's a robotics? Robotics is the science of the interface of robots or robot "parts" — eyes, arms and hands, and so on — to computers. Robotics is a science and technology that rarely touches on microcomputers, and never on the Color Computer, mostly reserved for the realm of higher machines and industry. Until now, that is — because several entrepreneurs are taking robots meant for something else, and hooking them up to the Color Computer. GOTO 18 for a look into a new world.

Then GOTO 50 and GOTO 112 for the far ends of one world: Steve Bjork presents a demonstration of display modes to let you advanced graphics programmers see some of the possibilities that lie within your grasp; while Scott Bain and Andrea Chartier present Part III of Graphics? Yes!, a teaching series on beginning graphics programming.

The summer was long, and many of you wrote games for our Summer Programming Project. So many of you, in fact, that we haven't had time to play them all before this issue went to press. For the latest update, GOTO 123.

Oh, what is that angelic music I hear? Why — can it be coming from my Color Computer? Indeed it is; hmm, perhaps I should take it into the shop for a check-up. Or — maybe it's haunted by a Ghost of Future Computer. Or — oh no! Maybe it's not a microcomputer at all, and I'll have to learn some strange new language to make it work!



Wait! Relax and GOTO 82 — it's just Dennis Kitsz's Quaver program. You won't believe it 'til you hear it, so enough chat.

Quick! GOTO 72 — The Aliens are attacking and only you can save the city from certain destruction! Quick! Quick!

Now that emergency is over, GOTO 44 for an educator's wish list, and GOTO 30 for answers to your microcomputing questions. Finally, settle back and peruse the reviews and new products, and plan your post-holiday toy-buying sessions!

Something to add to your article collection; GOTO 46 for a complete index of **The Color Computer Magazine's** 1983 articles.

Best of cheer!

— D.M., Managing Editor

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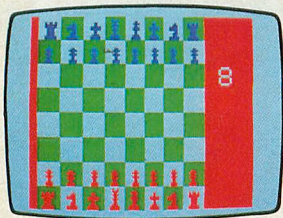
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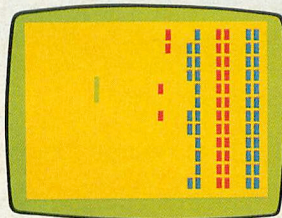


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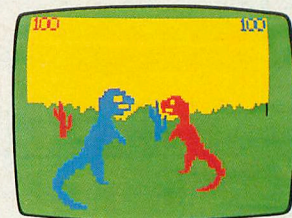


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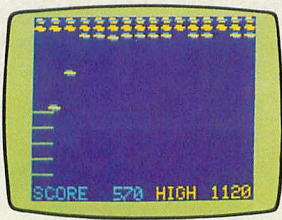


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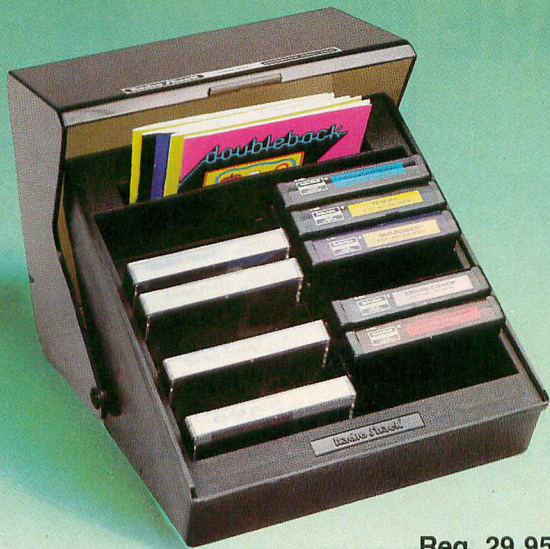
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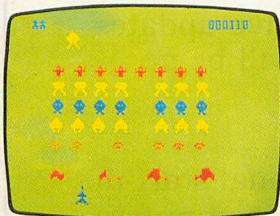


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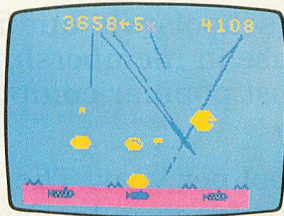
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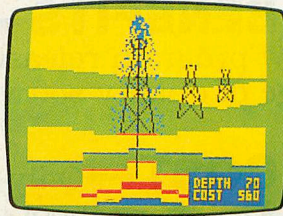
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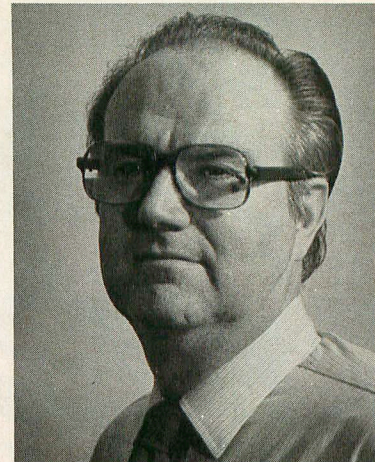
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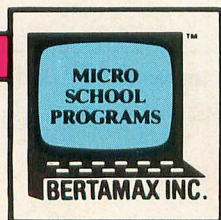
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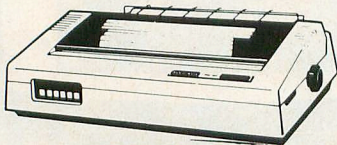
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The Color Computer Magazine
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Camden, ME 04843

Users Blues

Could you list out all the Color Computer clubs and bulletin boards for Orange County in your magazine? We have been plagued by the dreadful Color Computer boredom blues and would appreciate this help greatly. I'm sure there are many others in Orange County who have been exposed to the same virus.

I think your magazine is great. But you should have more games, particularly strategic games like CC Space Trek.. Tips and hints and projects for improving the Color Computer and programs to help children learn are fine, but there's not much for us teenagers.

Greg Caya
Santa Ana, CA

need help and when I get it, I promise to pass it on to all who write.

W.Reynolds
147 S. Brentwood Gen.
Mt. Laurel, NJ 08054

ET Club

Please announce the opening of the E.T. (East Texas) Color Computer Club. We're small now but plan on expanding to Marshall and Jefferson. Our software libraries are being stacked with the best programs available. For more information, please write the club in care of Glen Carlton Ford, Rt. 2, Box 527, Gilmes, TX 75644.

Memory Error

I am finally learning some of the "tricks of the trade" in machine-language programming and have found Jake Commander's April 1983 Memory Map very useful, but discovered an error that could make or break any programmer's efforts toward disabling any of Basic's key words. In the listing of the map, memory locations 288 and 289 (\$H120 and &H121) are described as containing the pointer to Basic's vocabulary table. This is not true. Actually, memory locations 289 and 290 (&H121 and &H122) contain the pointer.

Dan Burnett
Va. Beach, VA

Right you are. Thanks for pointing out the typo.

— Eds.

We publish news of user groups as the groups themselves pass information to us, so your best bet is to go over old issues of The Color Computer Magazine and keep an eye peeled in this section for news of new ones. In the meantime, try contacting the Southern California Amateur Radio/Computer Club at 962 Cheyenne in Costa Mesa, 92626, at (714) 549-8516.

— Eds.

Exatron Compatibility

I would like to hear from all Exatron owners. I am trying to come up with a way to make it compatible with Radio Shack. I would appreciate any help I can get. I did get Exatron to give me a commented listing of the Color Computer DOS. I

Ramblings

I was surprised to read that few have been able to run the "Reformat Your Video" program from the listing in the April 1983 **The Color Computer Magazine**, as the listing came from a FLEX assembler. I do have the EDTASM+ cartridge, but didn't try using it as the assembly language just looked like a lot of extra typing for stuff which I must admit I don't yet really understand. So I simply typed in the object code from the left columns, using a little Basic program which showed me the next address, and poked in decimal values of the hex numbers I entered. It ran the first time, too! I use it all the time now and like it a lot.

A program like this should become common among Color Computer owners so that Color Computer software might be written to optionally format their output to the larger screen. It is a shame the screen display module of Telewriter cannot be run independently. If it could, this capability would already be widespread among Color Computers.

Here is a mini-tip: When typing programs, I tend to hit shift-0 a lot when going for the right parenthesis. So a little POKE I like to use is 282,1 (or 282 and anything but 0 and 255). This keeps the keyboard caps locked when I am typing programs.

I made a little patch to my Telewriter so the editor comes up in lowercase mode but returns to uppercase lock in the disk menu. As I only know Basic, I wasn't able to do the same for the tape menu, which is called from machine code. Here it is:

"U": Change Line 2 to read
SW = 1 : POKE 282, 0.

"S/BIN": Alter 610 by inserting
POKE 282, 255 before rest of
line.

Change 640 to read: A =
PEEK(1): IF A = 0 THEN POKE 282,
0: RETURN

Change 655 to read: POKE 282,
0: RETURN.

"S/ASC" may be similarly modified.

About Disk Vitamin E: I cut C85 on my D-board (upgraded to E by Radio Shack) to try running in its unique .89/1.8 MHz

mode with the disk attached, and it works OK on my machine. It hasn't blown up during experimental use but I have read someplace that SAM chip overheating and component failure can result, and I wonder about this. Radio Shack declines to "support" the higher clock rate, so an aura of mystery surrounds the whole business. I would imagine the C-85 cut could also increase your Color Computer's RF emissions. It seems that a lot of people regularly run with "Vitamin E" on games, as I see magazine listings incorporating this. What can you tell me about this?

Of course, one must return to normal speed to use tape or disk. Now, what I would like to try is to patch Telewriter so it POKES the computer up in speed on entry to the editor for faster wraps and adjusts, and back to normal on entry to the main menu for saves. But I don't know nearly enough to do this on my own. Could anyone shed some light on this for me? Also, how can I change the format menu default values?

Jeffrey Kopp
Seattle, WA

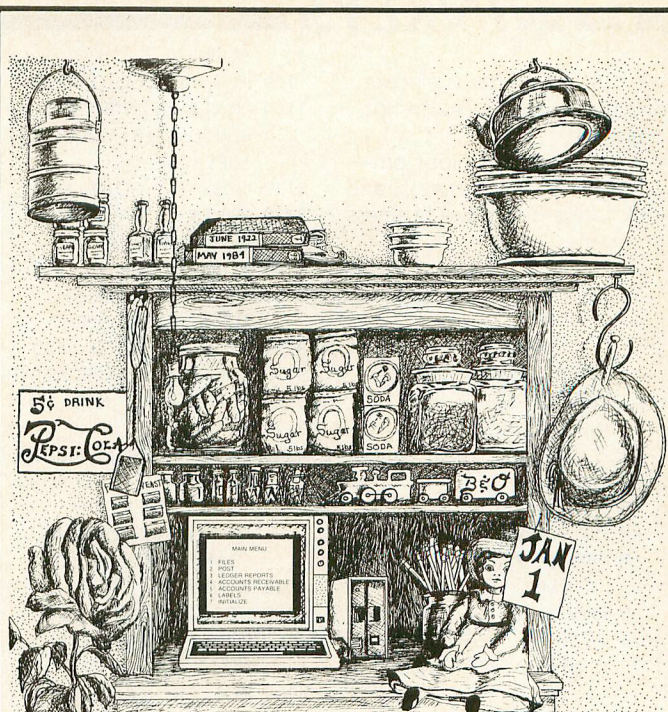
Thanks for the tips. Perhaps other readers know a short uppercase or high speed patch for Telewriter's menus? As for the high speed permitting mod, some people may find that two more capacitors in the disk cartridge need to be cut. As a TTL device, the SAM chips lines are only rated to drive 27pf; C85 is 220pf bypassing the cartridge select line for RF suppression. This is what causes the SAM to overheat on the high speed POKE. If the disk cartridge still seems to prevent high speed operation, look for bypass caps on the SAM's active lines inside the cartridge.

— Eds.

Amortization Print-outs

In the August issue, Mel Seder's amortization program can support a printer with the following additions. I made these additions for a DMP 200. It even has a personal touch on lines

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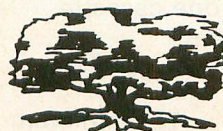
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48, 50. The printer is elective, and the dollar figures do not round off.

I am using my Color Computer for a small business, and look forward to more business programs.

William Wood
Jessup, MD

```
43 PRINT"DO YOU WANT A
PRINTED COPY? Y/N":
INPUT Q$
44 IF Q$="N" GOTO 1000
45 PRINT#-2,"
46 PRINT#-2
48 INPUT"NAME";NM$
50 PRINT#-2,"FOR ..... "
";NM$
60 PRINT#-2
1024 IFQ$="N" GOTO 1030
1025 PRINT#-2,"PRINCIPAL..."
";P
1049 IFQ$="N" GOTO 1060
1050 PRINT#-2,"NOMINAL
INTEREST RATE..."
";NR$;"%"
1069 IFQ$="N" GOTO 1080
1070 PRINT#-2, "YEARS..."
";YR$
1089 IFQ$="N" GOTO 1100
1090 PRINT#-2,"PAYMENTS PER
```

```
YEAR..." "; PY$
1109 IFQ$="N" GOTO 1120
1110 PRINT#-2,"INTEREST
PERIODS PER YEAR..."
";IP$
3129 IFQ$="N" GOTO 3140
3130 PRINT#-2,"PAYMENT
EVERY MONTH..."R"
3149 IFQ$="N" GOTO 3160
3150 PRINT#-2,"INTEREST
TOTAL..." "$";N*R-P
3169 IFQ$="N" GOTO 3180
3170 PRINT#-2, "APPROXIMATE
TOTAL..." "$";N*R
3175 PRINT#-2
4045 IFQ$="Y" GOTO 4080
4089 IF Q$="N" GOTO 4100
4090 IF X=1 THEN CLS
:PRINT#-2, "ORIGINAL
LOAN $";BAL:LC=LC+1
4095 PRINT#-2
4189 IFQ$="N" GOTO 4200
4190 PRINT#-2,"PAYMENT
NO..." ";X
4209 IFQ$="N" GOTO 4220
4210 PRINT#-2,"PAYMENT"
" "$";PMT;
4229 IFQ$="N" GOTO 4240
4230 PRINT#-2, " INTEREST"
";IN;
4249 IFQ$="N" GOTO 4260
4250 PRINT#-2, " PRINCIPAL"
"$";PR;
4269 IFQ$="N" GOTO 4280
```

```
4270 PRINT#-2," BALANCE" "
$";BAL
4290 PRINT
4350 PRINT#-2
4354 IFQ$="N" GOTO 4360
4355 PRINT#-2,"TOTAL
PAYMENTS ARE" " "$";TP
```

you send in, it will be published in the next issue with your name.

Matthew Kurzawa
8 Paprota Court
Parlin, N.J. 08859

Help!

Is there a computer magazine writer alive that wasn't born with stack pointers where he should have had hair?

I have read almost every computer magazine there is and find them all to have the same flaw. Most writers either assume you are well versed in computerology or else write stuff like "now hold the plug between your thumb and finger and push it into the little holes in the wall."

There are a great many of us out here who are quite intelligent but also quite ignorant of the most basic basics of computers. Have you ever stopped to think how you learned about machine language? I guarantee you had to get something not commonly available into your head before you could

TRS-80 Newsletter

I read every issue of your magazine and I must say that I enjoy it and find it helpful in my programming. I have a TRS-80 computer and a few friends and myself have started a newsletter for that computer. It has had little success. We feel it is a very well written and informative newsletter and that your readers with TRS-80s might be very interested in reading it.

If you wish to receive it please send a self addressed stamped envelope and we will rush you a newsletter (allow two months to send). We would be very pleased if you would send us your programs, comments and ideas to help keep the newsletter going. If we like what

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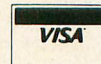
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make any sense out of something like Jake Commander's "explanation" of ROM. A reader doesn't even get a hint as to what the columns of numbers and letters represent. Believe it or not I once thought the comments column was computer output. And I'm not much beyond that now despite my constant search of computer mags of all descriptions.

Come on. Give us a break. Fill the gap between neophyte and advanced beginner.

Jim LaLone
Ooltewah, TN

The columns of the disassembly are now labeled. We will be starting an assembly language series for intermediates in early '84.

— Eds.

Piracy Skepticism

In response to your August editorial on software piracy, I am sure the facts about the behavior of some user groups are substantially as presented, but I

would first question whether the overall loss of potential earnings is as big as the software houses claim. Who has done a market survey to establish what the profit expectation could be in a no piracy environment?

It shouldn't be too hard to find out how many TRS-80 computers have been sold, how many users belong to clubs, how many users potentially would be interested in a specific piece of software. I will believe the serious nature of the problem when some independent survey produces facts to support the claim.

As a TRS-80 Color Computer user I would like to put forward a user view. I feel that I am paying far too much money for both hardware and software! I feel that manufacturers are hiding behind a smokescreen of research and development costs to make extraordinary profits. Naturally, software producers have jumped on the bandwagon and their prices have followed suit. It is just as easy for anyone to copy a phonograph record, or a book,

but I hear no anguished screams from the recording or publishing business. Why? - Well, the price of a record, or a book, is reasonable enough that it is not worth the effort to copy them. If software was in the \$10 - \$12 range, I doubt if piracy would ever be heard of.

Tell me someone isn't getting fat when the going rate for a good game is \$25!! For the love of Mike — I can buy half an hour of the best 100-man symphony orchestra in the world for \$10!

Yes, piracy is reprehensible but remember — Captain Morgan only took up the business because of the gold to be taken. He surely didn't pirate any cattle boats!

R. Hunter
Kitimat, B.C.

We can argue "reasonable" prices 'til the cows come home but will get nowhere without full financial disclosure statements from manufacturers, statements we might be able to get but doubt are forthcoming any time soon. Regarding piracy in general, either people

in your area are different from people elsewhere, or you've been too busy to notice: movie moguls, recording and television executives, and publishers alike have been screaming about profits lost to piracy for years (ask anyone at Sony). The United States has rewritten its copyright law, but many issues have yet to be decided. Meanwhile more and more folks are looking for a cheaper, if not free, entertainment and information ride, ethics be hanged. Morgan would be right at home.

— Eds.

Stuck

I have been looking for help in the 3-D arcade adventure "Beyond The Cimeeon Moon" which I love. I have gotten up to the yellow disc, and also have gotten the rifle and shield belt. If you can help me out, please write me at:

Richard Gregory
15 Forrest Blend Drive,
Titusville, NJ

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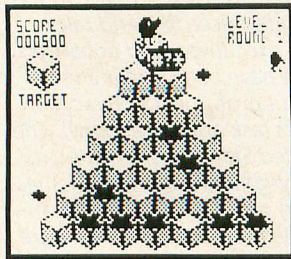
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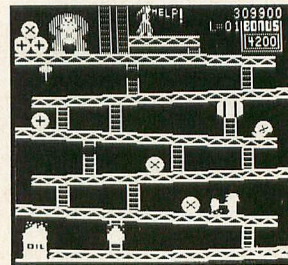
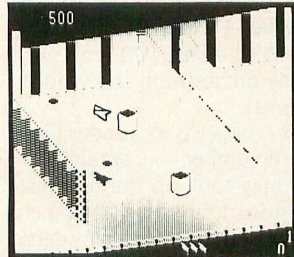


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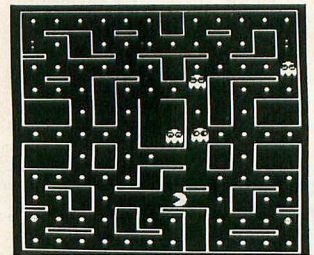


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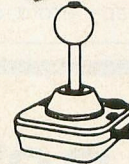
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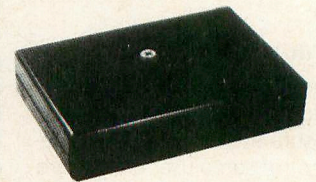
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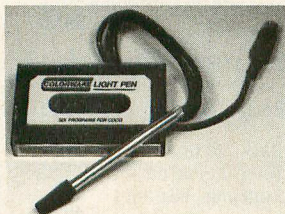
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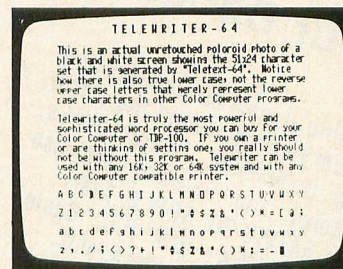


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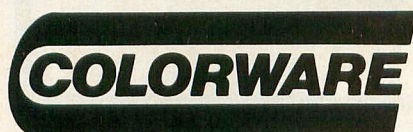
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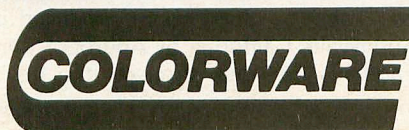
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Topo, Armatron, Poorbot, and the Magnificent Interface Machine

*Robotics moves closer to
Color Computerists.*

by Tom Juergens

COLOR COMPUTERISTS ARE about to get opportunities to connect their thinking machines to robots at more reasonable prices than they might imagine. The people opening the door to robotics for Color Computerists are already thinking of applications beyond simple grab and fetch commands. When it comes to complementing the Color Computer's brain, they say, robots must offer more than just brawn.

Tim McFadden, by day a service manager with Campbell Business Systems in Youngstown, Ohio, got interested in robotics when he saw a magazine contest that asked the simple but open-ended question, "What would you do with a robot?"

"I couldn't think of a thing at first, but after a while I reversed to thinking, 'what can't you do?' I want to use the Color Computer and dream up new applications," he said.

McFadden and Akron University student Doug Kelley got to work on an interface that will join the Color Computer to "Topo," a \$500 robot produced in Sunnyvale, California by Androbot. McFadden's interface connects the Color



Photo by Dr. Paul Kimmelman

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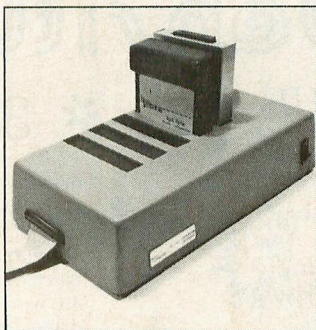
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Computer's RS-232 port and the 33-pound Topo, a unit that travels at two feet per second and can receive radio commands at ranges up to 100 feet. Topo was designed to work mainly with Apple IIs; a salesman at the Computer Showcase in Niles, Ohio noted that when Topos aren't bought by private Apple II owners they're bought by educators and exhibitors.

Dr. Paul Kimmelman, assistant superintendent of the nearby Norton school district, said Topo is used there and in districts around the country as an incentive for students to learn programming. Students immediately are encouraged when they see Topo follow the course they've outlined in Logo, he said. Potential applications in Topo's near future, in Kimmelman's view, include putting it to work for handicapped persons as a seeing-eye robot, as a driver of wheelchairs, or as a companion to just about anyone.

Interfacing the Color Computer and different robot hardware is an idea Joe Reeder of Odessa, Texas has built into a new company called the Grown-up's Toy Company, or "Groto" for short. When Reeder considers the open-ended question that so intrigues McFadden and others, robot voice recognition and the use of tactile and visual capabilities get him excited. One "socially significant" application he suggests is using the Color Computer and his Magnificent Interface Machine ("Mim") to teach deaf but literate persons how to speak more clearly.

Reeder heads up JR Systems, an outfit specializing in computer programs for oil field operations. Recently he went "looking for diversification" and started work on Mim. Mim is an interface for the Color Computer that lends itself to a potentially infinite variety of applications, robotics included. One of its building blocks is "Poorbot," the poor man's robot kit. The basis of Poorbot is the Armatron unit sold by Radio Shack.

The moniker of Reeder's company, "Groto," is a distillate of the fact that so many big kids take the mechanical, moveable Armatron from little kids to play with themselves. Groto has souped-up the Armatron unit by making possible the replacement of its stock gear box with eight independent motors and circuitry that "lets Armatron interface with the world," Reeder explained. While Poorbot stands alone as a product, it is also an integral part of Mim. And if robotics is the place for innovation and diversification, Mim sounds like a candidate as the central nervous system in many a marriage of brain and brawn. Mim's features include four joystick ports with two channels each, timers for Poorbot's mo-

tors, a socket for a disk pak, a serial I/O port so it can communicate with other machines, two digital-to-analog converters, and 7168 bytes of RAM.

The full-blown robotics system Reeder envisions assumes consumers already own a Color Computer and an MC-10. The MC-10 (with its simpler, single key-stroke command mode) mounts on a mobile robot platform and will translate complex instructions from the Color Computer into Basic radio frequency tones via walkie talkie, tones that can be understood by Poorbot. Mim will plug into the Color Computer's ROM socket and be "invisible" to the disk system. "The computer has no idea Mim exists," Reeder said. The cost, minus the Color Computer and MC-10, will be "well under a hundred dollars," he added. In that price range, Mim can help "us little guys make the breakthroughs" in robotics, Reeder believes.

"A lot of little guys can do more than a few doctorates," he said. "All things are possible."

"The big unanswered question" in McFadden's mind is "what is the impact robots will have on our lives?", particularly on our job-hunting and work habits. Beyond Topo's use as an educational tool McFadden mentioned security applications. Using Topo to patrol a route and call an emergency number if it sees or hears any sound or motion is one. And eventually "you could program the thing for self-defense if you really wanted to." There are sticky, unresolved legal issues surrounding the use of robots as agents of force, however.

Androbot spokesperson Elaine Haggan said in September that her firm had planned to put a Topo with an arm on the market in November. Another robot, "Bob" (for "brains on board") is being readied for the 1984 market. Androbot, she said, will market a Color Computer interface for its robots "if there's a call for it." If Androbot comes out with such an interface, McFadden will drop the idea of marketing his interface — an idea that isn't exactly upper-most in his mind anyway, he said.

And where is Radio Shack headed in the whole robotics field?

One rumor had it that Radio Shack and Androbot were considering some kind of joint venture, but Radio Shack public relations man Sid Bates, quoting Barry Thompson, the product line manager for the Color Computer, said as of September 12 his firm is pursuing no arrangement with Androbot.

However, "if we were to (pursue anything) we wouldn't want to divulge" what that would be in the research and development stage, he added. ■ ■ ■

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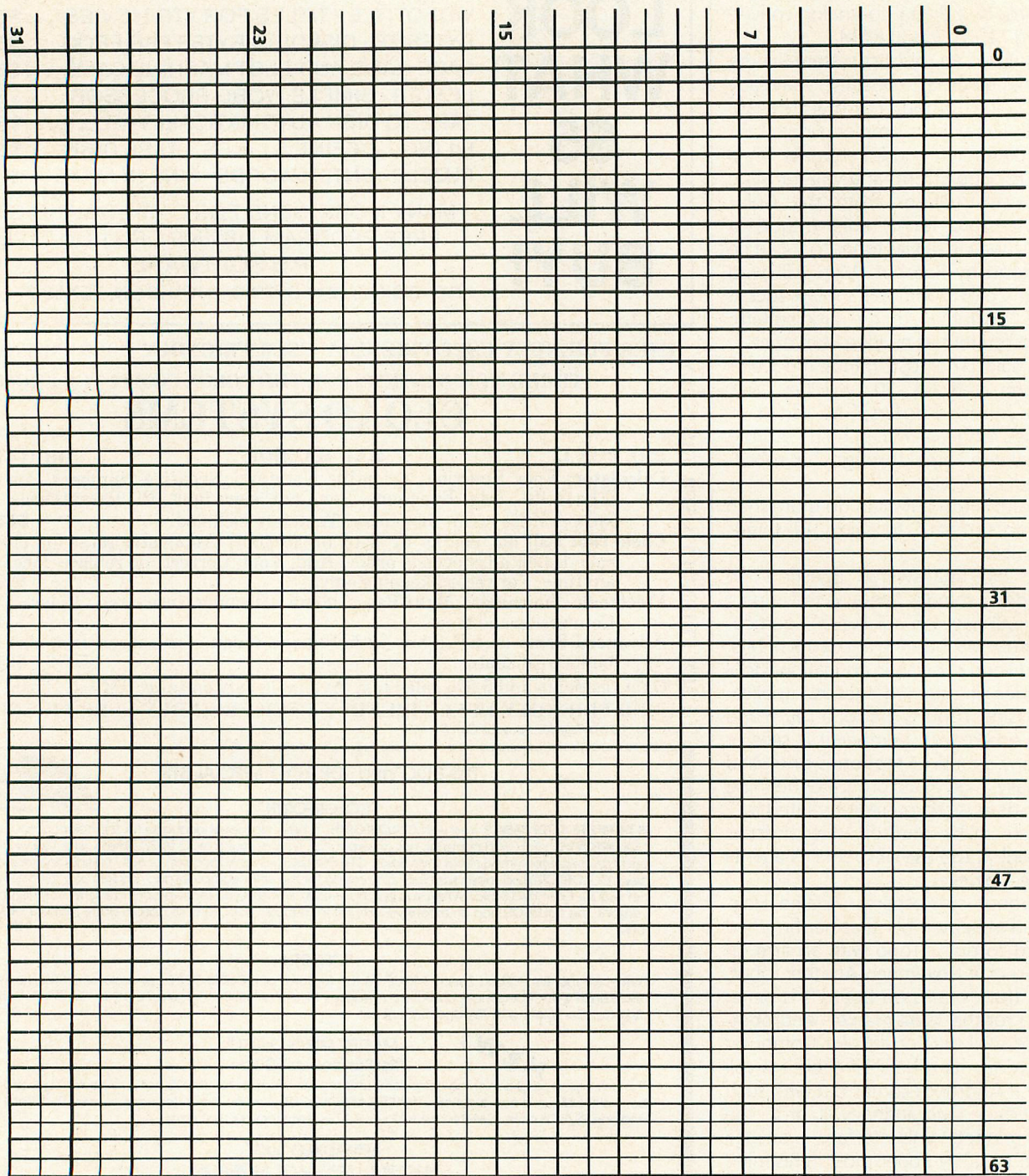


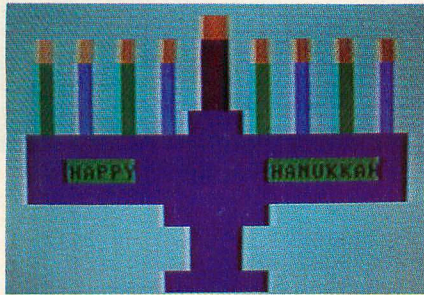
Figure 1. The Set/Reset worksheet.

Color Computing for Kids



4K Color Basic

Here's a lesson on low-resolution graphics, and two holiday programs!



Setting Points on Black

Turn on your computer and we'll start using the SET command. Type:

```
10 CLS(0)
20 SET(31,2,3)
90 GOTO 90
```

Line 10 clears the screen with black.

Line 20 sets a blue dot at horizontal position 31 and vertical position 2 (that's at the top center of your screen).

Line 90 keeps the computer at Line 90, reading it over and over again. This keeps the program from ending so a green line doesn't appear on the screen. You must press the BREAK key when you want to end a program with a loop (like this) that has no stop.

Type RUN. See the blue dot (Photo 1). Now look at the worksheet to find its exact location. Find the horizontal number 31 at the top of the sheet, then bring your finger down to the vertical row 2.

When you've looked at the blue dot long enough, press the BREAK key, then press the CLEAR key and type LIST. Now type this line:

```
30 SET(33,4,1)
```

After you press the ENTER key, type LIST again to see that the line was added to your program. Type RUN and once again look at the worksheet to find this new position.

Because the screen color is black we were able to set one rectangle within a block. We can also set two, three, or all four of the rectangles within each block, but only one color can be used in each block. Try this by setting other points on the screen using different colors in the SET command. You can change Lines 20 and 30 and add new lines to the program, but follow the worksheet for exact locations of the rectangles and blocks.

♦ more

by Jean Plesser

The SET Command

The graphics command that you use to draw on the screen is: SET(H,V,C). **SET** tells the computer to set, or color a rectangle on the screen. **H** will always be a number that tells the computer at what horizontal position to place the colored rectangle, which we'll also call a point because that's how it looks on the screen. Horizontal numbers go across the screen and the positions are numbered from 0 to 63. These numbers divide the screen into columns. **V** will always be a number from 0 to 31, telling the computer the vertical position of the point. The vertical numbers run up and down the screen and divide the screen into rows. **C** is a number from 0 to 8, and it represents the color you want the point to be. The number for each color is:

- 0—Black
- 1—Green
- 2—Yellow
- 3—Blue
- 4—Red
- 5—Buff
- 6—Cyan
- 7—Magenta
- 8—Orange

DECEMBER IS A HAPPY and festive month. The holidays bring celebrations, special decorations, surprises, and fun. In keeping with all this excitement, we're going to explore low resolution graphics — the first step in the graphics offered by Color Basic.

The Graphics Screen

Before we start work on the computer, it's important to learn how graphics are drawn on the screen. Look at the diagram of the "Set/Reset Worksheet" found on page 278 of *Getting Started With Color Basic*, and here in Figure 1. Follow it as I explain the graphics screen.

The low-resolution graphics screen is made up of *blocks* that each contain four *rectangles*. While there are 64 horizontal rectangles and 32 vertical rectangles, there are only 32 horizontal blocks and 16 vertical blocks. Check the worksheet for a clear picture of how this looks.

The computer draws graphics by coloring the rectangles. If the screen color is black the rectangles can be colored one at a time, but when drawing over any other color, the computer can draw only by using blocks of rectangles. Let's put this into action so you can see how it works.

Setting Points On Colored Backgrounds

If we change Line 10 in our original program we can use it to set the same points on a red screen. Re-type or change your program to look like this example:

```
10 CLS(4)
20 SET(31,2,3)
90 GOTO 90
```

Type LIST to be sure your program is exactly like the example. If you have extra lines, delete them by typing the line number and pressing ENTER for each unwanted line. Type RUN when your program is correct.

The blue dot is now larger than it was on the black screen (Photo 2). Look at the worksheet to see that the color blue filled in an entire block, not just one rectangle: the horizontal positions 30 and 31, with the vertical positions 2 and 3. Whenever you set a position on a colored screen, the entire block the rectangle appears in will be filled in by that color.

Try different screen colors, SET positions, and dot colors until you're sure which block of rectangles will be set for each command you use. As you see, the graphics worksheet is a valuable tool for planning graphics. Get copies of it, or use tracing paper over Figure 1 when you're planning your own graphics.

SET...RESET

You now know that the SET command sets a dot on the screen in a color you specify. What do you think the RESET command will do? To find out type NEW, then enter this program:

```
10 CLS(0)
20 SET(25,11,2)
30 RESET(25,11)
40 GOTO 20
```

When you run this program you'll see that RESET erases the dot that was set in the same position specified by SET. It does this by setting the dot to black, which is the color of the background; therefore, a color is never used in the RESET command because black is always used. The blinking effect is created by the GOTO statement in Line 40 which sends the computer back to Line 20 over and over again — SET...RESET...SET...RESET... — until you press the BREAK key.

The screen color, or background color, must be black to create a true SET/RESET routine, but try the program with different screen colors to see what will happen. Re-type Line 10: 10CLS(8) and type RUN.

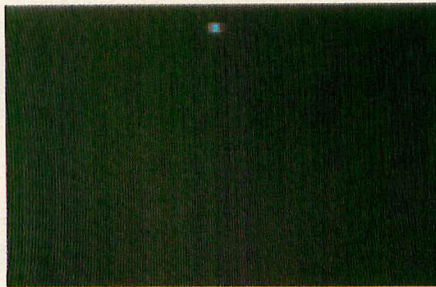


Photo 1. This is how the first program looks.

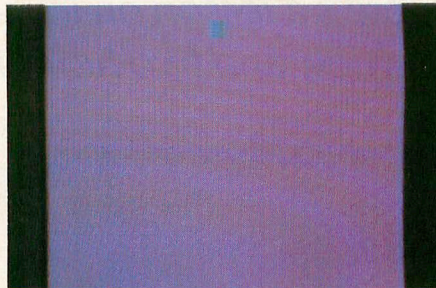


Photo 2. The first program with Line 10 changed to CLS(4).

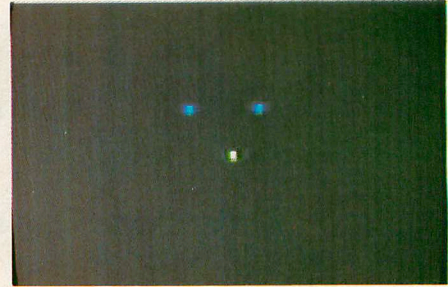


Photo 3. The beginning of a face.



Photo 4. Most of the face.

As you can see, when the background color is a color other than black, the dot doesn't disappear; instead you get a blinking black dot at the position you reset. This can also be useful in graphics; I used it in the "Christmas Tree" program at the end of this lesson to create blinking lights on the ornaments. In the "Hanukkah Menorah" program, however, I SET one color, then another at the same position to create a flickering effect for the candle lights. As you practice with these commands you'll soon get ideas of your own, so don't be afraid to experiment.

Before we go on to the next part of this lesson; type NEW, press the CLEAR key and Enter this program:

```
10 CLS(0)
20 SET(25,11,3)
30 SET(38,11,3)
40 FOR D=1 TO 50:NEXT D
50 RESET(25,11)
60 RESET(38,11)
70 SET(31,16,1)
80 SET(32,16,1)
90 GOTO 20
```

Line 40 creates a FOR/NEXT delay in the program. The computer counts to 50, and this counting process slows down the blinking action. You can replace the number 50 with any number you wish, to make the blinking faster or slower.

When you RUN this program you'll see that two dots are blinking on vertical row 11 and two rectangles are set on row 16 (Photo 3). This is the beginning of a face. We're going to add lines as we continue through the lesson.

Dot's Great... But What About Lines ?

The SET command is also used to draw lines; imagine having to type a SET statement for each point on a line! Your program would be very, very long and your fingers would get very, very tired. This is where you'll really learn to appreciate the FOR/NEXT loop we covered in last month's lesson. If you missed it or need a reminder, we'll review this very important programming step before we begin.

The FOR/NEXT loop is used to repeat a programming step a certain number of times. The FOR statement is the beginning of the loop, and it tells the computer how many times to repeat and what number values to use. A new value is assigned to the letter that follows the word FOR each time the computer goes through the loop.

One or more statements follow, telling the computer what you want done in the loop. These statements often use the value of the letter which changes the statement each time.

The NEXT statement changes the value of the letter and sends the computer back to the FOR statement until the

loop is complete. If a STEP command is used in the FOR statement, the computer will count by that number instead of counting by one. If you feel confused, relax! We'll use many FOR/NEXT loops throughout this lesson, and as you see them work you'll begin to understand them.

Add these lines to your program (Line 90 changes), but before you RUN it read the explanation of each line:

```
90 FOR H=28 TO 35
100 SET(H,21,4)
110 NEXT H
120 GOTO 20
```

Line 90 is the length of the horizontal line the computer will draw. It starts at position 28 and ends at position 35.

Line 100 sets a dot at the horizontal (H) value of the loop (at 28, then 29, then 30 and so on until 37) on vertical Line 21, using the color red.

Line 110 adds one to H and sends the computer back to Line 100 until the loop is complete.

Now type RUN to see what our loop accomplished. You should now have blinking eyes, a nose and a mouth. If you don't, LIST your program and correct the errors. Want a smile? Add this line:

```
120 SET(27,20,4):SET(36,20,4)
```

Add these lines to draw two horizontal lines at two different vertical positions:

```
130 FOR H=25 TO 38
140 SET(H,5,5)
150 SET(H,27,5)
160 NEXT H
170 GOTO 20
```

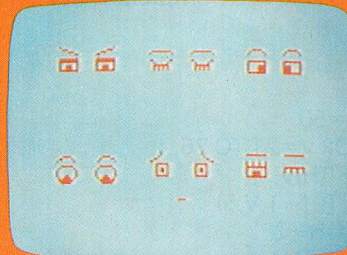
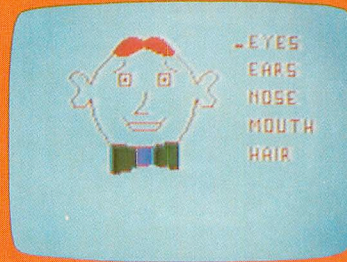
Are you wondering why we keep moving the GOTO 20 statement? It must always be our last statement or the computer will never get to the lines after it. RUN the program if you like, then add these lines to make vertical lines on the screen:

```
170 FOR V=12 TO 20
180 SET(12,V,5)
190 SET(51,V,5)
200 NEXT V
210 GOTO 20
```

Line 170 tells the computer to start V at 12 and end at 20. These values will be used for the vertical positions in the SET statements.

Lines 180 and 190 set a dot at the horizontal position 12, then at 51, in the value of V for the vertical positions, and in the color buff.

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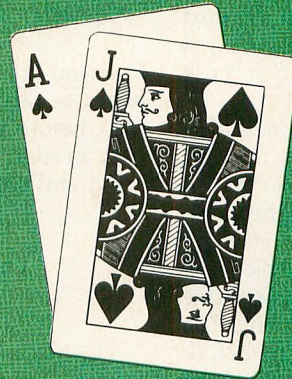
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S K I L L W A R E

When you RUN the program, notice that vertical lines are thinner than horizontal lines (Photo 4). That's because we're drawing with tall rectangles (blocks of rectangles appear the same) — check the worksheet to verify this.

Diagonal Lines? Well...Sort Of

Because low resolution graphics are drawn with fairly large-sized rectangles, true diagonal lines aren't really possible. What we get looks a bit like stairs, but the effect is interesting and serves the purpose.

To add a diagonal line to our program, type these lines:

```
210 H=39
220 FOR V=6 TO 11
230 SET(H,V,5)
240 SET(H+1,V,5)
250 H=H+2
260 NEXT V
270 GOTO 20
```

Line 210 makes H equal to 39. We will use H for the horizontal position in each SET statement.

Line 220 is for our vertical (V) positions from 6 to 11.

Line 230 sets a dot at the H value and V value, in the color buff.

Line 240 sets another dot at the next horizontal space (H+1), but the value of H doesn't change because we didn't use an equals sign (=).

Line 250 adds two to the value of H each time the computer goes through the loop. This moves our first horizontal position two spaces to the right when the loop repeats.

Line 260 adds one to V, which will move our vertical position down one space at the next SET statement. The computer then goes back to Line 220 or goes on to the next statement if the loop is complete.

When you run the program, notice how the computer sets two dots, then each time it passes through the loop it goes to the next vertical position and sets two more dots.

The next three FOR/NEXT loops will complete our program. They will draw the remaining diagonal lines that complete the face. These loops can be used as a guide whenever you want to draw diagonal lines in a program — you'll need only to add your own numbers for the length of your lines.

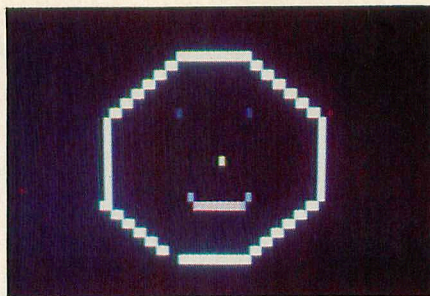


Photo 5. The Completed Face.

```
270 H=50
280 FOR V=21 TO 26
290 SET(H,V,5)
300 SET(H-1,V,5)
310 H=H-2
320 NEXT V
```

(Subtracting from H moves the diagonal line to the left — check this on the worksheet before you continue typing):

```
330 H=24
340 FOR V=6 TO 11
350 SET(H,V,5)
360 SET(H-1,V,5)
370 H=H-2
380 NEXT V
390 H=13
400 FOR V=21 TO 26
410 SET(H,V,5)
420 SET(H+1,V,5)
430 H=H+2
440 NEXT V
450 GOTO 20
```

If you like the program (Photo 5) and want to use it again, save it to tape or disk before you go on with the lesson. Ask an adult for help if you haven't saved programs before.

A Box? Why Not?

Use this program as an example for drawing boxes (Photo 6):

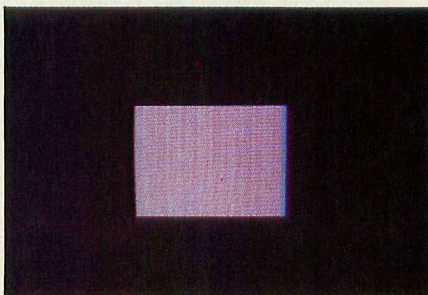


Photo 6. Boxes.

```
10 CLS(0)
20 FOR H=18 TO 45
30 FOR V=10 TO 21
40 SET(H,V,4)
50 NEXT V,H
60 GOTO 60
```

Line 10 clears the screen with black.

Line 20 determines the length of the horizontal line — the H value.

Line 30 determines the length of the vertical line — the V value.

Line 40 sets one red dot at the H and V positions each time the program loops.

Line 50 returns to Line 30 adding to and repeating the V loop until it is complete. Then it returns to Line 20, adding to the H value, then goes through the V loop again and again until the H loop is complete. This is a *nested loop* that draws a series of vertical lines until the box is finished.

Line 60 keeps the program from ending until you press the BREAK key.

When you draw boxes of your own, just change the position values and the colors.

Discover The Artist In You

Graphics are fun and rewarding, but practice is important, and so is planning out your projects on graphics worksheets before you start programming. Keep drawing lines, squares, and boxes until you're able to place everything exactly where you want it...

What? Did someone mention circles? Do you want to include circles in your masterpieces? I thought so, but like diagonal lines, true circles aren't really possible in low resolution graphics. Don't frown though, because I'm going to tell you how to come pretty close.

Use a graphics worksheet and color in lines of rectangles or blocks until your drawing is as close to the shape of a circle as the points will allow. Then write a program using a series of FOR/NEXT loops to draw each line. The middle line will be longest and each line will get shorter by a rectangle or block as it reaches the top and bottom. I think you'll like the results even if the edges aren't smooth, so give it a try.

I hope your holidays are happy and bright. My holiday greetings to you are in the following programs — there's one for Christmas and one for Hanukkah — each uses all the graphics routines you just learned.

Enjoy! I'll see you next month for an important lesson on variable names — a programmer's trusted keepers of the program's treasures!

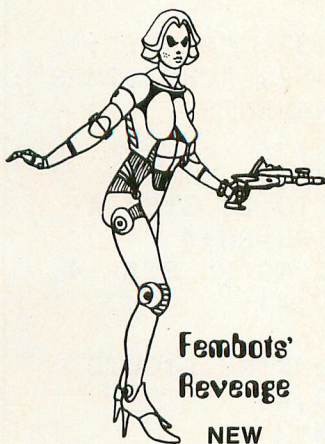


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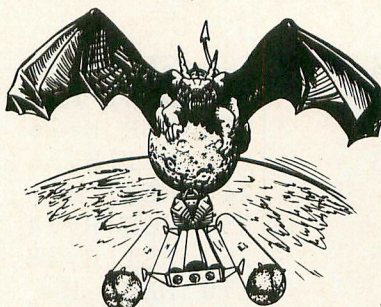
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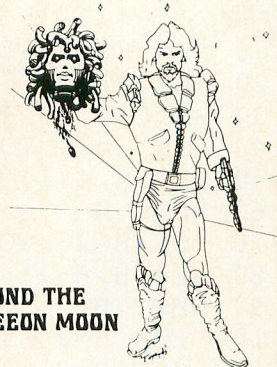
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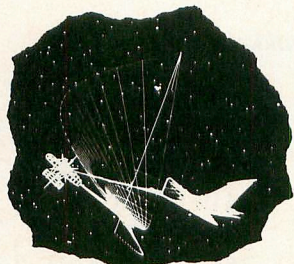


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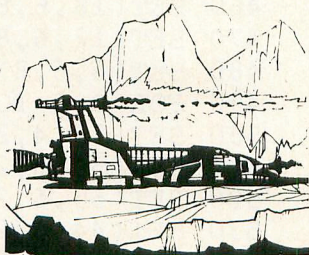
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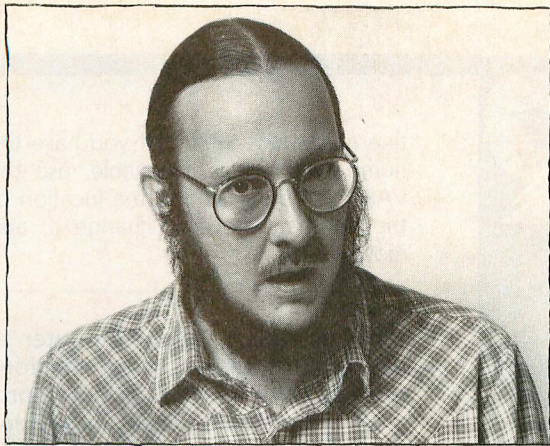


Program Listing. Christmas Program

```
10 REM--CHRISTMAS TREE | 200 SET(H,14,1) | 390 PRINT @ 37, "MERRY";
20 CLS(3) | 210 NEXT H | 400 PRINT @ 52, "CHRISTMAS";
30 SET(31,2,1) | 220 FOR H=16 TO 45 | 410 REM--ORNAMENTS
40 FOR H=28 TO 33 | 230 SET(H,16,1) | 420 SET(30,4,4)
50 SET(H,4,1) | 240 NEXT H | 430 LH=32:RH=28
60 NEXT H | 250 FOR H=14 TO 47 | 440 FOR V=8 TO 20 STEP 4
70 FOR H=26 TO 35 | 260 SET(H,18,1) | 450 LH=LH-4:RH=RH+4
80 SET(H,6,1) | 270 NEXT H | 460 FOR H=LH TO RH STEP 4
90 NEXT H | 280 FOR H=12 TO 49 | 470 SET (H,V,4)
100 FOR H=24 TO 37 | 290 SSET(H,20,1) | 480 NEXT H,V
110 SET(H,8,1) | 300 NEXT H | 490 REM--BLINKING LIGHTS
120 NEXT H | 310 FOR H=10 TO 51 | 500 RESET(30,4)
130 FOR H=22 TO 39 | 320 SET(H,22,1) | 510 LH=32:RH=28
140 SET(H,10,1) | 330 NEXT H | 520 FOR V=8 TO 20 STEP 4
150 NEXT H | 340 FOR H=30 TO 33 | 530 LH=LH-4:RH=RH+4
160 FOR H=20 TO 41 | 350 SET(H,24,5) | 540 FOR H=LH TO RH STEP 4
170 SET(H,12,1) | 360 SET(H,26,5) | 550 RESET (H,V)
180 NEXT H | 370 NEXT H | 560 NEXT H,V
190 FOR H=18 TO 43 | 380 REM--GREETING | 570 GOTO 420
```

Program Listing. Hanukkah Program

```
10 REM--HANUKKAH MENORAH | 310 SET(44,V,7)
20 CLS(5) | 320 SET(38,V,1)
30 FOR V=14 TO 18 | 330 SET(24,V,7)
40 FOR H=4 TO 58 | 340 SET(18,V,1)
50 SET(H,V,3) | 350 SET(12,V,7)
60 NEXT H,V | 360 SET(6,V,1)
70 FOR H=24 TO 38 | 370 NEXT V
80 SET(H,20,3) | 380 REM--LIGHTED CANDLES
90 NEXT H | 390 FOR L=1 TO 100
100 FOR H=28 TO 34 | 400 SET(30,4,8):SET(32,4,8)
110 SET(H,22,3) | 410 SET(56,6,8)
120 SET(H,24,3) | 420 SET(50,6,8)
130 NEXT H | 430 SET(44,6,8)
140 FOR H=24 TO 38 | 440 SET(38,6,8)
150 SET(H,26,3) | 450 SET(24,6,8)
160 NEXT H | 460 SET(18,6,8)
170 PRINT @ 261, " HAPPY "; | 470 SET(12,6,8)
180 PRINT @ 276, "HANUKKAH"; | 480 SET(6,6,8)
190 FOR H=28 TO 34 | 490 FOR D=1 TO 100:NEXT D
200 SET(H,12,3) | 500 SET(30,4,2):SET(32,4,2)
210 NEXT H | 510 SET(56,6,2)
220 REM--SHAMASH | 520 SET(50,6,2)
230 FOR V=6 TO 10 | 530 SET(44,6,2)
240 SET(30,V,4) | 540 SET(38,6,2)
250 SET(32,V,4) | 550 SET(24,6,2)
260 NEXT V | 560 SET(18,6,2)
270 REM--CANDLES FOR EACH NIGHT | 570 SET(12,6,2)
280 FOR V=8 TO 12 | 580 SET(6,6,2)
290 SET(56,V,7) | 590 FOR D=1 TO 100:NEXT D
300 SET(50,V,1) | 600 NEXT L
```



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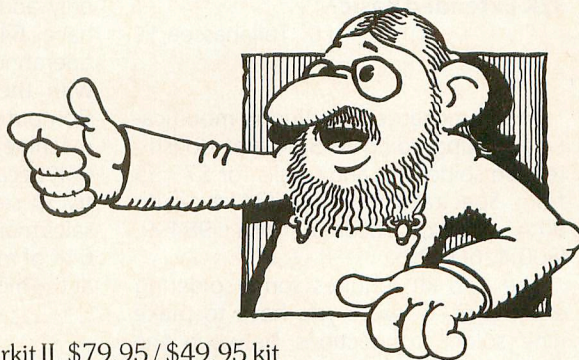
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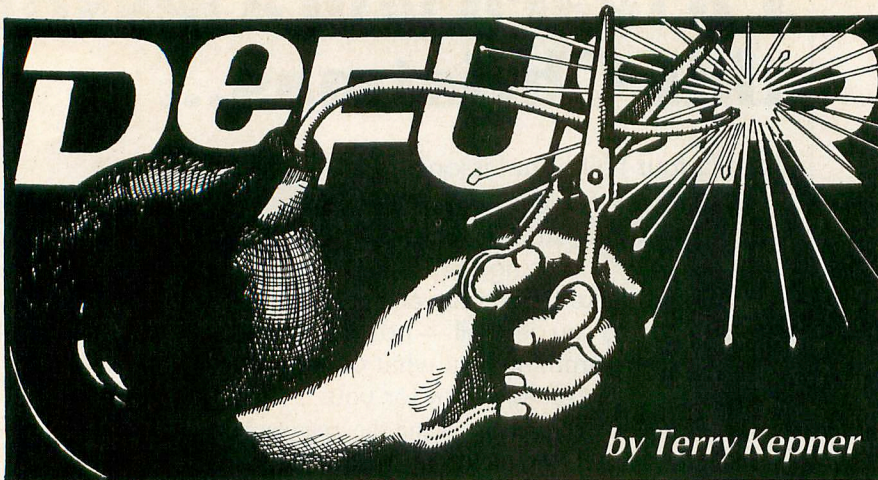
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by Terry Kepner

I have a Radio Shack 16K Extended Basic Color Computer (D-board) that I want to upgrade to 32K or possibly 64K bytes. Spectral Associates has a Ramcharger for going from 16K to 32K. Jarb has a kit to go from 16K to 32K with piggyback chips. Do they perform equally well? Is there a problem accessing memory with either? Jarb is cheaper. Also, is it possible to upgrade to 64K with the D-board? Will there be game programs available that will require more than 32K Extended Basic?

J.S., Tallahassee, FL

The Ramcharger is a plug-in modification for upgrading to 32K that doesn't require soldering, and retails for \$79.95 from Spectral Associates (3414 South 90th Street, Tacoma, WA 98409, (800)426-1830).

The Jarb kit requires some soldering experience, because you have to make nine solder connections between the eight chips, but none are made to the computer itself. The Jarb kit (1636 D Avenue, Suite C, National City, CA 92050, (619)474-6213) retails for \$25.95.

There's another kit available, from DSL Computer Products (P.O. Box 1113, Dearborn, MI 48121, (313)582-8930) that requires no soldering at all and retails for \$49.95.

All three kits are designed for computers with revision D or revision E boards, and all work equally well. If you have a revision F board, just buy the 64K chips, install them, and move the jumper blocks from the 16K designation to the 64K connection.

Yes, you can upgrade to 64K if you have a D board, but you have to remove the current memory chips and replace them with 64K chips and make several changes to the circuitry of the board; cut some traces and add some jumpers. If

you're going to upgrade to 64K in the near future, forget about the 32K upgrade, otherwise you'll just end up taking out the piggybacked chips and not using them. For information on how to upgrade the various 16K computers, including the D-board series, see Dennis Kitz's article in the September 1983 issue of **The Color Computer Magazine**.

You won't find many games that require more than 32K of memory and Extended Basic because Extended Basic can only address 32K at a time. You can't have 64K RAM and Extended Basic operating at the same time (at least not with the current version of the Color Computer). And you won't see many machine language programs that require 64K because no company would want to try to sell a program that restricts the sales market to only those machines with 64K of memory, a minority of computers at the moment.

Is there a machine language subroutine in Color Basic or Extended Basic that will convert a floating-point number, being held as a variable, into a 16-bit twos-complement number? The Extended Basic manual tells about a routine at address B3ED hexadecimal to convert a number in the floating-point accumulator, but this routine doesn't work on numbers being held as variables.

T.B., Biloxi, MS

Color Basic and Extended Basic move all numbers to the floating point accumulator before attempting any numeric operations with them. If you have a number you want converted to 16-bit twos-complement, just move the number from its current position to the floating-point accumulator and call the rou-

tine at address \$B3ED. If you have the number stored as a variable, use the VARPTR routine to find the location of the number, move it, change it, and move it back.

I'm using my Color Computer to develop a program for my genealogy records, both raw and final. The program is developing nicely, but I need an alphanumeric-order sorting program, for double-dimensioned arrays with many records. Do you know of a sort program or of the source of such a program?

W.R.D., Titusville, FL

I don't have any machine language sorts for the Color Computer (Basic sorts are far too slow for large numbers of items).

Skyline Software (Soft City, 442 Sunnyside, Wheaton, IL 60187, (312)260-0929) has a program called Quicksort (\$12.95) that should do the job. Call or write them for more information.

I have a Prism 132 Printer, from Integral Data Systems. I am able to list programs on my Color Computer with no problem once the data rates are matched and the printer line feed adjustment is set properly. However, I can't get Color Scripsit to work with this printer. Last week Radio Shack told me the problem was that Scripsit doesn't time the RS232 stop bit. First of all, I'm not enough of a "hacker" to understand what this means, nor do I know what to do about it. Radio Shack says to buy Radio Shack equipment. I have two choices: buy another word processor that is compatible with my printer, or modify my software or hardware to make them compatible. The latter is preferable if it's cost-effective (I'm not optimistic that Radio Shack will refund my money). So, can Color Scripsit be modified to "time the stop bit" and how do I do it; if it can't be done (or at least not easily or cheaply), what word processor will be guaranteed to work with my printer; and is Radio Shack right about why Color Scripsit doesn't work with my printer?

J.E., Gainesville, FL

Radio Shack is correct, the problem lies with the method used by Scripsit to time

the RS232 output. Because you don't mention disk drives I assume you have a cassette-based computer, which uses Color Scripsit as a ROMpak. To "fix" the ROMpak would be more trouble than it's worth: you would have to replace the Scripsit ROM with a corrected version. That would require knowing where the troublesome routine is located, and enough machine language skill to effect a change, plus having access to EPROM programming equipment for making the new ROM.

A possible solution would be to put a hardware device between the Color Computer and your printer that would intercept the "untimed" bit and rectify the situation. As yet no one has tried to do that.

The simplest and easiest solution would be to return Color Scripsit and ask for a refund (the worst they can do is say no, at best you'll get your money back — nothing ventured, nothing gained).

Next, check the word processors listed in the March 1983 issue, select the word processor with the features you like best, and write to the manufacturer and ask if he knows of any difficulties with his product and the IDS printer.

If you clearly state at the outset that you are buying the product solely because it's supposed to work with your printer, you should be able to get a refund if things don't work out.

I have a 32K Color Computer (E-board) with one disk drive and a printer. When Radio Shack installed the upgrade to 32K they used 64K chips, and they manually selected the upper or lower 32K bank for use. I want to modify the board to get full access to all 64K. How do I do it? Also, I want to know how to change Radio Shack EDTASM+ and T-Bug from ROMpak to disk-based so I can use it as a disk Editor/Assembler.

R.H., Beale AFB, CA

You don't really need to do much, because the memory is already installed. The design of the machine lets you select which bank of 32K you have available for use with the Extended Basic ROM, but if you don't need the ROM, you can use software to switch it out of the way to give access to the full 64K. Unfortu-

nately, there's no way to get 64K of RAM and the ROM at the same time.

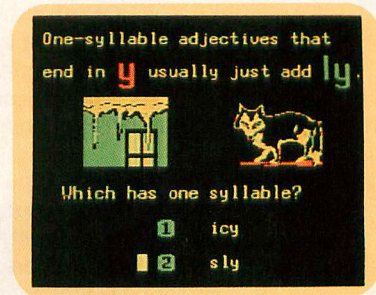
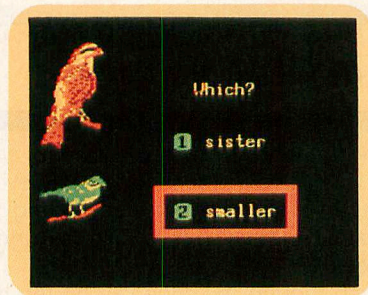
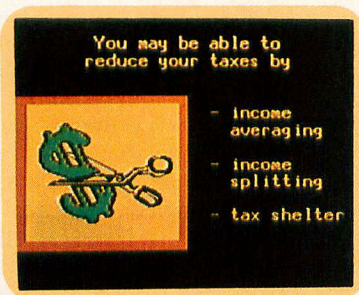
Putting the ROMpaks on disk is easy, making them disk interactive is not.

Micro Technical products (814 W. Keating Ave., Dept. A, Mesa, AZ 85202, (602)839-8902) has a program called ROML (\$25 tape, \$29 disk), which uses the 64K mode to move ROMpaks to RAM and save them to disk. Now when you want to use the programs, load them from disk and they'll execute from RAM, which makes them easy to modify and customize, and gives you lots more room for programs (because the 16K Basic ROMs are no longer in the way). They also have Plus-32K (\$15 tape, \$19 disk) which lets you run Color Basic and Extended Basic from RAM, where you can examine and modify it to suit your needs.

If you want to save and load programs from disk with T-BUG and EDTASM, you'll have to write your own disk I/O routines and patch them into the two programs. Personally, I think it would make more sense to buy the disk versions than to go to all the trouble. But if you like the challenge of it, please go right ahead. Let me know how you make out with the project. ■ ■ ■

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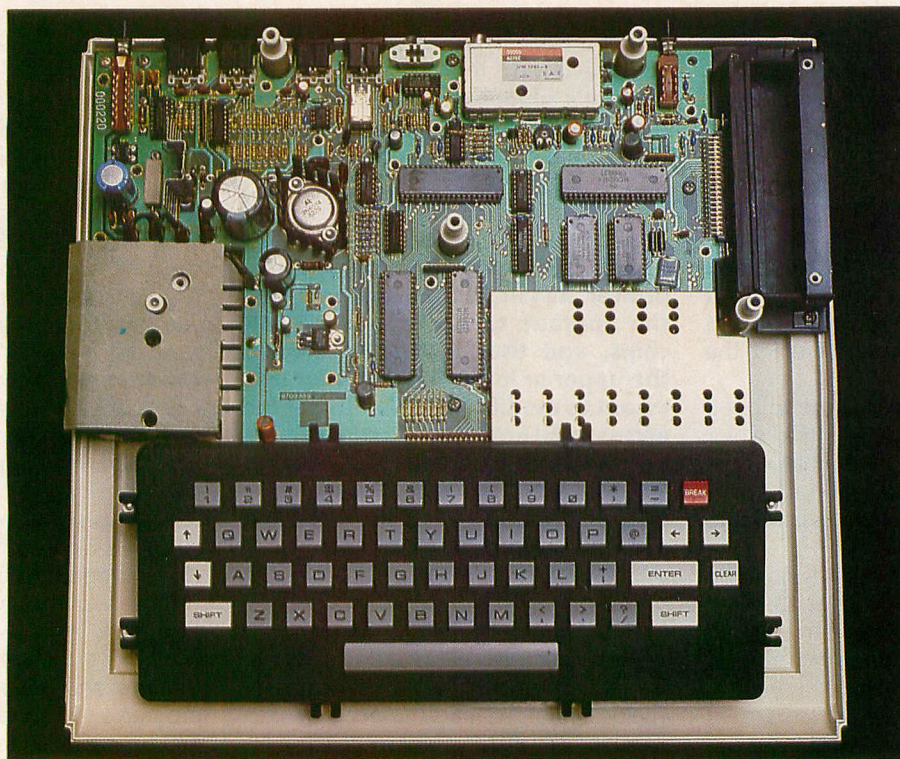


photo by Charley Freiberg

Dissecting Your ROM

Color Basic ROM explained. The fifth of 12 articles.

THIS MONTH'S PORTION of disassembly covers a very important routine. In fact, it could be argued that it's the lynchpin of the whole Basic interpreter. It's the number-crunching routine.

At location B156 in the ROM, you'll find the routine that does the computation of all expressions in Basic. Strings, numbers, functions, relational expressions — the lot. This routine does them all. It's also quite a complicated routine because it has to unravel expressions ranging in complexity from simple ones such as:

LETA = A + 1

all the way to nasties with multiple parentheses like:

LETA=A+COS((1+SIN(A))*2^(PEEK(INT(B/256)*256)))

To perform such a range of tasks, the routine becomes complex, and difficult to follow because it calls itself from within its own innards. This is called *recursion*

by Jake Commander

in the upper echelons of computing, and is a very powerful technique. However, for the solitary programmer debugging or following such code, it can be a nightmare.

Even though the code can be terribly difficult to follow, it's only as complicated as the expression it's evaluating, which may be as simple as the first example I gave. In fact, the routine functions by breaking every piece of an expression into steps involving only two at a time. So, if a formula contains multiplication followed by addition, the routine will evaluate the highest priority portion (the multiplication) as one piece, and then perform the addition to the pending total as another simple piece.

By breaking up complicated formulas into small segments like this and applying predetermined rules of precedence to each operation, the number-crunching proper is achieved. These rules are

kept in a table at location AA51. Each table entry consists of three bytes: the first gives a priority number to determine the order that the operations should be carried out; the second is the two-byte address of the algorithm to carry out that operation. For instance, AA51 contains the entry for the addition operator — bytes 79 B9 C5. The first byte (79) is the priority (lower than division, for instance, which is 7B) and the second two bytes (B9C5) give the address where floating point addition is performed at \$B9C5. Easy, huh?

Also included in this month's portion (just for dessert, you understand) is the code to assign the very results of the expression-evaluator just mentioned to a named variable. The variable in question can be either a normal or subscripted (array) variable. Compared with the number-cruncher routine, this code looks easy.

Next time we'll be covering some of Basic's string functions, including the dreaded garbage collector. Maybe we should all hold our noses in readiness.

◆ Program

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THE ORIGINAL

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

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

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

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

...one of the best programs for the Color Computer I have seen...

— Color Computer News, Jan. 1982

TELEWRITER-64

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

64K COMPATIBLE

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

64 COLUMNS (AND 85!)

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

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

RIGHT JUSTIFICATION & HYPHENATION

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

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

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPV11/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminus, etc).

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

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

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

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

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

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

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

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

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

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— The RAINBOW, Jan. 1982

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ROM Disassembly

Line Number	Object Address	Mnemonic	Operand	Jake's Comment	Object Address	Mnemonic	Operand	Jake's Comment
02134	B0CB DD 31	STD	<\$31	;Save it	B12F 9F A6	STX	<SA6	;Replace parse pointer
02135	B0CD A6 84	LDA	,X	;Get command	B131 7E AD9E	JMP	\$AD9E	;Between statements
02136	B0CF 81 86	CMPA	# \$86	;Is it DATA?	B134 32 E812	LEAS	\$12,S	;Adjust all info from stack
02137	B0D1 26 E6	BNE	\$B0B9	;No, go again	B137 9D A5	JSR	<SA5	;Parse current chr
02138	B0D3 20 94	BRA	\$B069	;Yes, continue READ	B139 81 2C	CMPA	# \$2C	;Another NEXT variable?
02139	B0D5 9E 35	LDX	<\$35	;I/P buffer	B13B 26 F4	BNE	\$B131	;NO
02140	B0D7 D6 09	LDB	<9	;READ mode?	B13D 9D 9F	JSR	<\$9F	;Parse next chr
02141	B0D9 1026 F00B	LBNE	FADE8	;Yes, update the data pointer	B13F 8D BD	BSR	\$B0FE	;Go again
02142	B0DD A6 84	LDA	,X	;Input delimited with 0 ?	B141 8D 13	BSR	\$B156	;Compute variable
02143	B0DF 27 06	BEQ	\$B0E7	;RTS if so	B143 1C FE	ANDCC	# \$FE	;CF off - flag must be numeric
02144	B0E1 8E B0E7	LDX	# \$B0E7	;=> "EXTRA IGNORED"	B145 7D 1A01	ORCC	01	;Variable type?
02145	B0E4 7E B99C	JMP	\$B99C	;-> Print it	B148 0D 06	TST	<6	;If string variable allowed
02146	B0E7 39	RTS			B14A 25 03	BLO	\$B14F	;RTS if numeric
02147	B0E8 3F	SWI		?	B14C 2A 99	BFL	\$B0E7	;B14F=BMI \$B0E7 (RTS if string)
02148	B0E9 45	ASLB		; E	B14E 8C 2B96<-	CMPX	# \$2B96	;TM Error
02149	B0EA 58	ASLB		; X	B151 C6 18	LDB	# \$18	;Error processing
02150	B0EB 54	LSRB		; T	B153 7E AC46	JMP	\$AC46	
02151	B0EC 52			; R				
02152	B0ED 41			; A				
02153	B0EE 20 49	BRA	\$B139	; I				
02154	B0F0 47	ASRA		; G				
02155	B0F1 4E			; N				
02156	B0F2 4F	CLRA		; O				
02157	B0F3 52			; R				
02158	B0F4 45			; E				
02159	B0F5 44	LSRA		; D				
02160	B0F6 0D 00	TST	<0	; C/R & 00 (end of message)				
NEXT								
02161	B0F8 26 04	BNE	\$B0FE	;-> If not end of line				
02162	B0FA 9E 8A	LDX	<\$8A	;zero constant				
02163	B0FC 20 03	BRA	\$B101	;-> Find or assign variable				
02164	B0FE BD B357	JSR	\$B357	;Save varptr or zero in scratch				
02165	B101 9F 3B	STX	<\$3B	;-> Get "FOR" info off stack				
02166	B103 BD ABF9	JSR	\$ABF9	;(Pop 3 bytes of "FOR")				
02167	B106 27 04	BEQ	\$B10C	;Was it there?				
02168	B108 C6 00	LDB	#0	;NF Error				
02169	B10A 20 47	BRA	\$B153	;-> If no "FOR" on stack				
02170	B10C 1F 14	TFR	X,S	;Bump over \$80 and varptr				
02171	B10E 30 03	LEAX	3,X	;Copy step variable to FPAC1				
02172	B110 BD BC14	JSR	\$BC14	;Sign of step				
02173	B113 A6 68	LDA	8,S	;Save it				
02174	B115 97 54	STA	<\$54	;Varptr of current "FOR"				
02175	B117 9E 3B	LDX	<\$3B	;Add step to variable				
02176	B119 BD B9C2	JSR	\$B9C2	;FPAC1 to variable				
02177	B11C BD BC33	JSR	\$BC33	;=> End value of "FOR"				
02178	B11F 30 69	LEAX	9,S	;Compare FPAC1 to variable				
02179	B121 BD BC96	JSR	\$BC96	;Account for step sign				
02180	B124 E0 68	SUBB	8,S	;If past end of loop				
02181	B126 27 0C	BEQ	\$B134	;Loop line number from stack				
02182	B128 AE 6E	LDX	\$0E,S	;Becomes current line number				
02183	B12A 9F 68	STX	<\$68	;"FOR" statement pointer				
02184	B12C AE E810	LDX	\$10,S					

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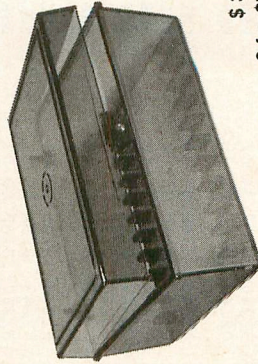
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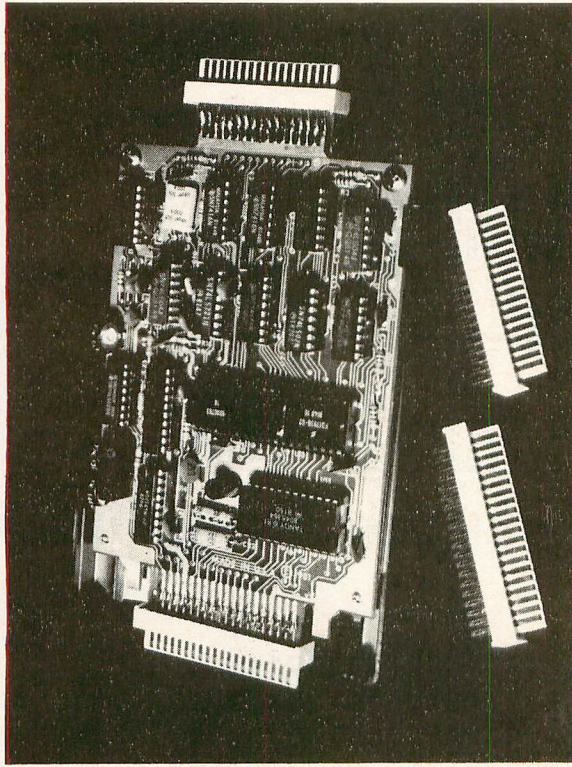


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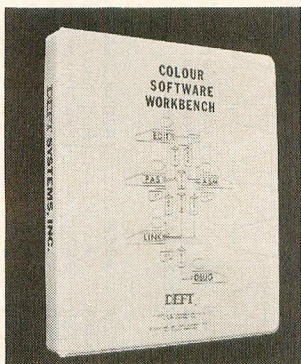
Line Number	Object Address Code	Mnemonic	Operand	Jake's Comment	Line Number	Object Address Code	Mnemonic	Operand	Jake's Comment
02234	B19A 8E AA51	LDX	#\$AA51	;=> Operator table	02278	B1F8 27 26	BEQ	\$B220	;No
02235	B19D 30 86	LEAX	A,X	;Offset to table	02279	B1FA 81 64	CMPA	#\$64	;Comparison?
02236	B19F 35 02	PULS	A	;Previous operator type	02280	B1FC 27 03	BEQ	\$B201	;If so
02237	B1A1 A1 84	CMPA	,X	;Table determines priority	02281	B1FE BD B143	JSR	\$B143	;Numeric TM check
02238	B1A3 24 55	BHS	\$B1FA	;If no carry, do pending calc	02282	B201 9F 3D	STX	<\$3D	;Save operator table pointer
02239	B1A5 8D 9C	BSR	\$B143	;Do numeric TM check	02283	B203 35 04	PULS	B	;Possible relational op
02240	B1A7 34 02	PSHS	A	;Save previous operator	02284	B205 81 5A	CMPA	#\$5A	; "NOT"?
02241	B1A9 8D 29	BSR	\$B1D4	;Save operator addr & FPAC1 to stack. Recurse to \$B15A	02285	B207 27 19	BEQ	\$B222	;RTS to do it if so
02242	B1AB 9E 3D	LDX	<\$3D	;Current operator addr (firm B201)	02286	B209 81 7D	CMPA	#\$7D	;Unary minus?
02243	B1AD 35 02	PULS	A	;Previous op	02287	B20B 27 15	BEQ	\$B222	;RTS to do it if so
02244	B1AF 26 1D	BNE	\$B1CE	;Decide priority, do if necessary	02288	B20D 54	LSRB		;Realign relational op
02245	B1B1 4D	TSTA		;Have all operators been done?	02289	B20E D7 0A	STB	<\$0A	;Save for comparison routine
02246	B1B2 1027 006A	LBEQ	\$E220	;Out if so	02290	B210 35 52	PULS	A,X,U	;F.P. # off stack
02247	B1B6 20 4B	BRA	\$B203	;Do this op	02291	B212 97 5C	STA	<\$5C	;FPAC2 exponent
02248	B1B8 08 06	ASL	<6	;Set carry if string variable	02292	B214 9F 5D	STX	<\$5D	;FPAC2 MSW
02249	B1BA 59	ROLB		;Carry flag into relational op	02293	B216 DF 5F	STU	<\$5F	;FPAC2 LSW
02250	B1BB 8D 09	BSR	\$B1C6	;Backoff BASIC pointer	02294	B218 35 04	PULS	B	;Sign bit
02251	B1BD 8E 1BCB	LDX	#\$B1CB	; "Compare" operator table	02295	B21A D7 61	STB	<\$61	;To FPAC2
02252	B1C0 D7 3F	STB	<\$3F	;Save current relational op	02296	B21C D8 54	FORB	<\$54	;Same sign as FPAC1?
02253	B1C2 0F 06	CLR	<6	;Return numeric value (0 or -1)	02297	B21E D7 62	STB	<\$62	;Hold result
02254	B1C4 20 D9	BRA	\$B19F	;Continue variable computation	02298	B220 D6 4F	LDB	<\$4F	;FPAC1 exponent (2nd operand)
02255	B1C6 9E A6	LDX	<\$A6		02299	B222 39	RTS		;To operation address
02256	B1C8 7E AEBB	JMP	\$AEBB		Check operand				
02257	B1CB 64 B2	LSR	,Y		02300	B223 BD 018B	JSR	\$018B	;RAM vector
02258	B1CD F4 A184	ANDB	\$A184	;Op=\$64, address=\$B2F4	02301	B226 0F 06	CLR	<6	;Reset variable type
02259	B1D0 24 31	BHS	\$B203	;Do operation if so	02302	B228 9D 9F	JSR	<\$9F	;Parse next chr
02260	B1D2 20 D3	BRA	\$B1A7	;Save FPAC1 and get next op	02303	B22A 24 03	BHS	\$B22F	;If not ASCII 0-9
02261	B1D4 EC 01	LDD	1,X		02304	B22C 7E BD12	JMP	\$BD12	;ASCII, convert ASCII # to FPAC1
02262	B1D6 34 06	PSHS	A,B		02305	B22F BD B3A2	JSR	\$B3A2	;Check if ASCII A-Z
02263	B1D8 8D 08	BSR	\$B1E2		02306	B232 24 50	BHS	\$B284	;If so, variable to FPAC1
02264	B1DA D6 3F	LDB	<\$3F		02307	B234 81 2E	CMPA	#\$2E	;Decimal point?
02265	B1DC 16 FF7B	LBRA	\$B15A		02308	B236 27 F4	BEQ	\$B22C	;Yes, cnvrt ASCII # to FPAC1
02266	B1DF 7E B277	JMP	\$B277		02309	B238 81 AC	CMPA	#\$AC	; "-"?
02267	B1E2 D6 54	LDB	<\$54		02310	B23A 27 40	BEQ	\$B27C	;Yes, flag unary minus
02268	B1E4 A6 84	LDA	,X		02311	B23C 81 AB	CMPA	#\$AB	; "+"?
02269	B1E6 35 20	PULS	Y		02312	B23E 27 E8	BEQ	\$B228	;Yes, step over unary plus
02270	B1E8 34 04	PSHS	B		02313	B240 81 22	CMPA	#\$22	;Quote?
02271	B1EA D6 4F	LDB	<\$4F		02314	B242 26 0A	BNE	\$B24E	;No, check other syntaxes
02272	B1EC 9E 50	LDX	<\$50		02315	B244 9E A6	LDX	<\$A6	;Current BASIC pointer
02273	B1EE DE 52	LDU	<\$52		02316	B246 BD B518	JSR	\$B518	;String info to string stack
02274	B1F0 34 54	PSHS	B,X,U		02317	B249 9E 64	LDX	<\$64	;String end
02275	B1F2 6E A4	JMP	,Y		02318	B24B 9F A6	STX	<\$A6	;Align BASIC pointer
02276	B1F4 9E 8A	LDX	<\$8A		02319	B24D 39	RTS		
02277	B1F6 A6 E0	LDA	,S+		NOT				
					02320	B24E 81 A8	CMPA	#\$A8	;Token="NOT"?
					02321	B250 26 0D	BNE	\$B25F	;No
					02322	B252 86 5A	LDA	#\$5A	; "NOT" op priority
					02323	B254 BD B15A	JSR	\$B15A	;Compute variable
					02324	B257 BD B3ED	JSR	\$B3ED	;Get number < 65536 to D
					02325	B25A 43	COMA		;Complement D
					02326	B25B 53	COMB		
					02327	B25C 7E B4F4	JMP	\$B4F4	;Return D as variable
					02328	B25F 4C	INCA		;Token = \$FF? ♦ more

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Part TWO of the CSW User's Guide provides you with the background information needed to write programs using the Colour Software Workbench.

LEARNING EXERCISE

- Complete Pascal and Assembler Language Source
- Uses All Parts Of the Workbench
- Resulting Program is a Text Processor

PASCAL

- Describes Standard Language Elements Supported
- Constants Include Decimal and Hexadecimal Integers, ASCII characters and strings
- Types Include:
 - Integer, Char, Boolean, Enumerated, Subrange
 - Multi-Dimensional Arrays
 - Records and Variant Records
 - Sets of Up to 256 Elements
 - Files
- PROCEDURES and FUNCTIONS with FORWARD
- Variables and LABELS
- Arithmetic, Boolean, and Set Expressions
- Statements: IF, WHILE, REPEAT, CASE, GOTO, EXIT, FOR, BEGIN, assignment (:=)
- Input/Output: RESET, REWRITE, READLN, EOF, WRITE, WRITELN, CLOSE, PAGE
- Built-in Functions and Procedures: ABS, CHR, CURSOR, ODD, ORD, PRED, SUCC

ADVANCED PASCAL

- Strings Support: Assignment, Comparing, Concatenation
- String Procedures and Functions: STRINGCOPY, STRINGDELETE, STRINGINSERT, STRINGPOS, HEX, ENCODE, DECODE
- Type Extensions for Structured Type Breaking
- Absolute Memory Access via Built-in WORD and BYTE Arrays
- ROM Routine Access via CALL Built-in Function
- Static and Public Variable Allocation
- Separate Compilation and Assembler Interface via INTERFACE, EXTERNAL, and PUBLIC
- Listing and Multiple Source File Directives
- Explanation of Error Messages

6809 MACRO ASSEMBLER

- Motorola Compatible Source Conventions
- Macro Facility With up to 9 Macro Parameters
- Separate Compilation and Pascal Interface via PUBLIC and EXT Directives
- Listing Control Directives
- Explanation of Error Messages

TECHNICAL NOTES

- CoCo ROM Compatibility
- Pascal Runtime Library Assembler Interface
- CSW Object File Format

TEXT EDITOR

- Screen Mode Editing
- Entering Text
- Finding Strings
- Changing Multiple String Occurrences
- Moving, Copying and Deleting Blocks of Text
- Reading, Writing and Merging Files From Tape and Disk

PASCAL COMPILER

- Specifying:
 - Source from Tape, Disk or Keyboard
 - Object and Listing to Tape, Disk, Screen or Printer
- Optional Symbol Table in the Object File for use by the Symbolic Debugger
- Explanation of Source Listing Format

MACRO ASSEMBLER

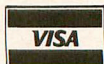
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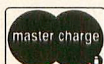
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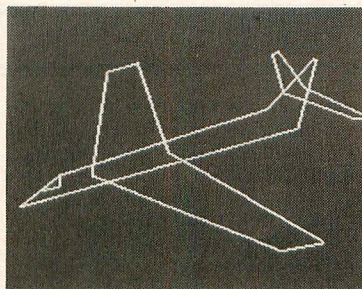
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PRO-COLOR-FORMS (C) 1983
Derringer Software
All programs require 32k Color Computer Disk System
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```

02329 B260 27 2E
02330 B262 8D 06
02331 B264 BD B156
02332 B267 C6 29
02333 B269 8C C628
02334 B26C 8C C62C
02335 B26F E1 9F00A6
02336 B273 26 02
02337 B275 0E 9F
SN_Error
02338 B277 C6 02
02339 B279 7E AC46
Unary minus
02340 B27C 86 7D
02341 B27E BD B15A
02342 B281 7E BEE9
Variable to FPAC1
02343 B284 BD B357
02344 B287 9F 52
02345 B289 96 06
02346 B28B 26 95
02347 B28D 7E BC14
RHS functions
02348 B290 9D 9F
BEQ $B290
BSR $B26A
JSR $B156
LDB #29
CMPX #C628
CMPB (00A6)
BNE $B277
JMP <$9F
LDB #2
JMP $AC46
LDA #7D
JSR $B15A
JMP $BEE9
JSR $B357
STX <$52
LDA <6
BNE $B222
JMP $BC14
JSR <$9F
;Yes, check RHS functions
;Syntax check for "("
;Compute variable in parentheses
;Syntax check for ")"
;B26A=LDB #28 (Check "(")
;B26D=LDB #2C (Check ",")
;Syntax chk B against parse pntr
;SN_Error if incorrect
;Else parse next chr
;Syntax error code
;Error processing
;Unary minus op priority
;Continue variable compute
;Negate FPAC1
;Find or assign variable
;Save current pointer
;Variable type
;RVS if string
;Copy variable (=> X) to FPAC1
;Parse next chr
02376 B2CE 3A
02377 B2CF AD 94
02378 B2D1 7E B143
AND/OR
02379 B2D4 86 4F
02380 B2D6 97 03
02381 B2D8 BD B3ED
02382 B2DB DD 01
02383 B2DD BD BC4A
02384 B2E0 BD B3ED
02385 B2E3 0D 03
02386 B2E5 26 06
02387 B2E7 94 01
02388 B2E9 D4 02
02389 B2EB 20 04
02390 B2ED 9A 01
02391 B2EF DA 02
02392 B2F1 7E B4F4
Comparison
02393 B2F4 BD B148
02394 B2F7 26 10
02395 B2F9 96 61
02396 B2FB 8A 7F
02397 B2FD 94 5D
02398 B2FF 97 5D
02399 B301 8E 005C
ABX
JSR (,X)
JMP $B143
LDA #4F
STA <3
JSR $B3ED
STD <1
JSR $BC4A
JSR $B3ED
TST <3
BNE $B2ED
ANDA <1
ANDB <2
BRA $B2F1
ORA <1
ORB <2
JMP $B4F4
;add offset
;Do as a subroutine
;Must be numeric
;B2D5=CLRA
;Set AND/OR switch
;FPAC1 to D
;Save number
;Copy FPAC2 to FPAC1
;FPAC1 to D
;"AND" or "OR"?
;If "OR"
;Else AND D ...
;... with previous number
;Return result
;OR D ...
;... with previous number
;Return D as variable value
;Check variable type
;If string
;FPAC2 sign in bit 7
;To mask out sign bit
;Bit 7 = 1 if negative
;Rstr sign bit to MSB
;=> FPAC2

```

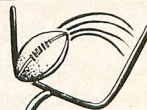

Line Number	Object Address	Object Code	Jake's Comment	Mnemonic	Operand
02349	B292	1F 89	;Hold token	TFR	A,B
02350	B294	58	;times 2 and remove high bit	ASLB	
02351	B295	9D 9F	;Parse next chr	JSR	<\$9F
02352	B297	C1 26	;Token > \$93?	MPB	#26
02353	B299	23 04	;If not	BLS	\$B29F
02354	B29B	6E 9F0132	;Special vector if > \$93	JMP	(0132)
02355	B29F	34 04	;Save offset	PHS	B
02356	B2A1	C1 1C	< "LEFT\$"?	MPB	#1C
02357	B2A3	25 22	;If so	BLO	\$B2C7
02358	B2A5	C1 24	>= "INKEY\$"?	MPB	#24
02359	B2A7	24 20	;-> If "MEM" or "INKEY\$"	BHS	\$B2C9
02360	B2A9	8D BF	;Syntax check for "("	BSR	\$B26A
02361	B2AB	A6 E4	;Offset	LDA	'S
02362	B2AD	81 22	;If "POINT"	MPA	#22
02363	B2AF	24 18	;Compute variable	BHS	\$B2C9
02364	B2B1	BD B156	;Syntax check for ","	JSR	\$B156
02365	B2B4	8D B7	;Do TM check for string	BSR	\$B26D
02366	B2B6	BD B146	;Offset from stack	JSR	\$B146
02367	B2B9	35 02	;Next string stack pointer	PULS	A
02368	B2BB	DE 52	;Compute number < 256	LDU	<\$52
02369	B2BD	34 42	;Offset from stack	PHS	A,U
02370	B2BF	BD B70B	;Mask following opcode	JSR	\$B70B
02371	B2C2	35 02	;-> Compute variable in ()	PULS	A,B
02372	B2C4	34 06	;Offset from stack	PHS	A,B
02373	B2C6	8E 8D99	;=> Function table	LDX	#8D99
-----	B2C7	8D 99		BSR	\$B262
02374	B2C9	35 04		PULS	B
02375	B2CB	BE 0128		LDX	\$0128

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; "A"?
; RTS if < "A"
; If > "A" - "Z" ...
; ... set carry flag

;zero constant
;Return address
;Putting variable to FPAC1?
;If so, don't assign
;Next array pointer
;Save it
;New next array pointer
;Save it
;Next variable pointer
;Save it
;Open gap
;New next array pointer
;Save it
;New next variable pointer
;Save it
;This variable's pointer
;Variable name
;Save name
; * Clear
; * the
; * variable

#008A
;S
;CPU #B287
;BEQ #B3DE
;LDD #F43
;STB #7
;STB #41
;LDD #41D
;STX #47
;JSR #AC1E
;LDD #41
;STX #41F
;LDD #45
;STX #45
;LDD #47
;LDD #47
;LDD #37
;STB #X++

CMPA #F41
BLO #B3AA
SUBA #F5B
SUBA #F45
RTS

LDX #008A
LDU #S
CMPU #B287
BEQ #B3DE
LDD #F43
STB #7
STB #41
LDD #41D
STX #47
JSR #AC1E
LDD #41
STX #41F
LDD #45
STX #45
LDD #47
LDD #47
LDD #37
STB #X++

Assign variable
02483 B3AB 8E 008A
02484 B3AE EE E4
02485 B3B0 1183B287
02486 B3B4 27 28
02487 B3B6 DC 1F
02488 B3B8 DD 43
02489 B3BA C3 0007
02490 B3BD DD 41
02491 B3BF 9E 1D
02492 B3C1 9F 47
02493 B3C3 BD AC1E
02494 B3C6 9E 41
02495 B3C8 9F 1F
02496 B3CA 9E 45
02497 B3CC 9F 1D
02498 B3CE 9E 47
02499 B3D0 DC 37
02500 B3D2 ED 81
02501 B3D4 4F
02502 B3D5 5F
02503 B3D6 ED 84

;Else default <
;If 2nd chr < 1st
;Else default >
;B=1 if <, B=2 if =
;B=4 if >
;Any condition met?
;No
;-1 (true)
;Return B in FPAC1
;Syntax check for ", "
;Flag DIM
;Dimension variable
;parse current chr
;?SN chk ", " if not end statemnt

;Flag assign
;parse current chr
;Save DIM/Assign flag
;Save first variable letter
;parse current chr
;If it's A-Z, set No Carry flag
;SN Error if not
;Initialize second letter default
;Initlize variable type
;parse next chr

#FFF #B33F
#1
<S0A
#B348
#F4F #BC7C
#B26D
#1 #B35A
<S45 #B34B
RTS

LDB #FFF
BHS #B33F
NEGB
ADDB #1
ROLB
ANDB #S0A
BEQ #B348
LDB #F4F
JMP #BC7C

JSR #B26D
LDB #1
BSR #B35A
JSR <S45
BNE #B34B
RTS

CLRB
JSR <S45
STB #5
STA #F37
JSR <S45
BSR #B3A2
LDB #B277

Find or assign variable
02442 B357 5F
02443 B358 9D A5
02444 B35A D7 05
02445 B35C 97 37
02446 B35E 9D A5
02447 B360 8D 40
02448 B362 1025 FF11
02449 B366 5F
02450 B367 D7 06
02451 B369 9D 9F
    
```

Line	Object	Number	Address	Mnemonic	Operand	Jake's Comment
02504	B3D8 ED 02	STX			2,X	; * to
02505	B3DA A7 04	STX			4,X	; * zero
02506	B3DC 9F 39	STX			<\$39	; Save variable value pointer
02507	B3DE 39	RTS				
	Floating point 32768					
02508	B3DF 90 80	SUBA			<\$80	
02509	B3E1 00 00	NEG			<0	
02510	B3E3 00 9D	NEG			<\$9D	
	Compute # <65536 to D					
02511	B3E4 9D 9F	JSR			<\$9F	; Parse next
02512	B3E5 9F BD	STX			<\$BD	
02513	B3E6 BD B141	JSR			\$B141	; Compute numeric variable
02514	B3E7 B1 4196	CMPA			\$4196	
02515	B3E8 54	LSRB				
02516	B3E9 96 54	LDA			<\$54	; Sign of number
02517	B3EB 2B 5D	BMI			\$B44A	; FC Error if negative
02518	B3ED 96 4F	LDA			<\$4F	; Exponent FPACL
02519	B3EF 81 90	CMPA			# \$90	; Size of exponent?
02520	B3F1 25 08	BLO			\$B3FB	; If <32768
02521	B3F3 8E B3DF	LDX			#B3DF	; => 32768 floating point
02522	B3F6 BD BC96	JSR			\$BC96	; Compare FPACL to 32768
02523	B3F9 26 4F	BNE			\$B44A	; FC Error if not = 32768
02524	B3FB BD BCC8	JSR			\$BCC8	; -> Floating point to integer
02525	B3FE DC 52	LDD			<\$52	; Integer
02526	B400 39	RTS				

Set NC flag if A = "A" - "Z"

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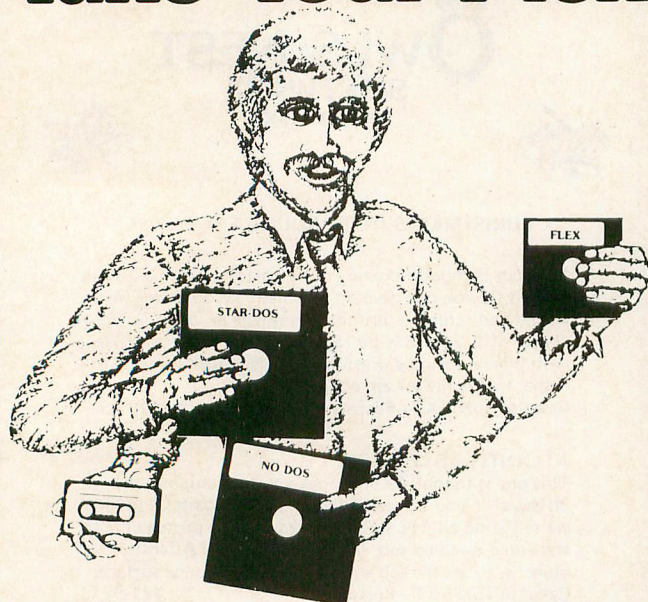


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02524	B401 D6 05	<5	;DIM/assign flag	02575	B46A C3 0001	ADDD #1	;Plus one for 0 element	02524	B401 D6 05	<5	;DIM/assign flag	02575	B46A C3 0001	ADDD #1	;Plus one for 0 element
02525	B403 96 06	<6	;Variable type	02576	B46D ED 05	STD 5,X	;Number of elements into array	02525	B403 96 06	<6	;Variable type	02576	B46D ED 05	STD 5,X	;Number of elements into array
02526	B405 34 06	A,B	;Save them	02577	B46F 8D 5D	BSR \$B4CE	;Calc # of bytes so far in array	02526	B405 34 06	A,B	;Save them	02577	B46F 8D 5D	BSR \$B4CE	;Calc # of bytes so far in array
02527	B407 5F	CLRB	;Initialize number of dimensions	02578	B471 DD 64	STD <\$64	;Save running total	02527	B407 5F	CLRB	;Initialize number of dimensions	02578	B471 DD 64	STD <\$64	;Save running total
02528	B408 9E 37	LDX	;Variable name	02579	B473 30 02	LEAX 2,X	;Bump array pointer	02528	B408 9E 37	LDX	;Variable name	02579	B473 30 02	LEAX 2,X	;Bump array pointer
02529	B40A 34 14	PSHS	;Save it	02580	B475 0A 03	DEC <3	;Done all DIMs?	02529	B40A 34 14	PSHS	;Save it	02580	B475 0A 03	DEC <3	;Done all DIMs?
02530	B40C 8D D6	BSR	;Compute subscript	02581	B477 26 E8	BNE \$B461	;No, continue	02530	B40C 8D D6	BSR	;Compute subscript	02581	B477 26 E8	BNE \$B461	;No, continue
02531	B40E 35 34	PULS	;Restore	02582	B479 9F 0F	STX <\$0F	;Save array info end pointer	02531	B40E 35 34	PULS	;Restore	02582	B479 9F 0F	STX <\$0F	;Save array info end pointer
02532	B410 9F 37	STX	;Variable name	02583	B47B D3 0F	ADDD <\$0F	;Add array size = new array end	02532	B410 9F 37	STX	;Variable name	02583	B47B D3 0F	ADDD <\$0F	;Add array size = new array end
02533	B412 DE 52	LDU	;Dimension size	02584	B47D 1025 F7C3	LBLO \$AC44	;OM Error if overflow	02533	B412 DE 52	LDU	;Dimension size	02584	B47D 1025 F7C3	LBLO \$AC44	;OM Error if overflow
02534	B414 34 60	PSHS	;Save it	02585	B481 1F 01	TFR D,X	;Save new end	02534	B414 34 60	PSHS	;Save it	02585	B481 1F 01	TFR D,X	;Save new end
02535	B416 5C	INCB	;Bump number of dimensions	02586	B483 BD AC37	JSR \$AC37	;Check memory space	02535	B416 5C	INCB	;Bump number of dimensions	02586	B483 BD AC37	JSR \$AC37	;Check memory space
02536	B417 9D A5	JSR	;Parse current chr	02587	B486 83 0035	SUBD #S0035	;Adjust	02536	B417 9D A5	JSR	;Parse current chr	02587	B486 83 0035	SUBD #S0035	;Adjust
02537	B419 81 2C	CMPA	; " " ?	02588	B489 DD 1F	STD <\$1F	;New next array address	02537	B419 81 2C	CMPA	; " " ?	02588	B489 DD 1F	STD <\$1F	;New next array address
02538	B41B 27 EB	BEQ	;If another dimension	02589	B48B 4F	CLRA	;Zero the array	02538	B41B 27 EB	BEQ	;If another dimension	02589	B48B 4F	CLRA	;Zero the array
02539	B41D D7 03	STB	;Save number of dimensions	02590	B48C 30 1F	LEAX 5,X	;point one back	02539	B41D D7 03	STB	;Save number of dimensions	02590	B48C 30 1F	LEAX 5,X	;point one back
02540	B41F BD B267	JSR	;Syntax check for ") "	02591	B48E A7 05	STA 5,X	;Clear element	02540	B41F BD B267	JSR	;Syntax check for ") "	02591	B48E A7 05	STA 5,X	;Clear element
02541	B422 35 06	PULS	;Variable type & DIM/assign flag	02592	B490 9C 0F	CMPL <\$0F	;Down to array information?	02541	B422 35 06	PULS	;Variable type & DIM/assign flag	02592	B490 9C 0F	CMPL <\$0F	;Down to array information?
02542	B424 97 06	STA	;Variable type	02593	B492 26 F8	BNE \$B48C	;Continue if not	02542	B424 97 06	STA	;Variable type	02593	B492 26 F8	BNE \$B48C	;Continue if not
02543	B426 D7 05	STB	;DIM/assign flag	02594	B494 9E 41	LDA <\$41	;Pointer to array start	02543	B426 D7 05	STB	;DIM/assign flag	02594	B494 9E 41	LDA <\$41	;Pointer to array start
02544	B428 9E 1D	LDX	;Next variable pointer	02595	B496 96 1F	LDA <\$1F	;D = next array address	02544	B428 9E 1D	LDX	;Next variable pointer	02595	B496 96 1F	LDA <\$1F	;D = next array address
02545	B42A 9C 1F	CMPL	;End of array table?	02596	B498 93 41	SUBD <\$41	;Calc size	02545	B42A 9C 1F	CMPL	;End of array table?	02596	B498 93 41	SUBD <\$41	;Calc size
02546	B42C 27 21	BEQ	;Yes	02597	B49A ED 02	STD 2,X	;Store array size	02546	B42C 27 21	BEQ	;Yes	02597	B49A ED 02	STD 2,X	;Store array size
02547	B42E DC 37	LDD	;Found the variable?	02598	B49C 96 05	LDA <5	;DIM statement?	02547	B42E DC 37	LDD	;Found the variable?	02598	B49C 96 05	LDA <5	;DIM statement?
02548	B430 10A384	CMPL	; " " ?	02599	B49E 26 2D	BNE \$B4CD	;RTS if so	02548	B430 10A384	CMPL	; " " ?	02599	B49E 26 2D	BNE \$B4CD	;RTS if so
02549	B433 27 06	BEQ	;Yes	02600	B4A0 E6 04	LDB 4,X	;Number of dimensions	02549	B433 27 06	BEQ	;Yes	02600	B4A0 E6 04	LDB 4,X	;Number of dimensions
02550	B435 EC 02	LDD	;Array size					02550	B435 EC 02	LDD	;Array size				
02551	B437 30 8B	LDX	;Bump over array					02551	B437 30 8B	LDX	;Bump over array				

Line Number	Object Address	Mnemonic	Operand	Object Code	Unit Address	Project Code	Mnemonic	Operand	Object Code	Unit Address	Project Code	Jake's Comment
02552	B439	EF			B4A2	D7 03	STB	<3		B4A2	D7 03	;Save it
02553	B43B	C6 12	\$B42A		B4A4	4F	CLR			B4A4	4F	;Initialize offset to variable
02554	B43D	96 05	\$12		B4A5	5F	CLRB			B4A5	5F	;in D
02555	B43F	26 0B	<5		B4A6	DD 64	STD	<\$64		B4A6	DD 64	;Save for multiply
02556	B441	D6 03	\$B44C		B4A8	35 06	PULS	A,B		B4A8	35 06	;Last element required first
02557	B443	E1 04	<3		B4AA	DD 52	STD	<\$52		B4AA	DD 52	;Hold
02558	B445	27 59	4,X		B4AC	10A305	CMPD	5,X		B4AC	10A305	;Within defined bounds?
02559	B447	C6 10	\$B4A0		B4AF	24 3A	BHS	\$B4EB		B4AF	24 3A	;BS Error if not
02560	B449	8C C608	\$10		B4B1	DE 64	LDU	<\$64		B4B1	DE 64	;Current offset
----	B450	C608	#8		B4B3	27 04	BEQ	\$B4B9		B4B3	27 04	;If zero
02561	B44C	7E AC46	\$AC46		B4B5	8D 17	BSR	\$B4CE		B4B5	8D 17	;Compute offset
					B4B7	D3 52	ADDD	<\$52		B4B7	D3 52	;Plus required element
					B4B9	30 02	LEAF	2,X		B4B9	30 02	;Bump ptr to next element tally
					B4BB	0A 03	DEC	<3		B4BB	0A 03	;Done all DIMs?
					B4BD	26 E7	BNE	\$B4A6		B4BD	26 E7	;Continue if not
					B4BF	ED E3	STD	,--S		B4BF	ED E3	;Hold
					B4C1	58	ASLB			B4C1	58	;Multiply
					B4C2	49	ROLA			B4C2	49	;*by
					B4C3	58	ASLB			B4C3	58	;*four
					B4C4	49	ROLA			B4C4	49	;*then
					B4C5	E3	ADDD	,S++		B4C5	E3	; * times five (5 bytes/variable)
					B4C7	30 8B	LEAX	D,X		B4C7	30 8B	;Add offset to array start
					B4C9	30 05	LEAX	5,X		B4C9	30 05	;Bump over array information
					B4CB	9F 39	STX	<\$39		B4CB	9F 39	;Save variable pointer
					B4CD	39	RTS			B4CD	39	

Line Number	Object Address	Mnemonic	Operand	Object Code	Unit Address	Project Code	Jake's Comment
02562	B44F	CC 0005	#5		B4C1	58	;Initialize numbr of bytes/element
02563	B452	DD 64	<\$64		B4C2	49	;Save it
02564	B454	DC 37	<\$37		B4C3	58	;Variable name
02565	B456	ED 84	<3		B4C4	49	;To array
02566	B458	D6 03	<X		B4C5	E3	;# dimensions
02567	B45A	E7 04	4,X		B4C6	0B	;To array
02568	B45C	BD AC33	\$AC33		B4C7	30 8B	;Check memory space
02569	B45F	9F 41	<\$41		B4C9	30 05	;Save pointer
02570	B461	C6 0B	#0B		B4CB	9F 39	;Default number of dimensions
02571	B463	4F			B4CD	39	;To D
02572	B464	0D 05	<5				;Dimensioning?
02573	B466	27 05	B46D				;No, use default # elements
02574	B468	35 06	A,B				;Number of specified elements

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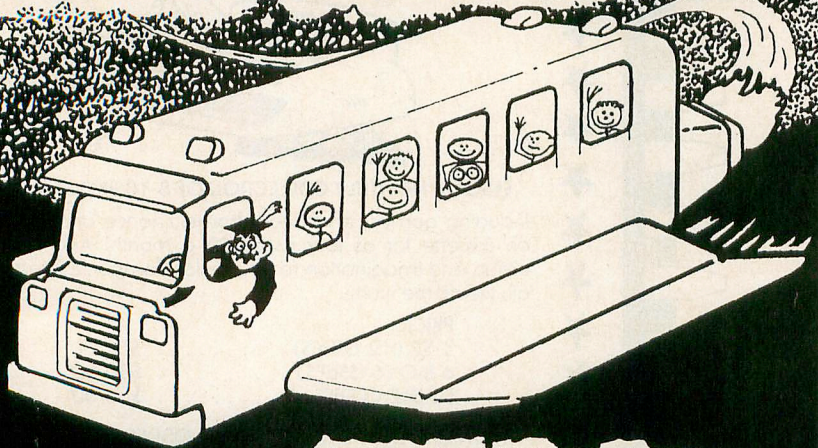
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GOTO School



by Dr. Paul Kimmelman

WHILE PONDERING TOPICS for the December education column it became obvious that rather than to write about new subjects, or even to continue with scheduled topics, it would be more appropriate to review the Year of the Color Computer and perhaps make an "Educational Stocking Stuffer Wish List." As we approach the holiday season and a new year, it becomes more apparent that the Color Computer is here to stay.

I look back 18 months when many people were telling me not to buy the Color Computer for education. Today I am happy that my closest colleagues persisted in their recommendation that we place our faith in Radio Shack and proceed with the Color Computer. Yes, there were those who predicted Radio Shack would discontinue the Color Computer; now we know that prediction was incorrect. In fact, we have one more model, as well as a new model with additional peripherals.

Some folks predicted Radio Shack wouldn't provide software or educational support; now we know *that* isn't true either. Approved educational institutions can receive a 20 per cent discount from Radio Shack on the purchase of equipment and software. Further, the Radio Shack education division, headed by Bill Gattis, has a national network of education consultants. There are also a variety of audio-visual computer literacy materials available from Radio Shack to help train teachers needing in-service education on computers. And look at the new educational software made available by Radio Shack and other software

companies! Their efforts don't give me the impression of a computer on the way out.

1983 will be recorded as the year that made the Color Computer a realistic educational purchase. The cost remained competitive in an extremely volatile market. Hopefully, some pricing stability will begin to emerge. This is particularly important to the education market because service, consultation, support, and future software and equipment development needs must fit tight budgets. A \$99 computer will not result in corporate support over a long period of time. Fortunately, Radio Shack has a history of improvements with compatibility for older equipment.

Software

Educational software releases were a highlight of 1983. I feel the most important was Color Logo. For \$49.95, the user receives an excellent version of Logo with an equally excellent manual. It didn't stop there, however. Color Logo was succeeded by two teacher's resource manuals to assist with Logo instruction. The manuals are well-written and very helpful to the classroom teacher. Further, the education division of Radio Shack has gone one step beyond in its approach to the education market with an interesting concept. A parent's guide to Logo was also released signifying a sincere interest in the home educational use of the Color Computer.

In addition to Color Logo, Radio Shack released a variety of other educational

software. Programs such as Color Math, Color Chemistry, Vector Addition, and Color Calculus have begun to establish the Color Computer for high school use. The Children's Computer Workshop programs along with Professor Pressanote are outstanding, and will undoubtedly be extensively used in elementary schools.

The Follet Library Publishing Co. chose to make 1983 its entry year into the Color Computer software market. Andy Larson, Follett's Computer Division Director, made the widely acclaimed Learning Company programs available to Color Computer users. One of the programs, Moptown, is a must for educators. It is motivating and requires critical thinking and analysis. It is hard not to say you must have the other programs as well. Juggles' Rainbow, Bumble Games, Bumble Plot, and Magic Spells are all excellent and should find their way into your school's software library.

Dorsett Educational Systems introduced its talk-tutor programs in Language Arts, Math, and Science. Officials from Dorsett are also predicting that many more programs for educators will be released in the near future.

Tom Mix expanded his offerings of educational software with programs like Story Problems. In addition, Mix continues to offer Teacher's Database, a utility that lets teachers maintain information files about their students.

Other software developers have had an impact on the education market. There are programs for reading, math, alphabet, history, and a host of other topics.

Other Goodies

The database is beginning to emerge as an important part of the educational curriculum. While 1983 would not be considered a banner year for database use in education, it was a year which saw plans being developed by CompuServe to better serve the home and school education market. Once a cost structure is developed that schools can afford, I am certain database use will become as common as going to the school library. We are working closely with officials from CompuServe, so continue to follow this column for future developments.

Peripherals also entered the Color Computer educational-use arena. For those who wanted to use a monitor instead of a television, a cable from Cheshire Cat was introduced. This cable is unique because it can be used with a monochrome monitor and a color monitor. This is a valuable asset to those who

need color graphics and word processing. The Cheshire Cat cable, coupled with an Amdek Color I monitor, is an excellent configuration and eliminates annoying screen interference.

Amdek also entered the Color Computer market with its three-inch double disk drive. Technical experts have told me it is a quality peripheral and can be an excellent way to add drives 1 and 2 while using the Radio Shack 5-1/4 inch drive 0.

For "gamers" (and I don't think it would be fair to separate educators from "gamers"), joysticks emerged everywhere. It should also be emphasized that educational programs such as Math Bingo require joysticks. Wico, probably the largest joystick company, released its new analog joystick designed for the Color Computer.

Stocking Stuffers

What December issue would be useful if it didn't include some ideas for "stocking stuffers?" I will restrict my suggestions to products for education, yet, there are some great games I wish I had!

My first thoughts are for the most forgotten aspect of our computer, maintenance. Why not ask for Dust-Off II and Stat-Off II from Falcon Safety Products?

These items are also available in a system kit which is designed to be a complete cleaning and maintenance kit for your computer. It is a quality package and should be a regular part of your computer use plan. The system kit has a suggested retail price of \$42.50, with refills available. Photographers have long attested to the quality of Dust-Off products.

Next, a modem and gift certificate to CompuServe. These two items really open a new dimension to computer use. The price of modems has come down and weekend/evening use of CompuServe is reasonably priced. Remember, you will need a terminal software package to use these gifts.

If you have been cassette-loading your programs, a disk drive would be a great addition to your equipment. If you already have a disk drive, what about a box of disks? No more running out when you most need them. Or, if you are a disk user, a quality disk storage box would be welcome. Now you can store your disks in an organized manner.

There really is no need to repeat a list of all the software available. New programs are always a welcome addition to a software library.

If you have been storing your equip-

ment on card tables and chairs, new furniture would be an exciting present. Gusdorf Computer Furniture offers economical and "good-looking" modular furniture. There are options available to continually expand your office as you add additional equipment.

For the computer user who has everything, consider additional selections for his or her book library. There are hundreds of books that cover almost every topic relating to computers.

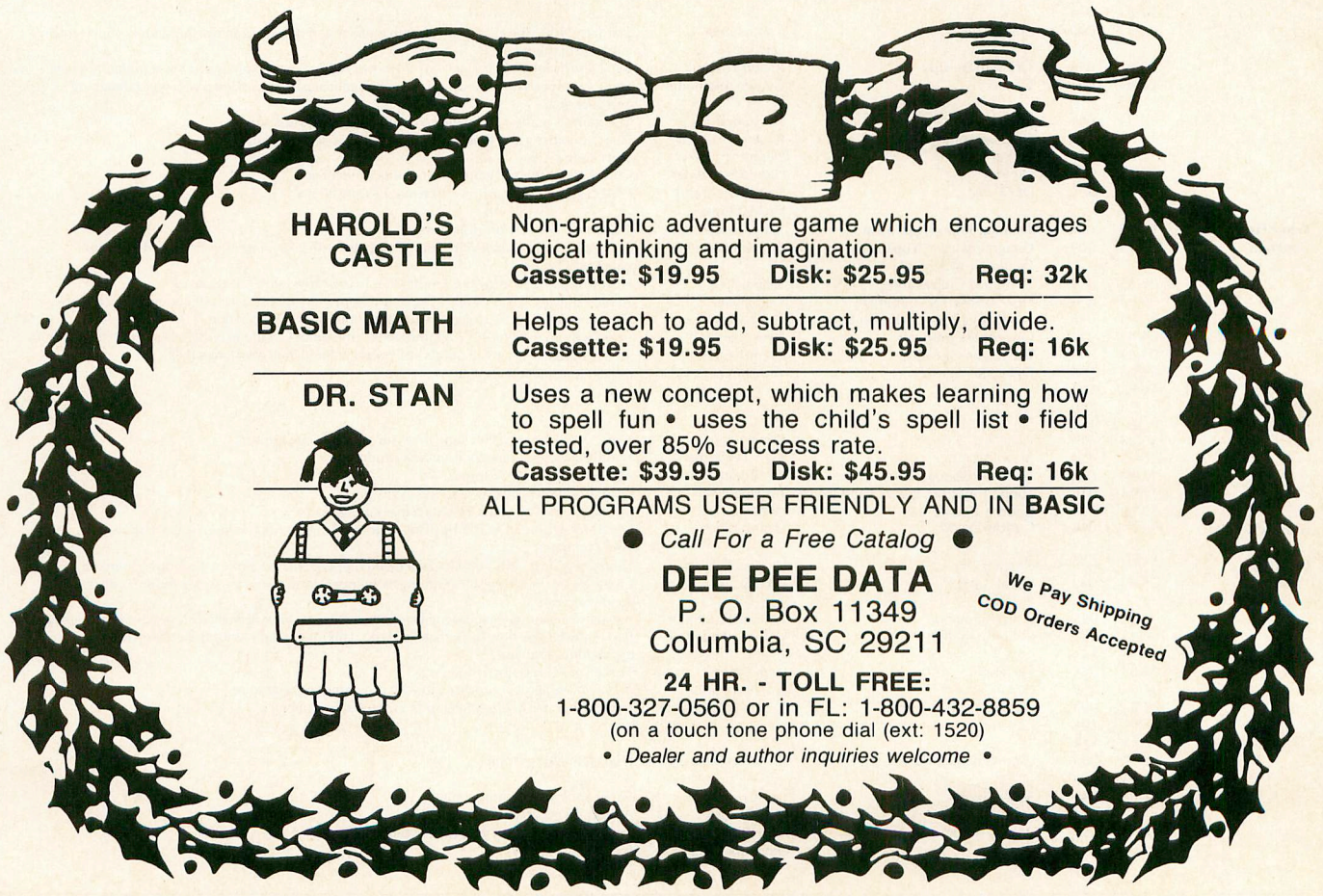
This has been an exciting year for Color Computer users. Next year should be even better. There is no doubt that a computer has become a major part of our daily lives. It has become a welcome addition to the school curriculum as well.

Next month I will return to our regular column. Features will include a school computer furniture lab, what to look for when evaluating software, learning styles, Logo, and responses to your questions.

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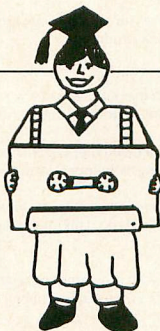
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1983 Article Index

Category	Issue	Pg. No.	Title of Article	Author	Description	
Communications:	03/83	014	Hello World!	Bob Rosen	The right software package, a modem, a telephone, and this article will turn your computer into a communications device.	
Construction:	07/83	012	CC Furniture	Brian H. Alsop	Neaten up your computer room: we've got the plans to show you how.	
	08/83	022	Indoor/Outdoor Thermometer	Theodore Hasenstaub	Hey, it's really cold outside—and in here! Just how cold is it? Turn your CC into a fancy thermometer.	
Education:	03/83	048	Tick Talk	Richard Ramella	Using a standard clock face and some good old fashioned advice, teach your child how to get home in time.	
	04/83	038	CC Speller	Lynn Davis	Learning how to spell was never this much fun. Input a spelling list and let your child have a go at it.	
	05/83	010	Language Teacher	Scott L. Norman	Parlez-vous Basic? Doesn't matter, that's not the language we have in mind. French, Spanish, German are!	
	05/83	048	Musical Flash Cards	R.F. Miller	A program to teach youngsters (and oldsters) music, note by note. The Program, NoteCard, uses graphics...	
	06/83	026	Math Drill	James Sanford	This program will teach math to students of different grade levels.	
	08/83	018	GOTO SCHOOL—Series	Dr. Paul Kimmelman	Teachers! Ever wonder what a computer can really do for you and your students?	
	09/83	074				
	10/83	074				
	12/83	044				
	08/83	052	Learning Games	David Stevens	These spelling and state capital teaching games are too much fun to restrict to kids.	
	09/83	015	Your Color Computer—A Tutor	Shirley Georgi	A computer in the hands of a skilled teacher is better than no computer and an overworked teacher.	
	09/83	032	Color Computing for Kids—Series	Jean Plesser	What's better than peanut butter? This series, teaching kids how to use a Color Computer.	
	10/83	049				
	11/83	020				
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	Fiction:	09/83	064	Children's Computer Workshop	Kerry Leichtman	What do Sesame Street and Radio Shack have in common?
		09/83	099	Teaching Computers to Teach	J. Craig Dickinson	Color Logo makes computer literacy easy and fun.
06/83		040	The Restaurant at the End of the Universe	Douglas Adams	Chapter 3 excerpted from the second book of the bestselling sci-fi trilogy, <i>The Hitchhiker's Guide To The Galaxy</i> .	
Finance:	08/83	030	Flexible Amortization	Mel Seder	Make your banker jealous with this program that will make any amortization program easier.	
	Game:	03/83	024	Field of Honor	Scott L. Norman	Your squire readies your mount as your opponents line up to battle you for the hand of one of the king's daughters.
Game:	04/83	008	Musical Tales	Robert Toscani	A game for the verbose. Collaborate with your computer to write a story and then put your prose to music.	
	04/83	032	The Sorcerer's Puzzles—Series	Richard Ramella	The first step in becoming a Sorcerer's apprentice is solving these brain-teasing puzzles.	
	07/83	032				
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	05/83	040	Space Trek	Commander & Leichtman	Stardate 2906. The galaxy once again is endangered by Klingon warships. Only you, Captain, can save mankind.	
	08/83	048	GO SUB Destroy	Robert Toscani	Sub Destroy for 4K machines—what more could a fleet captain want? Many difficulty levels.	
	08/83	078	Cliché	George Afamonow	Here's a game that will show off your computer at parties, and keep your guests laughing and guessing.	
	10/84	064	Orbit!	Tom Goodrick	This game is really a simulation that will require all your skill.	
	10/83	107	Cryptography	Robert L. Garrett	Here's another game that really is—or can be—serious business.	
	11/83	046	Slither	Stephen P. Allen	Slip-Sliding Away.	
	12/83	063	Dreidel	Harold Schneider	Computerize this top game for your kids, and for you.	
	12/83	072	DEFENSE!	Shawn Diehl and Jim McDowell	Protect your cities & fortress from missiles and aliens.	
Game Fix:	07/83	046	Damage Report, Mr. Scott	Jamie Tietjen	CC Space Trek for non-disk users.	
	General:	03/83	Congratulations, You Own an Incredible Machine!	Jake Commander	Being taken on a tour of your Color Computer with Jake is like traveling the Mississippi with Mark Twain.	
Game:	06/83	019	Computer Club Primer	Shawn Jipp	How to organize the Color Computerists in your area into a Users Group.	
	06/83	030	How to Shop for Equipment	Keith Baker	Avoid costly mistakes by applying smart shopping awareness to your computer purchases.	
	07/83	048	Family Outing—Computer Style	Tim & Debra Cole	Observing the Color Computer Club of Youngstown, OH in action.	
	08/83	012	One More Computer	Jyym Pearson	Learn why an Adventure programmer feels the Color Computer is more of a Ferrari than a Pinto.	
	09/83	095	The Jargon Generator	Glenn Knight	Talk to bureaucrats, technocrats and pseudocrats in their own languages.	
	09/83	108	DEFUSR—Series	Terry Kepner	A question and answer column.	
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12/83	018	Topo, Armotron, Poorbot and "Mim"	Tom Juergens	Color Computers talking to robots? Why not!		
12/83	124	Country Cousin	John C. Grier	Geographically isolated? Contact the outside world.		
Graphic Utility:	06/83	046	Custom Color	Dennis Kitsz	Create a neat, clean, scrolling display for your store, school, home, or just to show off your computer.	
Graphics:	03/83	020	Chapter 7	William Barden, Jr.	This excerpt from Bill's book, <i>Color Computer Graphics</i> examines the Draw command.	
	03/83	032	Spiral Galaxy	Lynn Davis	Create a galaxy using polar graphing techniques. Watch stars explode, and the birth of the universe.	
	05/83	025	Color Animation	William Barden, Jr	Age-old animation techniques combine with sound programming methods to create moving graphics.	
	06/83	032	Color Animation	William Barden, Jr	Part I showed you how to animate in Basic. This final installment applies the techniques to machine language.	
	06/83	064	Rectangle..	Lynn Davis	Teach your computer to doodle.	
	07/83	039	DYE It	H. Allen Curtis	Add a new graphics command to your programming repertoire.	
	10/83	094	Graphics? Yes!—Series	S. Bain & A. Chartier	This is the first of a series on graphics aimed at beginners.	
	11/83	104				
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	11/83	065	Unforgettable Characters	William Barden, Jr.	User-definable graphics.	
	12/83	100				
	11/83	015	Super Spiro!	Jake Commander	Super and hyper-spirographics!	
	11/83	031	Star	David Laut	A short, sweet graphics treasure.	
	12/83	050	Display Modes	Steve Bjork and Mark Randall	Double the number of your hi-res colors.	

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Hardware:	03/83	040	Custom Color	Dennis Kitz	Upgrade your computer from 4K to 16K, and 16K to 32K. Also install the circuitry to connect to a color monitor.	
	04/83	028	Custom Color	Dennis Kitz	Connect your Color Computer to other electrical devices. First in a two-part series.	
	05/83	016	Install a Power-on Light	Tom Garcia	Complete this easy and inexpensive project and you'll never accidentally leave your computer on overnight.	
	05/83	055	Custom Color	Dennis Kitz	With all the theory explained in April's issue, it's now time to put it all to use.	
	07/83	016	Custom Color	Dennis Kitz	Blow the doors off 64K with a 128K bubble memory upgrade.	
	08/83	033	Custom Color	Dennis Kitz	Ever wished your computer could produce characters in Kata Kana? Dennis show us how-and doesn't stop there.	
	09/83	078	Custom Color	Dennis Kitz	Give your MC-10 more memory.	
	Home Mgmt:	03/83	028	Your Basic DBM	Paul Detwiler	Managing your records is simple and quick with this very basic file manager.
		05/83	036	How to Borrow Money	Paul Detwiler	Use the program to better understand the amortization schedule of money lent to you.
		06/83	060	Sweet Add-A-Line	Richard Ramella	Make itemizing shoebox-stored receipts easier using this personal accounting program.
09/83		102	Refunding	Brian Alsop	Saving money's important—now you can save time saving money.	
Sound:	07/83	068	Zounds! Sounds!	William Barden, Jr	Teach your Color Computer to speak up.	
	06/83	036	How to Write Good Documentation	Kathleen Gill	Adventure Intl's documentation writer Gill explains the do's and don'ts of writing program documentation.	
Tutorial:	07/83	055	Dissecting Your Rom—Series	Jake Commander	The first of a 12-part series examining the Color Computer ROM, bit by bit.	
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	07/83	064	What is Color Disk Basic?	Franklyn D. Miller	A guide to help you decide if Disk Basic is for you before you spend the money.	
	09/83	049	Talk Together	Bill Barden	Make your MC-10 and your Color Computer share programs.	
	11/83	090	Custom Color	Dennis Kitz	Part I of the most incredible computer music you ever heard.	
	12/83	020	Custom Color	Dennis Kitz	More music programming from the maestro.	
	Utility:	03/83	016	Stash a Directory	Douglas L. Swank	One short utility to hide an extra disk directory and another to find it if the original ever bombs out.
		04/83	015	Reformat Your Video	Steve Odneal	Expand your video screen from 32 to 51 characters per line, and get a true upper/lowercase character set...
		04/83	046	The Map	Jake Commander	Programming in machine language made easier. The most complete Color Computer memory map ever published.
		05/83	019	Condense Your Programs	D.E. Wood	By using multi-line statements, you can increase program execution speed and conserve memory.
		06/83	068	Color Disassembler	Jake Commander	Assembly-language programmers rejoice, here's a disassembler just for you.
		07/83	052	GOTO Where?	D.E. Wood	Use this utility to trace your program's routes.
08/83		060	Wide Printing	Robert Lake	Color Scripsit takes on a new look with this w-i-d-e printing.	
08/83		066	RECOVER!	Kenneth Van Camp	No..No! Don't hit that Reset button! Oh—too late. Or is it? This program can help you out.	
11/83		096	One-Finger Hexload	Jim Norman	Save time storing and editing hex byte lists.	

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Display Modes

A demonstration to put changing display modes into your graphics programs!



by Steve Bjork with Mark Randall

HAVE YOU EVER wished your Color Computer could display more than four solid colors in the highest resolution modes? Let me show you a technique to get up to eight solid colors in the highest modes. You can also use this technique to mix the text mode and any high resolution mode on the same screen at one time. You can even mix any number of high resolution modes together on the same screen. We're able to perform this magic thanks to the 6809E's powerful interrupt abilities (see the box, "Interrupts").

Other computers, such as Atari's 400 and 800, have special hardware arrangements that allow them to change colors

as the screen is redrawn each sixtieth of a second. The Color Computer doesn't have a few of these special hardware goodies some other computers have, but it does have something which is just as useful: the 6809E microprocessor!

When I have worked with Atari programmers, they would often brag about the imagined superiority of their systems' graphic capabilities compared to those of the Color Computer. To get a little sweet revenge, I would use the power of the 6809E to emulate, through software, what it took special hardware for them to do. (Thanks Motorola!) As a matter of fact, I used some of those special techniques when I designed the arcade game Zaxxon.

Inside The Computer

The computer's graphic mode and colors are determined by the VDG (Video Display Generator). The VDG gets information about the display mode it should be in from an I/O (Input/Output) chip called the PIA (Peripheral Interface Adapter). PIA 1 is located at address 65314 (FF22 hexadecimal); when Basic executes a PMODE or Screen command, this is the location where the computer puts a new value.

There are five control lines from port B of PIA 1 to the VDG; bits 3 - 7 of any value stored at address \$FF22 may change these control lines and, in turn, change the VDG and the image being displayed. For example, changing bit 3 from 0 to 1 will cause the text mode to go from green to red. (This is what happens when a SCREEN 0,1 instruction is executed in Basic.) For more detailed information on the way the PIA and VDG work together, see the references listed at the end of this article.

To see a demonstration of directly changing display modes, try Running the program in Listing 1. It should cause the screen to alternately flash green and red, giving a stripe effect. Notice that the screen sometimes appears to be both red and green at the same time! This is where the core of our technique lies. (Press any key to exit the program.)

What you see on your screen is merely a representation of part of the memory in your Color Computer; this is called *memory-mapping*. How the VDG interprets what it finds in your computer's memory depends on the mode you have set it in through address \$FF22. Sixty times every second, the VDG looks at memory and puts what it finds on the screen. This is known as screen refresh. Listing 1 rapidly changes the way the VDG interprets that screen data.

The program sometimes displays two different modes at the same time because every once in a while it changes the value in \$FF22 while the VDG is in the middle of doing a screen refresh. So, why isn't the top half of the screen green and the bottom half red? Well, the problem lies in timing.

Basic is fine for timing things in terms of minutes and seconds, but it cannot provide the accurate timing in millisecond intervals that we require. Fortunately, we can rely on the 6809E's interrupts to do the dirty work for us.

Expanding the Technique

Program Listing 2 must be entered using an editor/assembler; the compan-

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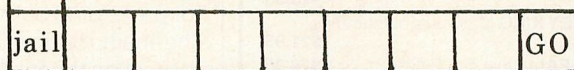


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ion Basic driver program is contained in Listing 2b. When you Run this program, you will see six different modes displayed on the same screen at the same time. First is the normal text mode, followed by inverse (red) text. Next is PMODE 3 SCREEN 0; 24 scan lines later, the VDG setting is switched to PMODE 3 SCREEN 1, which is displayed for another 24 scan lines; and then the mode is changed to PMODE 4 SCREEN 0, which is then changed to PMODE 4 SCREEN 1 (artifacting). The Break key will exit the program.

Essentially, this program babysits the VDG as it moves down the screen drawing each scan line. The process begins when the program picks up the vertical-blanking interrupt from the VDG (indicating that it is going to start drawing a new screen). Every time the VDG finishes drawing one of the scan lines (there are 192 scan lines displayed per screen) it sets the horizontal sync flag. The program counts 24 flags (lines) down and then switches display modes. After the last mode has been set, the processor returns to the main program while the rest of the screen is drawn un-interrupted (pun intended).

There are actually 262 scan lines, but only 192 of them are displayed. This means there are about 35 undisplayed scan lines off the top or bottom of the screen. These extra lines leave more time for processing between screen refreshes. The main routine of the program scrolls the text on the top of the screen and then checks for the Break key signal while it waits for the VDG to generate another vertical blanking interrupt so it can babysit another screen.

Program Details

Line 800—Program loads at \$3F00. Be sure to use a CLEAR 50,&H3EFF before loading.

Line 1000—START is the EXEC point of program. Turn off the IRQ by resetting the IRQ mask bit in the PIA control registers at \$FF01 and \$FF03.

Line 1600—Save old IRQ RAM vector in temporary location called OLDIRQ.

Line 1900—Now, point to our new IRQ subroutine called IRQ.

Line 2200—COLOR is a table of color patterns. The program uses Basic's start of graphic screen pointer at \$BA because start of screen is different for tape and disk systems. Skip over four 32-byte rows used by the two text modes.

Line 2500—Set up count of 24 color rows per mode.

Line 2800—Set up count of bytes per row.

Line 3100—Store color pattern in blocks of four rows.

Line 3500—Do this again for the whole row.

Line 3700—Did we do all 24 patterns?
 Line 3800—No, then loop back until we're done.

Line 4100—Enable vertical blanking interrupt by storing the IRQ mask in the control register.

Line 4300—Enable the 6809's IRQs.

Line 4500—This is the main program loop. The first routine makes the text appear to scroll in the top four text lines by incrementing each byte. AND #127 keeps the values text, not graphics.

Line 5500—SYNC tells the 6809E to wait for an interrupt. In this case, SYNC with

Interrupts

Interrupts are input that the processor examines before it executes each instruction; they allow the computer to react to asynchronous events without constant monitoring. An interrupt system is like a bell on a telephone; it rings when a call comes in so you don't have to constantly pick up the phone to see if someone is on the line. When an interrupt happens, the processor is alerted and is forced to service the device. By using the interrupt system, the computer can use most of its time for the task at hand without having to stop and scan for every potential source of input.

One interrupt I use in almost every program is the *vertical-blank interrupt*. This interrupt is generated by the VDG every time it has finished drawing a screen (60 times a second).

Using the interrupt allows my program to go on with the task of running the game, but still can keep track of the timing needed in different routines. Another use for this interrupt is to synchronize the program's graphics to the VDG's screen drawing. The screen would not have clean graphics if we were to change data while the screen is being drawn. The SYNC instruction can be used to synchronize the graphic subroutine with the VDG. SYNC is like a "wait for interrupt" command or, in this case, a "wait for the VDG to finish drawing the screen before changing the VDG graphic data." For more information on interrupts or the SYNC instruction, see Lance Leventhal's *6809 Assembly Language Programming*.



the vertical blank so the text is moved 60 times every second, and synchronizes the program to the screen's refresh. Line 5600—Check for the Break key, reset the old IRQ vector, and exit to Basic if it was down.

The IRQ Subroutine

This is where the modes are actually mixed. It always starts as the VDG begins to draw the screen.

Line 6500—Clear the flag of the H-blank by reading the data register.

Line 6700—Select green text mode by resetting all the PIA control lines.

Line 6900—Clear SAM register 0—2 for text screen size.

Line 7300—Wait 37 blank lines plus two text lines before going to red text mode.

Line 7600—After 24 scan lines (two text rows) select red text mode for 24 more scan lines.

Line 8200—Select high-resolution mode and continue changing mode every 24 scan lines.

Line 10900—Clear IRQ by reading from data register (similar to Line 6500).

Line 11000—Exit IRQ and return to main program.

Line 11300—SYNC subroutine waits for a sync or timing pulse from H-blank at the end of each scan line, and then clears it. The push and pull are timing delays needed for a clean screen.

Line 12000—SCOUNT counts the number of scan lines by using the SYNC subroutine. This allows the program to know when to change modes.

Line 12600—COLOR is the table of color values used to set up the patterns on the screen.

Line 15900—OLDIRQ is temporary storage for the original IRQ vector until it is restored upon exiting.

Line 16100—END assigns the label START as the execute address of the program.

Conclusion

I hope you have found this demonstration interesting. Remember that this is just a demo, and it is up to you to take this technique and add your creativity to make it useful. ■ ■ ■

References

- *Color Computer Technical Reference Manual*; Tandy (26-3193).
- *MC6809E Microprocessor Programming Manual*; Motorola Semiconductor Products (M6809PMAD).
- *6809 Assembly Language Programming*; Lance Leventhal, McGraw-Hill (ISBN 0-931988-35-7).

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Program Listing 1. Stripes

```

10 POKE 65314,0
20 IF INKEY$<>" " THEN 50
30 POKE 65314,8
40 IF INKEY$=" " THEN 10
50 POKE 65314,0      ■ ■ ■
    
```

Program Listing 2. Sync Test

```

00300 * THIS PROGRAM SHOWS HOW TO DISPLAY MORE THAN ONE
00400 * GRAPHIC MODE ON THE SAME SCREEN SIMULTANEOUSLY.
00500 *
00600 *      USE <BREAK> TO EXIT THIS PROGRAM
00700
3F00      00800      ORG      $3F00
00900
3F00 86      36      01000 START LDA      #$36      DISABLE IRQ LINE ON PIA
3F02 B7      FF01    01100      STA      $FF01    HORZ. SYNC
3F05 B7      FF03    01200      STA      $FF03    AND VERT. SYNC
3F08 1A      50      01300      ORCC     #$50
01400
01500
3F0A BE      010D    01600      LDX      $10D
3F0D BF      3FD8    01700      STX      OLDIRQ   SAVE OLD IRQ SUBROUTINE
01800
3F10 8E      3F63    01900      LDX      #IRQ     AND USE OUR IRQ SUBROUTINE
3F13 BF      010D    02000      STX      $10D
02100
3F16 CE      3FC0    02200      LDU      #COLOR   LET'S PUT SOME COLORS & PATTERNS
3F19 9E      BA      02300      LDX      $BA      ON THE SCREEN
3F1B 30      89 0080 02400      LEAX    32*4,X
3F1F C6      18      02500      LDB      #24
3F21 34      04      02600      PSHS    B
02700
3F23 C6      20      02800 CLEAR1 LDB      #32
3F25 A6      C0      02900      LDA      ,U+
03000
3F27 A7      89 0300 03100 CLEAR2 STA      24*32*1,X
3F2B A7      89 0600 03200      STA      24*32*2,X
3F2F A7      89 0900 03300      STA      24*32*3,X
3F33 A7      80      03400      STA      ,X+
3F35 5A      03500      DECB
3F36 26      EF      03600      BNE     CLEAR2
3F38 6A      E4      03700      DEC     ,S
3F3A 26      E7      03800      BNE     CLEAR1
3F3C 35      04      03900      PULS    B
04000
3F3E 86      37      04100      LDA      #$37     TURN ON VERT. BLANK IRQ
3F40 B7      FF03    04200      STA      $FF03
3F43 1C      EF      04300      ANDCC   #$EF
04400
3F45 9E      BA      04500 MAIN   LDX      $BA     MAIN LOOP
3F47 A6      84      04600      LDA      ,X     CHANGE THE TEXT SCREEN DISPLAY
3F49 C6      80      04700      LDB      #32*4  TO SEE ALL THE CHR'S
04800
3F4B 4C      04900 MAIN2  INCA
3F4C 84      7F      05000      ANDA    #127
3F4E A7      80      05100      STA      ,X+
3F50 5A      05200      DECB
3F51 26      F8      05300      BNE     MAIN2
    
```

♦ more

Program Listing. Basic Driver

```

10 PMODE 4,1
20 PCLSO
30 CLEAR 50,&H3EFF
40 LOADM"SYNCTEST"
50 SCREEN 1,1
60 POKE &HFF40,0
70 EXEC
80 PRINT"ALL DONE"
90 END      ■ ■ ■
    
```


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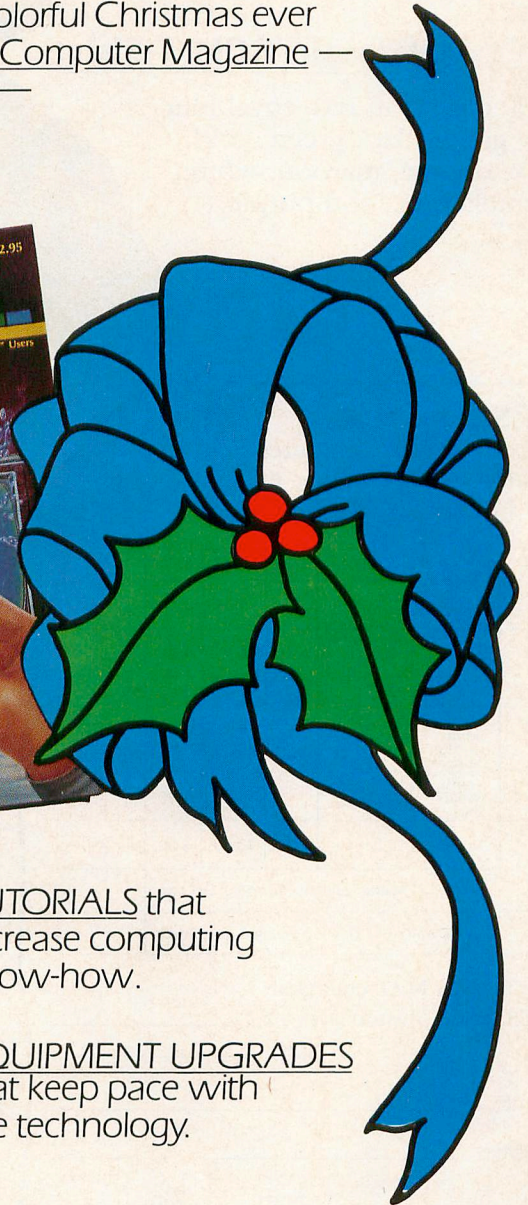
			05400			
3F53	13		05500		SYNC	SYNC W/ THE VERT. BLANK
3F54	AD	9F A000	05600		JSR	[\$A000] CALL KEYBOARD SCAN ROUTINE IN ROM
3F58	81	03	05700		CMPA	#3 TEST FOR A <BREAK> KEY
3F5A	26	E9	05800		BNE	MAIN LOOK AGAIN IF <BREAK> NOT PRESSED
			05900			
3F5C	BE	3FD8	06000		LDX	OLDIRQ IF <BREAK> PRESSED THEN
3F5F	BF	010D	06100		STX	\$10D RESET THE OLD IRQ SUBROUTINE
3F62	39		06300		RTS	AND RETURN TO BASIC
			06400			
3F63	B6	FF00	06500	IRQ	LDA	\$FF00 CLEAR HORZ. SYNC
			06600			
3F66	7F	FF22	06700		CLR	\$FF22 SET GREEN TEXT MODE ON VDG
			06800			
3F69	B7	FFC0	06900		STA	\$FFC0 AND TELL THE SAM ABOUT IT TOO
3F6C	B7	FFC2	07000		STA	\$FFC2
3F6F	B7	FFC4	07100		STA	\$FFC4
			07200			
3F72	C6	3D	07300		LDB	#37+12*2 DO TWO TEXT LINES
3F74	8D	44	07400		BSR	SCOUNT
			07500			
3F76	86	08	07600		LDA	#8 SET RED TEXT MODE
3F78	B7	FF22	07700		STA	\$FF22
			07800			
3F7B	C6	18	07900		LDB	#12*2
3F7D	8D	3B	08000		BSR	SCOUNT DO TWO MORE TEXT LINES
			08100			
3F7F	86	E0	08200		LDA	#\$E0 SET PMODE 3 W/ SCREEN 1,0 (GREEN)
3F81	B7	FF22	08300		STA	\$FF22 TELL VDG
			08400			
3F84	B7	FFC3	08500		STA	\$FFC3 AND SAM
3F87	B7	FFC5	08600		STA	\$FFC5
			08700			
3F8A	C6	18	08800		LDB	#24
3F8C	8D	2C	08900		BSR	SCOUNT WAIT 24 SCAN LINES
			09000			
3F8E	86	E8	09100		LDA	#\$E8 SET PMODE 3 AND SCREEN 1,1 (BUFF)
3F90	B7	FF22	09200		STA	\$FF22 TELL VDG
			09300			
3F93	C6	18	09400		LDB	#24
3F95	8D	23	09500		BSR	SCOUNT WAIT 24 SCAN LINES
			09600			
3F97	86	F0	09700		LDA	#\$F0 SET PMODE 4 W/ SCREEN 1,0 (GREEN)
3F99	B7	FF22	09800		STA	\$FF22 AND TELL VDG
			09900			
3F9C	C6	18	10000		LDB	#24
3F9E	8D	1A	10100		BSR	SCOUNT AND WAIT 24 SCAN LINES AGAIN
			10200			
3FA0	86	F8	10300		LDA	#\$F8 SET PMODE 4 W/ SCREEN 1,1 (BUFF)
3FA2	B7	FF22	10400		STA	\$FF22 AND TELL VDG
			10500			
3FA5	C6	18	10600		LDB	#24
3FA7	8D	11	10700		BSR	SCOUNT AND WAIT 24 SCAN LINES
			10800			
3FA9	B6	FF02	10900		LDA	\$FF02 CLEAR PIA'S IRQ VERT. BLANK FLAG
3FAC	3B		11000		RTI	EXIT IRQ
			11100			
			11200			
3FAD	B6	FF01	11300	SYNC	LDA	\$FF01 WAIT FOR VDG TO GENERATE SYNC
3FB0	2A	FB	11400		BPL	SYNC AT THE END OF SCAN LINE
3FB2	B6	FF00	11500		LDA	\$FF00
3FB5	34	34	11600		PSHS	X,Y,B TIME DELAY FOR 10 CLOCK CYCLES
3FB7	35	34	11700		PULS	X,Y,B TIME DELAY FOR 10 CLOCK CYCLES
3FB9	39		11800		RTS	
			11900			
3FBA	8D	F1	12000	SCOUNT	BSR	SYNC WAIT FOR "B" SCAN LINES
3FBC	5A		12100		DECB	TO BE DRAWN
3FBD	26	FB	12200		BNE	SCOUNT THEN RETURN
3FBF	39		12300		RTS	
			12400			
			12500			
3FC0	00		12600	COLOR	FCB	0 COLOR TABLE TO GENERATE

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3FC2	55	12800	FCB	\$55		
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3FC4	AA	13000	FCB	\$AA		
3FC5	AA	13100	FCB	\$AA		
3FC6	FF	13200	FCB	\$FF		
3FC7	FF	13300	FCB	\$FF		
		13400				
3FC8	44	13500	FCB	\$44		
3FC9	11	13600	FCB	\$11		
		13700				
3FCA	88	13800	FCB	\$88		
3FCB	22	13900	FCB	\$22		
		14000				
3FCC	99	14100	FCB	\$99		
3FCD	66	14200	FCB	\$66		
		14300				
3FCE	BB	14400	FCB	\$BB		
3FCF	EE	14500	FCB	\$EE		
		14600				
3FD0	77	14700	FCB	\$77		
3FD1	DD	14800	FCB	\$DD		
		14900				
3FD2	33	15000	FCB	\$33		
3FD3	CC	15100	FCB	\$0CC		
		15200				
3FD4	00	15300	FCB	0		
3FD5	00	15400	FCB	0		
3FD6	00	15500	FCB	0		
3FD7	00	15600	FCB	0		
		15800				
3FD8		15900	OLDIRQ	RMB	2	HOLD ON TO OLD IRQ VECTOR
		16000				
	3F00	16100	END	START		
00000	TOTAL ERRORS					...

CLEAR1	3F23
CLEAR2	3F27
COLOR	3FC0
IRQ	3F63
MAIN	3F45
MAIN2	3F4B
OLDIRQ	3FD8
SCOUNT	3FBA
START	3F00
SYNC	3FAD

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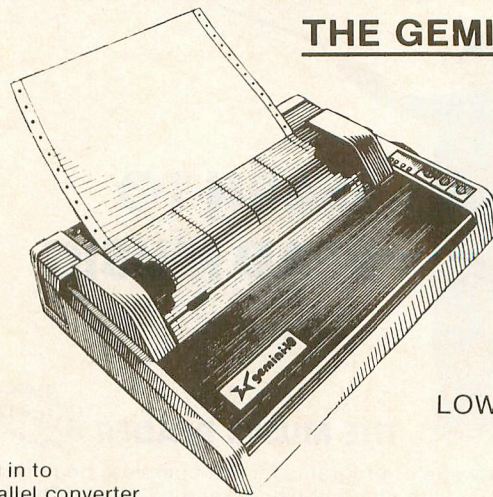
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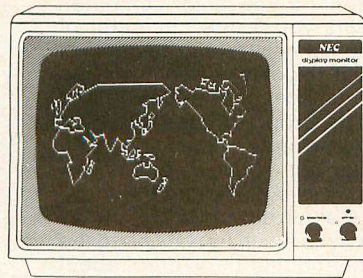


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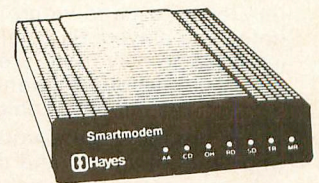
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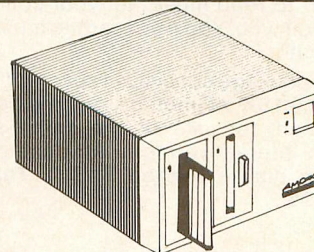
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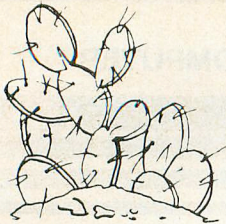
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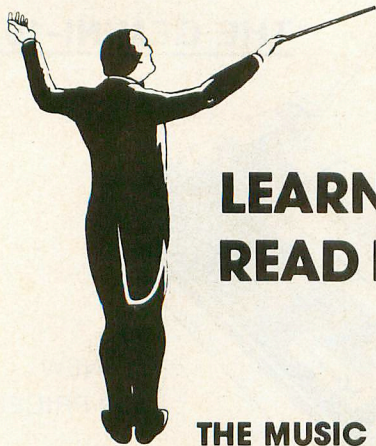
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Each of the seven programs fills 16K of memory and each covers one aspect of music reading completely. These programs are complete in themselves — a student can use them without reference to an instruction manual. This means that no knowledge of the computer is needed. Also, all staves 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 wrong, 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**

Programs are available on AMDEK cartridges - add \$5.00 to the disk price.

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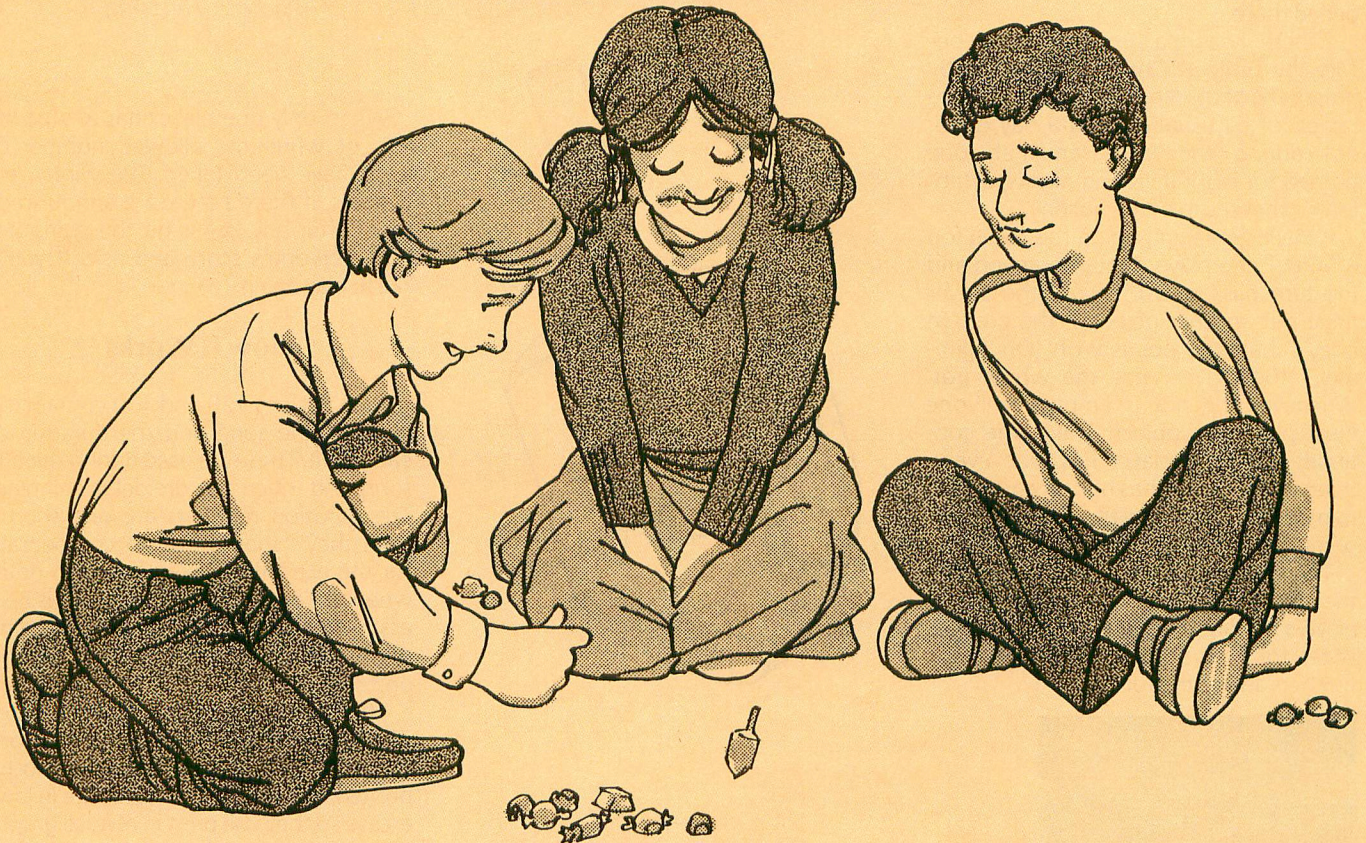
Dreidel



16K Color Basic

*A Hanukkah top game can be lots
of fun during the entire year!*

by Harold Schneider



DREIDEL IS AN ANCIENT game you can easily modernize and use to entertain and educate even your youngest child. Dreidel (pronounced "drā' - dl") is traditionally played during the eight nights of Hanukkah. It can be enjoyed any time of year, however, and children don't have to be Jewish to enjoy this simple game of put and take. As a fun introduction to computers, for anyone, this game is hard to beat.

The game is played with a four-sided top, also called a dreidel (see Figure 1). The outcome is determined solely by luck, so the game's appeal is primarily to young children. In the first through fourth-grade classes at my synagogue it was a huge success — even the eighth-graders seemed to enjoy it.

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The Game

Each player starts with the same number of objects, be they candies, nuts, coins, or anything else. Before turns spinning the dreidel are taken, each player puts one object in the pot. Carved or painted on each side of the dreidel is one of four Hebrew letters — "nun," "gimmel," "hey," and "shin." The dreidel is spun, and once it falls over, these letters determine what action is taken at the end of each turn. The letters are also the first letters of the words of the Hebrew phrase meaning "a great miracle happened there."

"There" was in a temple built long before the birth of Christ, a temple lit by menorahs of burning oil. A cruze, or container, of oil usually lasted a day or so, but during the first Hanukkah one burned for eight days and nights, establishing the length of the holiday.

If the letter facing up on the fallen top is "nun," the player takes no action and the turn passes. On "shin," the player must put another object in the pot. On "hey," half the pot is won. On "gimmel," the player wins the whole pot. Whenever the pot is empty, everyone must put in an object. The game continues until one player has won everything, or until each has had an agreed-on number of turns. Then the player with all, or most, of the objects wins.

There's an advantage to being one of the last to play, so change the order of players if more than one game is played. Prizes for first, second, and third place finishers add to the fun.

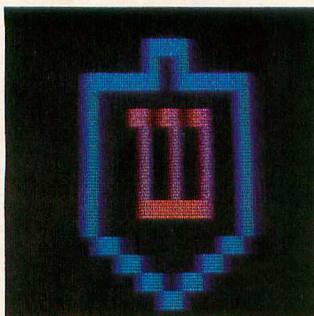
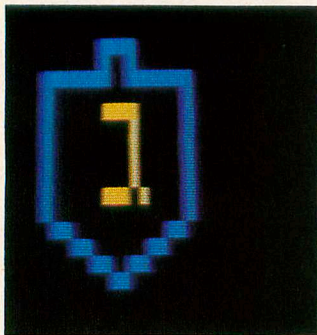


Photo 1. Dreidel

Running the Program

The program requires 16K bytes of memory, but doesn't use Extended Basic.

After loading the program and entering Run, the title screen appears as the computer plays the traditional Hanukkah song, "I Had a Little Dreidel." The program then asks that a key be hit so the game can begin. (If you hit G the program skips the sing-along and goes straight to

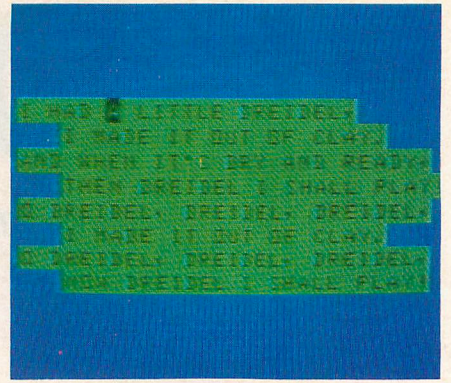


Photo 2. The Song

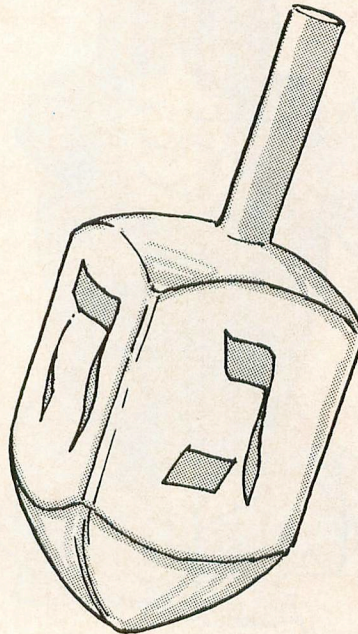


Figure 1. The Dreidel

the action.) During the sing-along, the words appear on the screen, each highlighted with reverse lettering as it's sung.

After the song, the game begins. The computer asks for each player's name and for the number of turns in the game. If you want to play until one player has all the points, enter a large number, but remember, in this case the game may take quite a while. All players start with 10 points. If a player loses more than 9 points, he or she is eliminated before the end of the game.

The dreidel always spins to the tune of the song. Just like a real dreidel, the computer version spins quickly at first, then slows down. The computer's random-number generator is reseeded with each turn, so the element of chance remains.

When only one player has any points left, or when the allowed number of turns have been taken, the winner (or winners, if there's a tie) are announced; then, after any key is hit the computer lists everyone's score and asks if you'd like to play again.

How It Works

Data in Lines 120 and 130 contain the notes of the song and the duration of each note. These are used during the title song and when the dreidel is spinning. The duration numbers are one shorter than they "should" be to compensate for the extra time taken between notes when the dreidel is spinning. This is necessary because of the song words being printed, and the checking that's going on.

The second set of data, listed in Lines 720 to 790, is for the sing-along. It consists of PRINT@ locations, words to be printed, and notes. The words are in lowercase so they will print in reverse graphics on the screen. To type these into the program, hit SHIFT o before typing each word. Hit SHIFT o after each word to return to uppercase. The words to the song are originally printed by Line 630, and the sing-along routine is in Lines 800 through 960.

The game runs from Line 140 to Line 560. It calls the subroutine in Lines 1390 to 1530 once to construct the low resolution graphics that form the dreidel. The subroutine starting at Line 990 spins the dreidel; those in Lines 1080, 1130, 1180, and 1230 act on the outcome.

One technical point is worth noting: the seemingly useless INKEY\$ statement at the end of the page subroutine in Line 970 catches any extra keystrokes, so a screen will not be flashed by if a key is hit at the wrong time.



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Table 1. Variable List

Arrays	
N\$	Player names
G	Player scores
W	Winner flags. Contains 1 for winner, 0 otherwise
L\$	Middle of dreidel
Others	
NT	Note for Sound command
LT	Length of note
A\$	INKEY\$ value
N	Number of players
T	Points in pot
NN	Number of turns allowed each player
PT	Number of player whose turn it is
NB	Number of bankrupt players
HS	High score
NW	Number of winners
LC	Location for PRINT @
W\$	Word to print
K	Random number from 1 to 4
TP\$	Top of dreidel
BM\$	Bottom of dreidel
TX	Timer for changing letter on dreidel
L	Number of letter on dreidel
H	Points in half of the pot
SP\$	String of black rectangles
I, J, II	Looping variables

Program Listing. Dreidel

```

10 CLEAR 1000
20 CLS RND(9)-1: DIM N$(20), G(20)
  , W(20), L$(4)
30 FOR I=1 TO 13: READ NT, LT: SOUN
D NT, LT+1: NEXT I: PRINT@172, "DREI
DEL";: FOR I=1 TO 13: READ NT, LT: S
OUND NT, LT+1: NEXT I: PRINT@238, "B
Y";
40 FOR I=1 TO 13: READ NT, LT: SOUN
D NT, LT+1: NEXT I: PRINT@296, "HARO
LD SCHNEIDER";: FOR I=1 TO 13: REA
D NT, LT: SOUND NT, LT+1: NEXT I
50 PRINT@480, "HIT ANY KEY TO STA
RT TO PLAY!";
60 A$=INKEY$: IF A$="" THEN 60
70 CLS RND(9)-1
80 IF A$="G" THEN 140
90 GOSUB 630
100 GOSUB 800
110 CLS RND(6)+1
120 DATA 147,3,89,3,89,3,108,3,
108,3,125,3,89,6,125,3,147,3,147
,3,133,3,125,3,108,10,108,3,108,
3,108,3,125,3,125,3,133,3,108,6,
108,3,147,3,133,3,125,3,108,3,89
,10
130 DATA 125,3,147,3,125,3,147,3
,125,3,147,3,125,6,125,3,147,3,1
47,3,133,3,125,3,108,10,108,3,13

```



```

460 IF W(I)=1 THEN PRINTN$(I)
470 NEXT I
480 GOSUB 970:CLS RND(6)+1
490 PRINT@32,"THE FINAL SCORES W
ERE:"
500 FOR I=1 TO N:IF G(I)<0 THEN
G(I)=0
510 NEXT I
520 FOR I=1 TO N
530 PRINT N$(I);G(I)
540 NEXT I
550 PRINT@448,"WOULD YOU LIKE TO
PLAY AGAIN";:INPUT A$
560 IF LEFT$(A$,1)="Y" THEN RUN
ELSE END
630 CLS 3:GOSUB 640:GOSUB 650:GO
SUB 660:GOSUB 670:GOSUB 680:GOSU
B 690:GOSUB 700:GOSUB 710:RETURN

```

```

640 PRINT@130,"I HAD A LITTLE DR
EIDEL,";:RETURN
650 PRINT@165,"I MADE IT OUT OF
CLAY,";:RETURN
660 PRINT@194,"AND WHEN IT'S DRY
AND READY,";:RETURN
670 PRINT@229,"THEN DREIDEL I SH
ALL PLAY!";:RETURN
680 PRINT@258,"O DREIDEL, DREIDE
L, DREIDEL,";:RETURN
690 PRINT@293,"I MADE IT OUT OF
CLAY,";:RETURN
700 PRINT@322,"O DREIDEL, DREIDE
L, DREIDEL,";:RETURN
710 PRINT@357,"NOW DREIDEL I SHA
LL PLAY!";:RETURN
720 DATA 130,i,147,132, had,89,13
6,a,89,138,lit,108,141,tle,108,1
45,drei,125,149,del,89
730 DATA 165,i,125,167,made,147,
172,it,147,175,out,133,179,of,12
5,182,clay,108
740 DATA 194,and,108,198,when,10
8,203,"it's",108,208,dry,125,212
,and,125,216,rea,133,219,dy,108
750 DATA 229,then,108,234,drei,1
47,238,del,133,242,i,125,244,sha
11,108,250,play,89
760 DATA 258,o,125,260,drei,147,
264,del,125,269,drei,147,273,del
,125,278,drei,147,282,del,125
770 DATA 293,i,125,295,made,147,
300,it,147,303,out,133,307,of,12
5,310,clay,108
780 DATA 322,o,108,324,drei,133,
328,del,108,333,drei,133,337,del
,108,342,drei,133,346,del,108

```

```

790 DATA 357,now,108,361,drei,14
7,365,del,147,369,i,159,371,shal
1,170,377,play,176
800 FOR I=1 TO 6:READ LC,W$,NT:P
RINT@LC,W$;:SOUND NT,4:GOSUB 640
:NEXT I
810 READ LC,W$,NT:PRINT@LC,W$;:S
OUND NT,8:GOSUB 640
820 FOR I=1 TO 5:READ LC,W$,NT:P
RINT@LC,W$;:SOUND NT,4:GOSUB 650
:NEXT I
830 READ LC,W$,NT:PRINT@LC,W$;:S
OUND NT,12:GOSUB 650
840 FOR I=1 TO 6:READ LC,W$,NT:P
RINT@LC,W$;:SOUND NT,4:GOSUB 660
:NEXT I
850 READ LC,W$,NT:PRINT@LC,W$;:S
OUND NT,8:GOSUB 660
860 FOR I=1 TO 5:READ LC,W$,NT:P
RINT@LC,W$;:SOUND NT,4:GOSUB 670
:NEXT I
870 READ LC,W$,NT:PRINT@LC,W$;:S
OUND NT,12:GOSUB 670
880 FOR I=1 TO 6:READ LC,W$,NT:P
RINT@LC,W$;:SOUND NT,4:GOSUB 680
:NEXT I
890 READ LC,W$,NT:PRINT@LC,W$;:S
OUND NT,8:GOSUB 680
900 FOR I=1 TO 5:READ LC,W$,NT:P
RINT@LC,W$;:SOUND NT,4:GOSUB 690
:NEXT I
910 READ LC,W$,NT:PRINT@LC,W$;:S
OUND NT,12:GOSUB 690
920 FOR I=1 TO 6:READ LC,W$,NT:P
RINT@LC,W$;:SOUND NT,4:GOSUB 700
:NEXT I
930 READ LC,W$,NT:PRINT@LC,W$;:S
OUND NT,8:GOSUB 700
940 FOR I=1 TO 5:READ LC,W$,NT:P
RINT@LC,W$;:SOUND NT,4:GOSUB 710
:NEXT I
950 READ LC,W$,NT:PRINT@LC,W$;:S
OUND NT,12:GOSUB 710
960 RETURN
970 A$=INKEY$:PRINT@480,"HIT ANY
KEY TO CONTINUE.";
980 A$=INKEY$:IF A$="" THEN 980 E
LSE RETURN
990 'SPIN DREIDEL
1000 K=RND(4):A$=INKEY$:IF A$=""
THEN 1000
1010 CLS 0:PRINT@15,TP$;:PRINT@1
72,BM$;:RESTORE
1020 FOR I=0 TO 16-K:L=I+1-INT(I
/4)*4
1030 PRINT@76,L$(L);:TX=0

```

◆ more



TOM MIX SOFTWARE

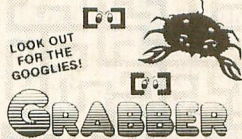
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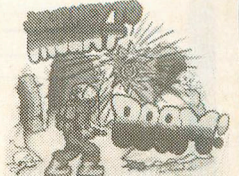
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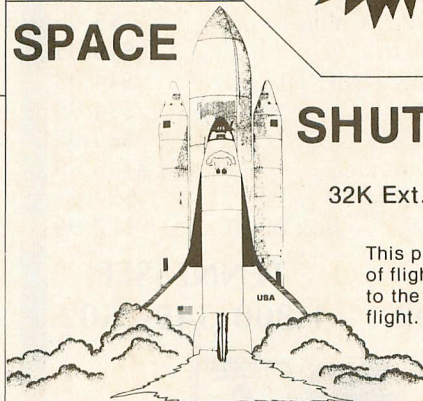
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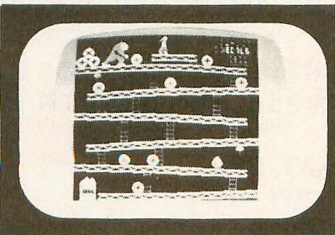
By KEN KALISH
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The "Pitfalls" in this game are many. Hidden treasures, jump over the pits, swing on the vine, watch out for alligators, beware of the scorpion. Another game for the Color Computer with the same high resolution graphics as "The King."



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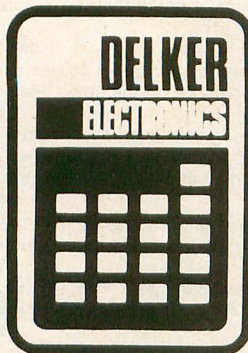
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```

1040 READ NT,LT:TX=TX+LT:SOUND N
T,LT:IF NT=176 THEN RESTORE
1050 IF TX<I THEN 1040
1060 NEXT I
1070 ON L GOTO 1080,1130,1180,12
30
1080 'NUN
1090 PRINT@359,"YOU GOT A 'NUN'.
";
1100 PRINT@391,"YOU DO NOTHING."
;
1110 PRINT@423,"YOU NOW HAVE"G(P
T)"POINTS.";
1120 GOSUB 970:RETURN
1130 'GIMMEL
1140 PRINT@358,"YOU GOT A GIMMEL
!";
1150 PRINT@390,"YOU WIN THE WHOL
E POT!";
1160 G(PT)=G(PT)+T:T=0:PRINT@422
,"YOU NOW HAVE"G(PT)"POINTS.";
1170 GOSUB 970:RETURN
1180 'HEY
1190 PRINT@357,"YOU GOT A HEY!";

1200 PRINT@389,"YOU WIN HALF OF
THE POT!";
1210 H=INT((T+1)/2):G(PT)=G(PT)+
H:T=T-H:PRINT@423,"YOU NOW HAVE"
G(PT)"POINTS.";
1220 GOSUB 970:RETURN
1230 'SHIN
1240 PRINT@356,"YOU GOT A SHIN."
;
1250 PRINT@384,"YOU LOSE ONE POI
NT TO THE POT.";
1260 G(PT)=G(PT)-1:IF G(PT)<0 TH
EN PB=PT:GOSUB 1280 ELSE T=T+1:P
RINT@420,"YOU NOW HAVE"G(PT)"POI
NTS.";
1270 GOSUB 970:RETURN
1280 'PLAYER #PB IS BROKE
1290 CLS 4
1300 PRINT@160,N$(PB)" CAN NOT P
AY!";
1310 PRINT@224,N$(PB)" HAS LOST,
AND IS";:PRINT@256,"NO LONGER I
N THE GAME.";
1320 NB=NB+1:GOTO 970
1330 'PUT INTO POT
1340 CLS RND(6)+1:PRINT@192,"THE
POT IS EMPTY. EACH PLAYER MUS
T PUT ONE POINT IN THE POT.:GOS
UB 970
1350 FOR I=1 TO N:IF G(I)<0 THEN
1370
    
```



```

1360 G(I)=G(I)-1:IF G(I)<0 THEN
PB=I:GOSUB 1280:ELSE T=T+1
1370 NEXT I
1380 RETURN
1390 TP$=CHR$(174)+CHR$(173)+CHR
$(128)+CHR$(128):SP$=CHR$(128)
1400 FOR I=1 TO 23:SP$=SP$+CHR$(
128):NEXT I:TP$=TP$+SP$+CHR$(128
)+CHR$(174):A$=CHR$(172)+CHR$(17
2)+CHR$(168)+CHR$(164)
1410 A$=A$+CHR$(172)+CHR$(172)+C
HR$(173):TP$=TP$+A$
1420 L$(1)=CHR$(170)+CHR$(128)+C
HR$(128):L$(1)=L$(1)+CHR$(140)+C
HR$(141)+CHR$(128)
1430 A$=CHR$(128)+CHR$(165)+SP$+
CHR$(170)+CHR$(128):L$(1)=L$(1)+
A$+CHR$(128)+CHR$(128)+CHR$(133)
:L$(1)=L$(1)+CHR$(128)+A$
1440 L$(1)=L$(1)+CHR$(128)+CHR$(
131)+CHR$(135):L$(1)=L$(1)+CHR$(
128)+CHR$(128)+CHR$(165)
1450 BM$=CHR$(169)+CHR$(162)+CHR
$(128)+CHR$(128)+CHR$(128):BM$=B
M$+CHR$(128)+CHR$(161)+CHR$(166)
+SP$:BM$=BM$+CHR$(128)+CHR$(164)
+CHR$(169)
1460 BM$=BM$+CHR$(162)+CHR$(161)
+CHR$(166)+CHR$(168):BM$=BM$+CHR
$(128)+SP$+CHR$(128)+CHR$(128):B
M$=BM$+CHR$(128)+CHR$(164)+CHR$(
168)
1470 L$(2)=CHR$(170)+CHR$(128)+C
HR$(128):L$(2)=L$(2)+CHR$(252)+C
HR$(253)+CHR$(128):L$(2)=L$(2)+A
$+CHR$(128)+CHR$(128)+CHR$(245):
L$(2)=L$(2)+CHR$(128)+A$
1480 L$(2)=L$(2)+CHR$(128)+CHR$(
243)+CHR$(246):L$(2)=L$(2)+CHR$(
242)+CHR$(128)+CHR$(165)
1490 L$(3)=CHR$(170)+CHR$(128)+C
HR$(148):L$(3)=L$(3)+CHR$(156)+C
HR$(156)+CHR$(154):L$(3)=L$(3)+A
$+CHR$(149)+CHR$(128)+CHR$(128):
L$(3)=L$(3)+CHR$(154)+A$
1500 L$(3)=L$(3)+CHR$(149)+CHR$(
128)+CHR$(128):L$(3)=L$(3)+CHR$(
154)+CHR$(128)+CHR$(165)
1510 L$(4)=CHR$(170)+CHR$(128)+C
HR$(189):L$(4)=L$(4)+CHR$(180)+C
HR$(186)+CHR$(189):L$(4)=L$(4)+A
$+CHR$(181)+CHR$(128)+CHR$(186):
L$(4)=L$(4)+CHR$(181)+A$
1520 L$(4)=L$(4)+CHR$(181)+CHR$(
179)+CHR$(187):L$(4)=L$(4)+CHR$(
183)+CHR$(128)+CHR$(165)
1530 RETURN

```

■ ■ ■



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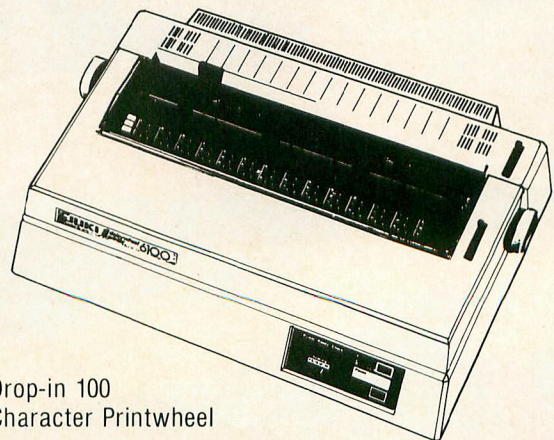
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16K or 32K

Extended Color Basic

Defense

Sit steady, aim low, and good luck.

DEFENSE IS A GAME similar to "Missile Command" at the arcades. It requires at least 16K RAM, Extended Basic ROM, and a joystick. The object is to save your six cities from destruction by three different colored missiles, or to protect your fortress from an alien attack. Four skill levels of play increase missile and alien speeds — skill level one changing to two at 2000 points, level two to level three at 4000 points, and level three to level four at 6000 points. Skill level one has no alien attacks, but in the other three levels aliens attack at random.

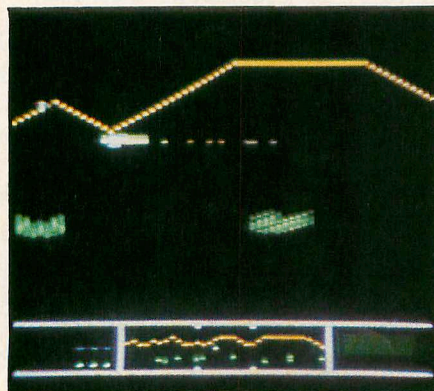
To hit a missile, position the sighting cursor on or just below the leading point of the target missile's streamer and depress the joystick's fire button. To destroy an alien, center the sighting cursor just below the darkened spot representing the alien and depress the joystick button.

When firing at aliens, no points are assessed for missed shots. In fact, rapid firing is almost imperative at high skill levels. When firing at missiles, though, the story is different. The base value of a score is 25 points. Every shot that misses decreases the score value by five points, to a minimum of five. When a shot does score, the present score value is multiplied by the skill level. If the shot is a direct hit the player is rewarded with a bonus multiplier of two, five, or ten, depending on missile color. The score value is reset to 25 points each time a shot scores on missile or alien (see Table 1).

*by Shawn Diehl
and Jim McDowell*

Program set up is simple. After Entering and checking your typing, CSAVE to a blank tape. The next time you feel defensive and have time on your hands, just CLOAD and RUN ... for your joystick!

Failure to destroy a missile will result in the destruction of a city or the ground, or penetration into the underground. Underground penetration costs the player the game. Losing all six cities yields the same end. When one city is destroyed the game checks the bonus cities remaining. If there are any, you get a new city. Failure to destroy an alien is another mat-



ter. Once your fortress is invaded, the alien will seek no fewer than five bonus cities (the ransom goes up with the score) and if you can't pay ... you lose. If you do destroy the alien you get 250 points times the skill level. Bonus cities are awarded every 750 points.

One advanced feature of this game is an arcade-like "Top Ten" scoring display which actually modifies the program in RAM to save the new high scores for the next time you CLOAD and play the game. To be assured of this feature, however, when you copy the program from this article keep Line 1090 exactly as shown, especially if you make any modifications to the program. The routine relies on SL\$ to contain the "Top Ten" information in exactly the same position all the time. If any changes are made in spacing the program will write over incorrect portions of itself and, to say the least, create errors.

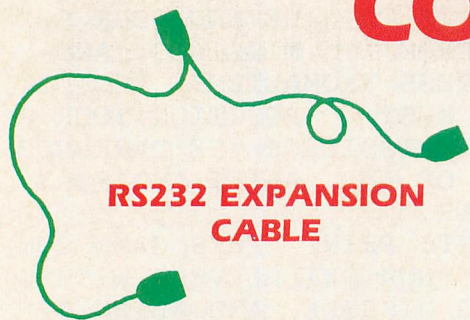
This program was written for a 32K Extended Basic system, but can be converted for use on a 16K Extended system with the following modifications: delete all Remark statements and Lines 1390 and 2630 – 2890. Change Lines 1380 and 2620 to:

```
1380 PLAY P1$ : POKE PF,O : FOR T=O TO 511 :  
      NEXT T  
2620 END
```

Program line-for-line description and a variable table follows.

♦ more

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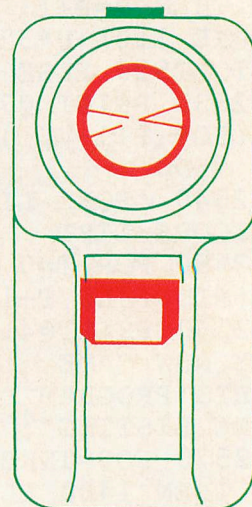
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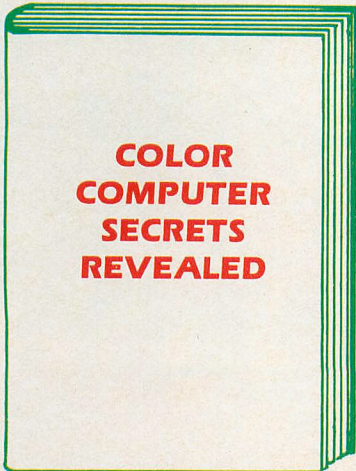
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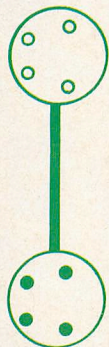
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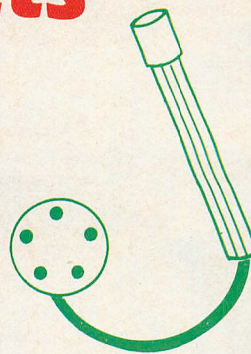
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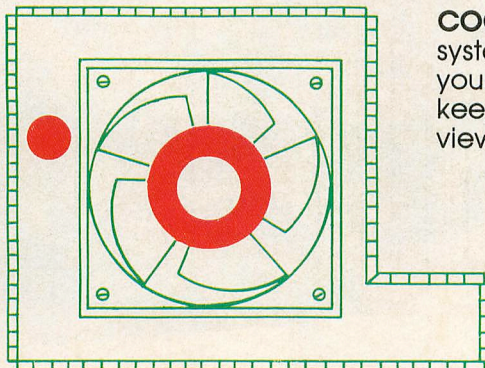
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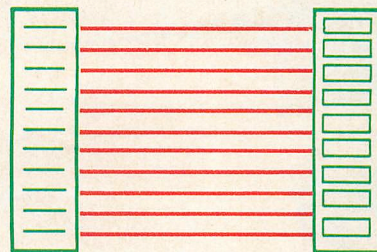
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by Dennis Kitz

ALTHOUGH QUAVER HAS numerous prompts, instructions are still needed. On a first run, the PMODE and PCLEAR instructions may cause an error due to a minor bug found in Basic. Music storage memory is cleared, followed by presentation of the main menu, which offers eight selections:

1. Build Waveform
2. Build Envelope
3. Save Waves/Envelopes
4. Enter or Edit Music
5. Play Music
6. Load from Tape
7. Display Waveforms
8. Do Spectral Transforms

points, you only need set locations outlining the wave's shape. Make wave-shapes simple and rounded where possible, and do not set points on the very top line. Sharp-edged wave shapes have strong harmonic content which will produce distinct aliasing when the music is played.

• An envelope is created with a joystick in exactly the same way as a waveform. Envelopes can be sharp-edged, however, but do avoid high volume levels on both timbres and envelopes as this can contribute to distortion. Try envelopes which start softly, rise, and fall back off; these produce sweet, overlapping effects. Note that envelopes run the length of a whole note; if your music will be fast (or you choose to change the speed), use only as much of the 64-element envelope as your music will need.

• All waveforms (timbres and envelopes) can be saved as a block. Although other load and save features are provided, this method is convenient for saving the components of an entire piece of music.

• Music entry and editing are simple but tedious. I plead guilty to providing a weak input system — like most music programs — which requires note names, durations, and octave markings. Up to 37 pages of score are available (over 180 notes per voice). Select the page you wish to work on (1 if this is a first session; 0 returns the menu). Music is entered in a simple format: *note name* (A through G), *accidental* (= for natural, + for sharp, - for flat), *duration* (thirty-second note to whole note), and *octave* (@ sign plus a number 1 through 8). Since high pitches are prone to aliasing distortion, use octaves higher than six only for special effects. Rests are a special case, and are marked only with R plus a duration code, such as R@6 for a dotted quarter note. The note durations are as follows:

♦ more

Figure 1. The score to Dinsmore, from The Sacred Harp.

DINSMORE. C. M.

Slow, and with accent. Theme from EHUD.



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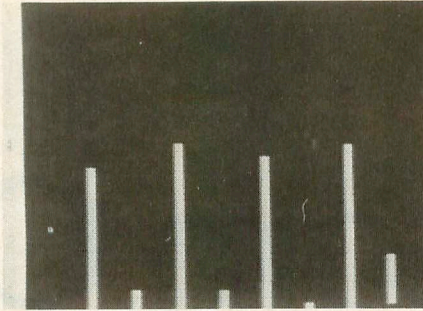
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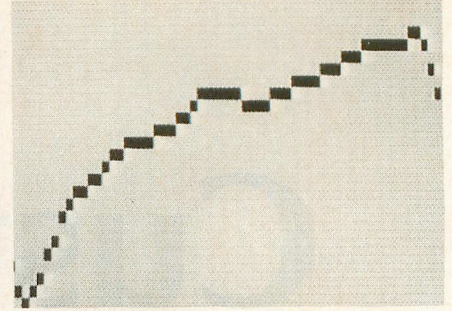
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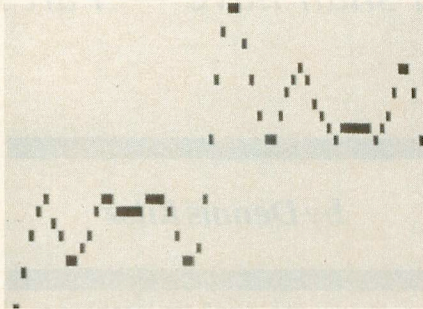
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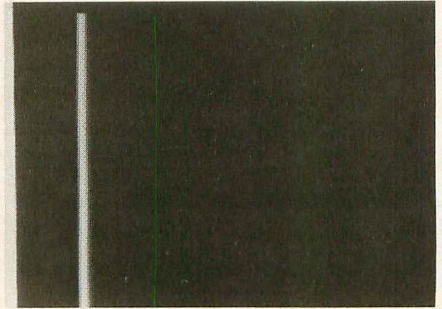
Odd harmonics of equal intensity make up this frequency spectrum. A small amount of even harmonic content has been added.



Waveform developed by the Spectral Transform. The result is roughly a ramp (sawtooth) wave.



Waveform developed by the Spectral Transform. The result is a rough approximation of a square wave.



One fundamental waveform frequency created used the Spectral Transform option.

Figure 2. The Quaver version of Dinsmore, from Figure 1.

SCORE: VOICE LINE #1
A=1@4B-1@4C=3@4C=3@4C=3@4B-1@4A=1@4D=3@4D=3@4D=3@4C=3@4C=3@4C=3@4C=3@4G=3@3G=6@3 A=3@4D=3@4C=3@4B-3@4A=3@4 B-3@4A=3@4D=3@4C=3@4C=3@4 C=3@4A=3@4A=3@4C=6@4 C=3@4B-5@4D=3@4B-3@4A=3@4 C=5@4 B-3@4 A=8@4 >

SCORE: VOICE LINE #2
F=3@3F=3@3F=3@3F=3@3F=3@3F=3@3F=3@3F=3@3F=3@3F=3@3E=3@3F=3@3E=6@3 F=3@3F=3@3F=3@3F=3@3F=3@3 F=3@3F=3@3F=3@3F=3@3F=3@3E=6@3 E=3@3F=3@3F=3@3E=6@3 F=3@3F=5@3F=5@3 A=4@4 G=1@3F=3@3 E=3@3 F=8@3 >

SCORE: VOICE LINE #3
F=1@3G=1@3A=3@4A=3@4A=3@4G=1@3F=1@3B-3@4B-3@4B-3@4A=3@4C=3@4A=3@4G=3@3B=3@4C=6@4 C=3@3F=3@3E=3@3D=3@3C=3@3 D=3@3C=3@3B-3@3A=3@3C=3@3 B-3@3A=3@3F=3@2G=6@2 C=3@3D=5@3F=3@3D=3@3C=4@3 B-1@3A=3@3 G=3@3 F=8@3 >

SCORE: VOICE LINE #4
F=3@2F=3@2F=3@2F=3@2F=3@2F=3@2F=3@2F=3@2F=3@2A=3@3F=3@2G=3@2G=3@2C=6@2 F=3@2F=3@2F=3@2F=3@2F=3@2 F=3@2F=3@2F=3@2F=3@2G=3@2C=6@2 G=3@2F=3@2D=3@2C=6@2 A=3@3B-5@3B-5@2 C=6@2 C=3@2 F=8@1 >

◆ from page 83

- Whole note 9
- Dotted half note 8
- Half note 7
- Dotted quarter note 6
- Quarter note 5
- Dotted eighth note 4
- Eighth note 3
- Dotted sixteenth note 2

Sixteenth note 1
 Thirty-second note 0

Move the cursor with the arrow keys, and type the musical text; for visual balance, spaces may be added. Figure 1 is a sample musical score from the Sacred Harp collection, and Figure 2 is its render-

◆ more

Figure 3. A memory dump of Dinsmore as used by the Quaver player routine to perform the hymn.

MEMORY CONTENTS, VOICE LINE #1

```

01 04 04 00 02 04 04 00 04 04 08 00 04 04 08 00
04 04 08 00 02 04 04 00 01 04 04 00 06 04 08 00
06 04 08 00 06 04 08 00 04 04 08 00 04 04 08 00
04 04 08 00 04 04 08 00 0B 03 08 00 0B 03 18 00
01 04 08 00 06 04 08 00 04 04 08 00 02 04 08 00
01 04 08 00 02 04 08 00 01 04 08 00 06 04 08 00
04 04 08 00 04 04 08 00 04 04 08 00 01 04 08 00
01 04 08 00 04 04 18 00 04 04 08 00 02 04 10 00
06 04 08 00 02 04 08 00 01 04 08 00 04 04 10 00
02 04 08 00 01 04 30 00
  
```

MEMORY CONTENTS, VOICE LINE #2

```

09 03 08 00 09 03 08 00 09 03 08 00 09 03 08 00
09 03 08 00 09 03 08 00 09 03 08 00 09 03 08 00
09 03 08 00 09 03 08 00 09 03 08 00 08 03 08 00
09 03 08 00 08 03 18 00 09 03 08 00 09 03 08 00
09 03 08 00 09 03 08 00 09 03 08 00 09 03 08 00
09 03 08 00 09 03 08 00 09 03 08 00 09 03 08 00
08 03 08 00 09 03 08 00 09 03 08 00 08 03 18 00
09 03 08 00 09 03 10 00 09 03 10 00 01 04 0C 00
0B 03 04 00 09 03 08 00 08 03 08 00 09 03 30 00
  
```

MEMORY CONTENTS, VOICE LINE #3

```

09 03 04 00 0B 03 04 00 01 04 08 00 01 04 08 00
01 04 08 00 0B 03 04 00 09 03 04 00 02 04 08 00
02 04 08 00 02 04 08 00 01 04 08 00 04 04 08 00
01 04 08 00 0B 03 08 00 03 04 08 00 04 04 18 00
04 03 08 00 09 03 08 00 08 03 08 00 06 03 08 00
04 03 08 00 06 03 08 00 04 03 08 00 02 03 08 00
01 03 08 00 04 03 08 00 02 03 08 00 01 03 08 00
09 02 08 00 0B 02 18 00 04 03 08 00 06 03 10 00
09 03 08 00 06 03 08 00 04 03 0C 00 02 03 04 00
01 03 08 00 0B 03 08 00 09 03 30 00
  
```

MEMORY CONTENTS, VOICE LINE #4

```

09 02 08 00 09 02 08 00 09 02 08 00 09 02 08 00
09 02 08 00 09 02 08 00 09 02 08 00 09 02 08 00
09 02 08 00 01 03 08 00 09 02 08 00 0B 02 08 00
0B 02 08 00 04 02 18 00 09 02 08 00 09 02 08 00
09 02 08 00 09 02 08 00 09 02 08 00 09 02 08 00
09 02 08 00 09 02 08 00 09 02 08 00 01 03 08 00
0B 02 08 00 09 02 08 00 06 02 08 00 04 02 18 00
01 03 08 00 02 03 10 00 02 02 10 00 04 02 18 00
04 02 08 00 09 01 30 00
  
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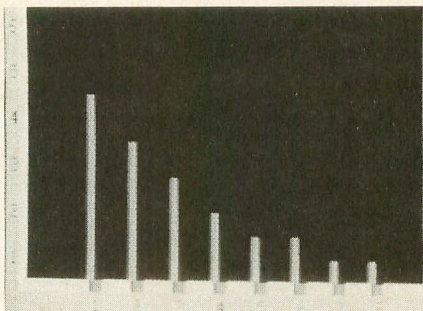
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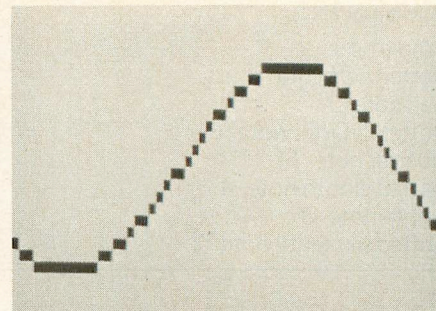
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Eight harmonics of decreasing intensity make up this frequency spectrum.



Waveform developed by the Spectral Transform. The sine wave represents a single fundamental frequency, and is the simplest of all waveforms.

ing into computer data. Enter each page, and end the entire piece of music with a greater-than sign (>) at the conclusion of each musical line. Use the Shift Left Arrow keys to begin compiling the musical information. Your edited source code may be saved on tape at this point. After saving to tape, you may return to the main menu, or begin the music compilation into performance memory. In this version, compilation takes some time (it is all in Basic), especially for long scores.

When compilation is finished, you may save it to tape. This compiled score may be played at any time, so long as one set of waveforms and envelopes is loaded, and the Quaver machine language player routine is in place. When this is done, you will be returned to the main menu.

- The sixth selection is playing the music itself. If the Quaver play routine is missing, or the music has not been compiled, a warning will be displayed. Otherwise the music will be played immediately. Since a prompting "beep" is sounded at each presentation of the menu, it is wise to add a long rest or two at the end of any music. Figure 3 is a memory dump of the actual values used by Quaver to play the Dinsmore hymn.

- Loading from tape is self-prompting, including the option of loading an entire waveform and envelope set-up (eight elements in all), or individually loading waveforms, envelopes, or music source code.

- It isn't easy remembering every waveform and envelope, nor easy guessing what will be their overall relationship (such as the combined effect of all the envelopes). Selection 7 displays all those wave and envelope creations individually, transparently (as if overlaid on transparent screens), and with a composite of all output, both fast (waveform) and slow (envelope).

- Most interesting is the spectral transform option. Also called a Fourier transform, this process takes a spectrum of frequencies and, by applying sine and cosine functions, transforms it into a complete waveform. This is a time-consuming calculation, but affords excellent control over the resulting waveform, and permits the suppression of alias frequencies. Each fundamental tone has a set of natural harmonics allied to it. The note middle C, for example, has the following harmonics:

Twelfth harmonic	G	3062
Eleventh harmonic	ca. F	2816
Tenth harmonic	E	2560
Ninth harmonic	ca. D	2304
Eighth harmonic	C	2048
Seventh harmonic	ca. Bd	1992
Sixth harmonic	G	1536
Fifth harmonic	E	1280
Fourth harmonic	C	1024
Third harmonic	G	768
Second harmonic	C	512
Fundamental	C	256

Quaver only allows the selection of harmonics up to the eighth. Since in that group only the seventh harmonic is "dissonant," the spectrum will not be as rich as acoustic music, but system limits and aliasing prevent that, anyway.

Move the joystick slowly across the screen, and the harmonics will rise to meet its path. Press R (reset) to lower the graph to the joystick's path, S (set) to raise it again. Press Enter when the harmonic spectrum is satisfactory; due to system limits, make sure to use less height as you use more harmonics. Waveform processing will proceed after the Fourier transform is complete.

A few notes about the Quaver Basic driver:

1. Upon running, it will always clear the compiled music memory, but will

leave your score intact. If you crash the program and wish to save all your score work, merely re-run the Basic driver. If you completely deleted it, you can CLOAD it again, or save the musical score by entering CSAVEM"SCORE",&H6000,&H6FFF,&H47F0.

2. Avoid asking for a display of waveforms or envelopes until you have created all eight, or loaded a previous group in place. Memory garbage from previous programs may result in an ?FC error.

3. As noted, the sampling rate for this program is unavoidably low (2852 Hz). Although it is subtle, this rate can actually be heard as a slight background hiss or whistle. To improve the sampling rate, fewer voices can be used by deleting them from the assembly listing. If you do this, be sure to enter rests into the unused voices in the Basic driver, or the program will not compile correctly.

4. I re-emphasize that intense envelopes and intensely rich waveforms should not be used together. A harsh distortion will be produced.

The Quaver Programs

The Basic driver provides the main user interaction with the music execution routines, but is not necessary to key in the entire 14K program to audition the Quaver player. Instead, enter and assemble Program Listing 1 using EDTASM+, and save several copies of the source and assembled listing on tape. CLOADM the Quaver machine language routine, and enter the short program in Program Listing 3. It will create triangle waveforms and envelopes, set up a group of random notes, octaves, and durations, and play a random four-part tune of 256 notes length. After that try Listing 4. It is a "scale scurry," with fast, overlapping chromatic scales across the entire range of Quaver.

Ritardando ma a Tempo

The Quaver assembly listing (Listing 1) embodies the music performance software. Because of the compactness of this program, and because of its self-modifying character, it should be understood before any modifications are attempted. Because the idea here is to save time and maintain accuracy, there are unorthodoxies and efficiencies used that would be unnecessary — in fact, undesir-

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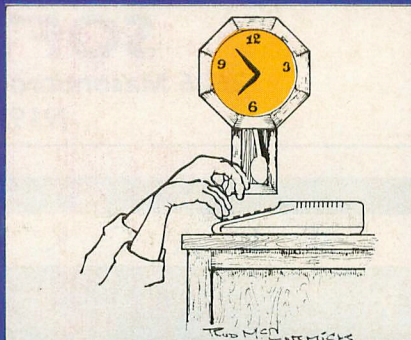
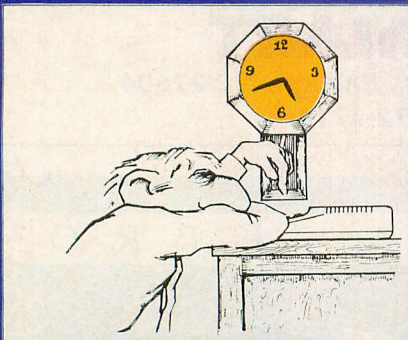
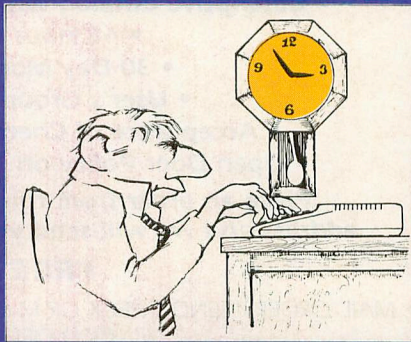
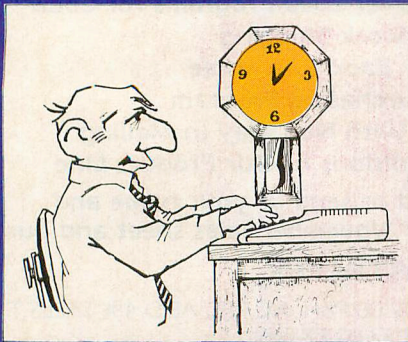
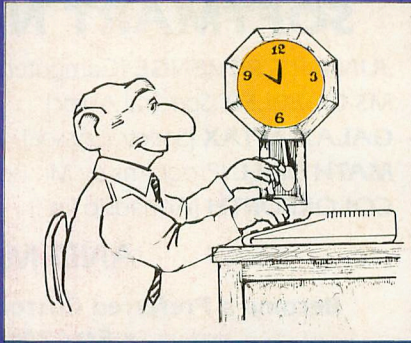
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able — in other sorts of programs. Every machine cycle makes a difference; leave the NOPs!

For reference, a group of table, envelope, storage, pitch and duration equates are established at the outset (Lines 330 – 630). Since, as I've said, it is self-modifying, the program is put in order by the subroutine accessed from Line 670. This subroutine (Lines 3200 – 3550) clears out leftover values in the waveform table pointer, thereby setting each wave's phase in synchronization. Pitch, duration, and envelope are also cleared to zero. The compiled music table pointers are re-established, should a previous performance lack the end-of-music marker and spin far off into memory. The Color Computer's sound port is opened (Lines 3450 – 3460), and the first set of four notes, octaves and durations is plucked from memory.

After set-up, the direct page register is pointed to within the program itself. This shaves one clock cycle off certain operations. Interrupts are turned off (Line 760), and the actual performance is ready to begin.

Since all four voices are identical, my comments about the first one apply to the rest. The envelope counter is prepared (Line 800), and the 1-in-65535 binary counter is advanced (the note odometer, Lines 810 – 830). The most-significant portion of this counter is selected, transferred to the least-significant portion of the waveform table pointer, unnecessary bits are masked out so the table can loop around to its start, and the proper table is selected (Lines 840 – 870).

The waveform value is extracted from the table (Line 880), and the value from the envelope table is subtracted from it (Line 890). If the result is less than zero, "foldover" distortion — a very intense crackling — is avoided by setting it to zero. Dummy actions are added to make both program branches equal in length (Lines 900 – 920). The massaged waveform value is then stored pending final output.

The note's length is now acted upon. The 16-bit duration is decremented a byte at a time; dummy actions are again included in this process to make both program branches equal, and avoid glitches, gargling or intonation queasiness in the output pitch (Lines 940 – 1040). When the duration counter reaches zero, the note set-up subroutine is called (Line 1050).

The first subroutine begins at Line 2230, where X points to the note to be played and Y points to the tempered note table located at Lines 2080 – 2210.

The first note is read from memory, and compared with the "end of music" value. If there's still music to play, the value is doubled and used as an offset to pick a pitch out of the tempered note table (Lines 2250 - 2300). The pitch counter is stored in the play routine, and the octave value is selected. Since octaves are labeled musically from 0 to 8, it's necessary to reverse the bits (make them read 8 to 0) to use as an octave multiplier (Lines 2320 - 2350). The 16-bit pitch value already stored in memory is shifted and rotated right by — that is, divided by — the octave (Lines 2360 - 2390). Finally, the note's duration is taken from Basic and used without modification (Line 2400), the musical score counter is incremented and stored (Lines 2410 - 2420), and the envelope is set to its start (Line 2430).

When all four voices have been passed through, creating new note set-ups as needed, the values are summed, masked to six bits, and output through the digital-to-analog converter (Lines 1920 - 1970). The process is repeated until the note-creation subroutine finds an "end-of-music" marker, \$FF. At that point the stack is cleared out, the original direct page register is reset, and the program returns to Basic (Lines 3150 - 3180).

Two notes on this program:

1. It is not relocatable, since it uses absolute addressing, and it cannot be ROMmed, since it is self-modifying. Because immediate addressing is faster than extended or direct addressing in the 6809 — and because every machine cycle is critical — Lines 800, 810, 820 and 940 all contain data which is modified as the program progresses.

2. Each voice takes only 78 machine cycles. Although this time is minuscule

(only .000087 seconds), passing through all four voices and including the output routine and finish-to-start jump (24 cycles) raises this to a total of 336 machine cycles (.00037 seconds). As short a time as this may seem, it represents only a 2,852-Hz sampling frequency — far less than the hi-fi standard of 44,100 Hz.

Remarks

I sincerely hope you enjoy Quaver. It represents considerable research, rewriting, and paring down for greatest effi-

ciency in order to run at the Color Computer's slow .89 MHz clock rate. Using a dedicated computer system using a 6809 running at 2.5 MHz, plus an eight-bit digital-to-analog converter, the sampling rate can be raised to a respectable 7,200 Hz, and better quality sound can be achieved.

By the way, G.B. in San Jose, I really didn't mind being called all those names. I'm framing your letter and hanging it over my computer. Every time I start feeling like an egotistical maniac, I'll be sure to read it. ■ ■ ■

Note

Tempo changes are not allowed in this version, but tempo speed-up may be achieved by this technique:

```
1000 REM * T IS TEMPO DIVIDER
1010 FOR X=&H5002 TO &H5FFF STEP 4
1020 Y = 256*PEEK(X) + PEEK(X+1)
1030 Y = Y*T
1040 A=INT(Y/256)
1050 POKE X,A : POKE X+1,Y-A
1060 NEXT X
```

System requirements: 32K Color Computer, cassette based; television or monitor with audio output.

Availability: The Quaver Basic driver, source and assembly listings, plus a set of precompiled waveforms, envelopes, and musical samples are available for \$19.95 (plus \$2.50 shipping and handling) from Green Mountain Micro, Roxbury, Vermont 05669, (802)485-6112.

Further Reading:

The Byte Book of Computer Music, Byte Publications, 1978, Peterborough NH.

Wayne Bateman: *Introduction to Computer Music*, Wiley-Interscience, 1980, New York.

Hal Chamberlin: *Music Applications of Microprocessors*, Hayden Book Company, 1980, Rochelle Park NJ.

Dennis Kitz: "Micro/Sonics" (monthly), *Programmer Magazine* (through 1982), Peterborough NH.

Thanks to Gregg Shadel for assistance with understanding Fourier transforms, and to Hal Chamberlin for the Basic Fast Fourier Transform used in Quaver.

◆ more

Figure 4. The first five measures of J.S. Bach's Well Tempered Clavier.

The image shows a musical score for the first five measures of J.S. Bach's Well-Tempered Clavier. The score is written for a single instrument, likely a keyboard, and is in C major, 3/4 time. The tempo is marked 'Moderato' with a metronome marking of 112. The score consists of two staves: a treble clef staff and a bass clef staff. The first measure begins with a quarter rest in the treble and a quarter note in the bass. The subsequent measures feature a complex interplay of eighth and sixteenth notes in both hands, with various rests and dynamic markings. The notation includes slurs, accents, and fermatas, indicating the phrasing and articulation of the piece.

A Brief Glossary

Alias: An undesirable frequency produced by the interaction of a digital sampling process with the note being sampled. It occurs when the sampling rate is less than one-half the frequency being sampled. In tape recording, this is a bias beating; in radio, these are "birdies."

Chord: A group of three or more notes played simultaneously. To the individual character of the individual notes is added a simultaneous aural characteristic called harmony.

Consonance: Harmonies which sound pleasant to the ear. Although consonance varies with musical style and era, harmonic thirds, fifths, and sixths, and octaves are considered consonant. See also Dissonance.

Counterpoint: see Polyphony.

Cycle: A repetition, particularly of one full length of waveform.

DAC: see Digital-to-Analog Converter.

Digital-to-Analog Converter: An electronic circuit which accepts binary computer data and transforms it into a current or voltage proportional to the numeric value of the binary data.

Digitize: To convert from a real-world, analog state into binary form. See also Sample.

Dissonance: Harmonies which sound unpleasant to the ear. This definition is not absolute, and changes with musical style and era. In modern times, very few harmonic intervals are considered dissonant, depending on their context. See also Consonance.

Envelope: The "life" of a musical note (in acoustic music called *embouchure* or *technique*), traditionally including attack, decay, sustain, and release. Digital systems afford control over the entire course of the note, blurring these four descriptions.

Fourier Transform: A sine-cosine formula which describes the relationship between waveform and frequency spectrum, and calculates one from the other.

Frequency: In sound, a repetitive variation in air pressure which can be described as repetitions (i.e., cycles) per second. "Cycles per second" has been replaced by the term Hertz.

Fundamental: The lowest sounding frequency of any simple or complex tone.

Harmonic: A high pitch generated by the irregular or partial vibration of a natural object, normally of lesser volume. A harmonic is an arithmetic multiple of the original frequency, and contributes to a sound's timbre.

Harmony: The simultaneous playing of at least two separate notes. Harmony does not refer to pleasantness (see Consonance and Dissonance), but rather the cumulative aural effect of multiple notes.

Hertz: Cycles per second; see Frequency.

Melody: A pattern of notes played one after the other. Melody is usually considered to be singable (a tune or song), but any pattern of sequential notes can be so defined.

Octave: A distance between two notes whose frequency relationship is precisely 2 to 1. Octaves sound as the same note consisting of a higher and a lower part.

Overtone: see Harmonic.

Partial: A harmonic, but not including the fundamental. That is, the first partial is the second harmonic. See Harmonic.

Pitch: Also called a note or a tone, a pitch is a specific, unvarying frequency which can be identified and described. In music, a pitch is called by its note name (A, B-flat, B, etc.). In music, pitches always contain harmonics which enrich the tone's timbre. When a single frequency is intended, the term frequency or fundamental tone is used.

Polyphony: The simultaneous playing of at least two separate music

lines or tunes. These tunes bear a distinct musical relationship (which varies with era and style), but always maintain an independence of rhythm and melody.

Quality: see Timbre.

Sample: An amplitude level extracted from a tone at a specific instant in time. Since digital storage is numerical, analog signals must be broken into discrete segments and evaluated. These discrete segments are samples.

Score: A written pattern of music notation (including notes, rests, rhythms, orchestration, directions, and often words) which can be read and interpreted as music. As music has grown more sophisticated, scores have evolved from simple symbols placed next to sung text as reminders to large pages of detailed musical notation.

Spectrum: A breakdown of all frequencies which combine to form a complex tone.

Temperament: A system of tuning notes in a scale. When music was mostly melodic, with only simple harmonic underpinnings, temperament could closely follow natural laws; that is, notes could be tuned "perfectly." As harmony and harmonic changes grew more sophisticated, it was discovered that some note relationships sounded out of tune. In the 17th Century, a system was devised to tune every note to an "equal tempered" system. In this system, each note was equally spaced in pitch from its neighbor. Although notes no longer bore a physically perfect relationship to each other, the scale and chord as a whole sounded properly tuned. In fact, one note is related to the previous by an irrational ratio, the twelfth root of two (1.059463094049...). The tuning of quaver may be heard using the score excerpt from J.S. Bach's "The Well Tempered Keyboard;" the first five measures of music are presented in Figure 4 of part two, and the rendition into Quaver notation is shown in Figure 5 of part two.

Timbre: The aural quality of a tone which usually identifies its source. Specifically, timbre is a combination of a fundamental and its natural harmonics, the proportion of which distinguish the tone from any other.

Tone: see Pitch.

Tune: see Melody.

Voice: A musical line for instrumental or vocal rendition; see Melody.

Waveform: A linear representation of the changes of air pressure which are perceived as sound. Oscilloscope patterns and record grooves are examples of waveforms. ■ ■ ■

Figure 5. The Quaver rendition of the J.S. Bach score in Figure 4.

SCORE: VOICE LINE #1
R=3@1G=1@3C=1@4E=1@4G=1@3 C=1@4E=1@4R=3@1G=1@4C=1@4 E=1@4G=1@3C=1@4E=1@4R=3@1 A=1@4D=1@4F=1@4A=1@4D=1@4 F=1@4R=3@1A=1@4D=1@4F=1@4 A=1@4D=1@4F=1@4R=3@1G=1@3 D=1@4F=1@4G=1@3D=1@4F=1@4 R=3@1G=1@3D=1@4F=1@4G=1@3 D=1@4F=1@4R=3@1G=1@3C=1@4 E=1@4G=1@3C=1@4E=1@4R=3@1 G=1@3C=1@4E=1@4G=1@3C=1@4 E=1@4R=3@1A=1@4E=1@4A=1@5 A=1@4E=1@4A=1@5R=3@1A=1@4 E=1@4A=1@5A=1@4E=1@4 A=1@5 R=8@1

SCORE: VOICE LINE #2
R=1@1E=5@3E=5@3 E=5@3 E=5@3 D=5@3D=5@3 D=5@3D=5@3 E=5@3 E=5@3 E=5@3
@3 D=5@3D=5@3 D=5@3D=5@3 E=5@3 E=5@3 E=5@3
E=5@3 E=5@3E=5@3 E=5@3E=5@3 D=8@3

SCORE: VOICE LINE #3
C=7@2 C=7@2 C=7@2 C=7@2 B=7@2B=7@2 C=7@2C=7@2 C=7@2C=7@2
@2 C=8@2

SCORE: VOICE LINE #4

Program Listing 1. Assembly listing of the Quaver music performance subroutine. This program should be analyzed before any modifications are attempted.

```

00100 *****
00110 *
00120 *           Q U A V E R 1 . 0
00130 *           Dennis Bathory Kitzsz, July 1983
00140 *
00150 *           A four-voice music performance subroutine
00160 *
00170 * Quaver executes the following:
00180 * -- four independent musical lines
00190 * -- 64-element envelope control
00200 * -- 64-element waveshape table
00210 * -- theoretical 8-octave range
00220 *           (5 octaves without aliasing)
00230 * -- full polyphony, including rests
00240 * -- fairly accurate, tempered tuning
00250 *
00260 *           (c) 1983 by Dennis Bathory Kitzsz
00270 *
00280 *****
48 00290 SETDP $48 * DIRECT PAGE WITHIN PROGRAM
00300 *
00310 *
00320 * WAVEFORM (TIMBRE) TABLES FROM BASIC
0040 00330 TABLE1 EQU $40
0041 00340 TABLE2 EQU $41
0042 00350 TABLE3 EQU $42
0043 00360 TABLE4 EQU $43
00370 *
00380 * ENVELOPE (EMBOUCHURE) TABLES FROM BASIC
4400 00390 ENVEL1 EQU $4400
4500 00400 ENVEL2 EQU $4500
4600 00410 ENVEL3 EQU $4600
4700 00420 ENVEL4 EQU $4700
00430 *
00440 * COUNTER OFFSET (PITCH) VALUE FOR UPDATE
0000 00450 STORE1 EQU $0000
0000 00460 STORE2 EQU $0000
0000 00470 STORE3 EQU $0000
0000 00480 STORE4 EQU $0000

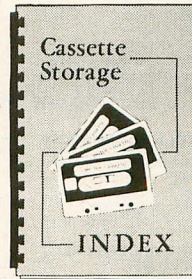
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Address	Frequency	Pitch	Storage	Duration	Note	Output	Address
4880 86	42	01420	LDA	01510	DECB	01500	MODK
4882 1F	01	01430	TFR	01510	BEQ	01520	
4884 A6	84	01440	LDA	01530	NOP	01540	
4886 A0	84	01450	SUBA	01550	NOP	01560	
4888 25	02	01460	BCS	01570	BRA	01580	INCRM3
488A 20	03	01470	BRA	01590	NOP	01600	
488C CC	0000	01480	DUMMY3	01610	DECA	01620	NEWL3
488F 97	EF	01490	LDD	01630	BNE	01640	NOTE3
4891 CC	0000	01500	STA	01660	JSR	01670	<MODK+1
4895 27	06	01510	DEC	01680	STD	01690	
4897 12		01520	BEQ	01700	LDY	01710	
4898 12		01530	NOP	01720	LDD	01730	
4899 12		01540	NOP	01740	BCS	01750	
489A 12		01550	NOP	01760	BRA	01770	
489B 20	08	01560	BRA	01780	ANDB	01790	
489D 0C	73	01570	INC	01800	OUT4	01810	
489F 4A	03	01580	INCRM3	01820	STA	01830	
48A0 26		01590	DECA	01840	LDD	01850	
48A2 BD	4971	01600	BNE	01860	DEC	01870	
48A5 DD	92	01610	JSR	01880	BEQ	01890	
48A7 108E	4700	01620	STD	01900	NOP	01910	
48AB CC	0000	01630	LDY	01920	NOP	01930	
48AC C3	0000	01640	LDD	01940	NOP	01950	
48B1 DD	AF	01650	BCS	01960	NOP	01970	
48B3 1F	89	01660	BRA	01980	NOP	01990	
48B5 C4	3F	01670	ANDB	02000	NOP	02010	
48B7 86	43	01680	LDA	02020	NOP	02030	
48B9 1F	01	01690	TFR	02040	NOP	02050	
48BB A6	84	01700	LDA	02060	NOP	02070	
48BD A0	A4	01710	TFR	02080	NOP	02090	
48BF 25	02	01720	LDA	02100	NOP	02110	
48C1 20	03	01730	BCS	02120	NOP	02130	
48C3 CC	0000	01740	BRA	02140	NOP	02150	
48C6 97	F0	01750	OUT4	02160	NOP	02170	
48C8 CC	0000	01760	STA	02180	NOP	02190	
48CB 5A		01770	LDD	02200	NOP	02210	
48CC 27	06	01780	DEC	02220	NOP	02230	
48CE 12		01790	BEQ	02240	NOP	02250	
48CF 12		01800	NOP	02260	NOP	02270	
48D0 12		01810	NOP	02280	NOP	02290	
48D1 12		01820	NOP	02300	NOP	02310	
48D2 20	08	01830	NOP	02320	NOP	02330	
48D4 0C	AA	01840	NOP	02340	NOP	02350	
48D6 4A		01850	NOP	02360	NOP	02370	
48D7 26	03	01860	NOP	02380	NOP	02390	
48E1 0E		01870	NOP	02400	NOP	02410	
48E3 8E	48	01880	NOP	02420	NOP	02430	
48E5 1F	8B	01890	NOP	02440	NOP	02450	
48F7 7E	4802	01900	NOP	02460	NOP	02470	
4800		01910	NOP	02480	NOP	02490	
4800 1A	50	01920	NOP	02500	NOP	02510	
4802	4802	01930	NOP	02520	NOP	02530	
4802 108E	4400	01940	NOP	02540	NOP	02550	
4806 CC	0000	01950	NOP	02560	NOP	02570	
4809 C3	0000	01960	NOP	02580	NOP	02590	
480C DD	0A	01970	NOP	02600	NOP	02610	
480E 1F	89	01980	NOP	02620	NOP	02630	
4810 C4	3F	01990	NOP	02640	NOP	02650	
4812 86	40	02000	NOP	02660	NOP	02670	
4814 1F	01	02010	NOP	02680	NOP	02690	
4816 A6	84	02020	NOP	02700	NOP	02710	
4818 A0	A4	02030	NOP	02720	NOP	02730	
481A 25	02	02040	NOP	02740	NOP	02750	
481C 20	03	02050	NOP	02760	NOP	02770	
481E CC	0000	02060	NOP	02780	NOP	02790	
4821 97	ED	02070	NOP	02800	NOP	02810	
4823 CC	0000	02080	NOP	02820	NOP	02830	

* PITCH (FREQUENCY) STORAGE VALUES FROM TABLE

* LENGTH (DURATION) NOTE VALUES FROM BASIC

* 6-BIT DAC SOUND OUTPUT ADDRESS

* SET UP PHASES, TABLES, ETC.

* GET NEW DIRECT PAGE VALUE

* GO TO PLAY ROUTINE

* DISABLE INTERRUPTS

* POINT TO ENVELOPE TABLE

* GET 1-IN-65536 COUNTER

* ADD 16-BIT PITCH OFFSET VALUE

* UPDATE 1-IN-65536 COUNTER

* USE MSB AS WAVELENGTH LSB

* WAVELENGTH HAS 64 ENTRIES

* MSB OF WAVEFORM TABLE POINTER

* TRANSFER COUNTER POINTER TO X

* GET WAVEFORM VALUE FOR ENVELOPE

* OFFSET OUTPUT WITH ENVELOPE

* OK TO STORE (0 OR MORE)

* ADDS 3 CYCLES (WAVE BALANCE)

* NO FOLDOVER OR CLIPPING

* SAVE WAVEFORM VALUE FOR DAC

* GET NOTE LENGTH REMAINING


```

4826 5A 00950 DECB * DECREMENT LOWER PORTION
4827 2T 00960 BEQ * IF LSB=0, CHANGE ENVELOPE
4828 12 00970 NOP * ... AND 2 CYCLES ...
4829 12 00980 NOP * ... AND 2 MORE ...
4830 12 00990 NOP * ... FOR A TOTAL OF EIGHT
4831 20 01000 NOP * BRANCH TO NOTE LENGTH STORE
4832 20 01010 BRA * MOVE TO NEXT ENVELOPE VALUE
4833 0C 01020 INCRM1 * DECREMENT MSB OF REMAINDER
4834 4A 01030 DECA * IF NOT ZERO, STORE NEW LENGTH
4835 26 01040 BNE * IF LENGTH=0, GET NEW NOTE
4836 2D 4900 JSR * ELSE STORE REMAINING LENGTH
4837 DD 24 STD *
4838 108E 4500 #ENVEL2 * D
4839 CC 0000 LDD #PITCH2 * U
4840 C3 0000 ADD #STORE2 * P
4841 DD 41 STD <MODB+1 * L
4842 1F 89 TFR A,B * I
4843 44 3F ANDB #S3F * C
4844 86 41 LDA #TABLE2 * A
4845 1F 01 LDA D,X * T
4846 1F 01 TFR 'Y * E
4847 A0 A4 SUBA 'Y * V
4848 25 02 BRA OUT2 * O
4849 20 03 BCS DUMMY2 * I
4850 CC 0000 LDD #S0000 * C
4851 97 EE <WAVE2 * E
4852 5A CC 0000 #LENGTH2 * #
4853 27 06 BEQ INCRM2 * #
4854 27 06 NOP * #
4855 12 01250 NOP * #
4856 12 01260 NOP * #
4857 12 01270 NOP * #
4858 12 01280 NOP * #
4859 20 08 BRA NEWL2 * #
4860 0C 3C INC <MOD2+3 * #
4861 26 03 DECA NEWL2 * #
4862 26 03 BNE NEWL2 * #
4863 DD 493F JSR NOTE2 * #
4864 DD 5B STD <MODJ+1 * #
4865 4600 LDD #ENVEL3 * D
4866 00 4600 LDD #PITCH3 * U
4867 CC 0000 LDD #STORE3 * P
4868 DD 78 ADD #MODC+1 * I
4869 1F 89 TFR A,B * I
4870 1F 89 ANDB #S3F * C

```

```

4871 96 01890 JSR * NOTE4
4872 96 01900 STD * <MODL+1
4873 96 01910 *
4874 96 01920 SUMMIT *
4875 96 01930 LDA * <WAVE4
4876 96 01940 ADDA * ADDITIVE SYNTHESIS: +WAVE #3
4877 96 01950 ADDA * ADDITIVE SYNTHESIS: +WAVE #2
4878 96 01960 ADDA * ADDITIVE SYNTHESIS: +WAVE #1
4879 96 01970 ANDA * #SFC
4880 B7 FC20 STA * MASK OUT UNUSED DAC BITS
4881 0E 02 JMP * OUTPUT VALUE TO AUDIO DAC
4882 0E 02 * CONTINUE THE LOOP
4883 00 00 FCB * TEMPORARY STORAGE VOICE #1
4884 00 00 FCB * TEMPORARY STORAGE VOICE #2
4885 00 00 FCB * TEMPORARY STORAGE VOICE #3
4886 00 00 FCB * TEMPORARY STORAGE VOICE #4
4887 00 00 SETDP * RESTORE ORIGINAL PAGE MARKER
4888 00 0000 FDB *
4889 5555 FDB * T
4890 5A68 FDB * O
4891 5FC8 FDB * P
4892 657A FDB * A
4893 65F3 FDB * O
4894 71E8 FDB * C
4895 78AD FDB * T
4896 7FDB FDB * A
4897 8775 FDB * V
4898 8F83 FDB * A
4899 980B FDB * E
4900 A116 FDB *
4901 AAAA FDB *
4902 4A3C LDX * MUSIC1
4903 108E 48F1 LDY * POINT TO NOTES FROM BASIC
4904 34 10 * #TEMPER
4905 84 84 PSHS * SAVE NOTE TABLE FOR USE
4906 C1 FF LDB * GET FIRST NOTE TO PLAY
4907 1027 00B3 CMPB * IS NOTE 255? MEANS END!
4908 58 491F AE LBEQ * GO OUT IF MUSIC IS DONE
4909 AE A5 LSLB * DOUBLE IT FOR 2-BYTE OFFSET
4910 BF 4807 STX * GET PITCH (Y TABLE + B)
4911 35 10 PULS * SAVE IN VOICE #1 STORAGE
4912 35 10 PULS * RESTORE BASIC NOTE TABLE
4913 E6 01 LDB * GET OCTAVE FROM BASIC
4914 53 07 COMB * REVERSE BITS FOR LOOPING
4915 C4 07 ANDB * MASK OUT SPURIOUS VALUES

```

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Color Computer/93

Program Listing 2. Basic listing for the Quaver music editor and driver. Line 8 contains a string variable which will be used to store working information, and its length must always be 32 characters.

```

2 CLS:PRINT"IF AN ERROR MESSAGE (?SN, ?NF ORSIMILAR) APPEARS BEL
OW, RUN THIS PROGRAM AGAIN. THE MESSAGE WILLNOT RECUR. ERROR ME
SSAGE.":PRINT
4 PROMEO:PCL:CLR
6 CLS:SOUND255,1,CLEAR200,6H4000:FO=4:TW=2:J=63:K=31:OQ=6H4000:C
LS:V=256:SS=6H6000
8 D$="LEAVE THIS STRING ALONE, PLEASE!"
10 U=VARPTR(D$):U=V*PEEK(U+2)+PEEK(U+3):DIMW(8):DIMP(16):DIMD(1
64),D2(64):DIMS(3,26):DATA96,64,65,66,67,68,69,70,71,82,91,93,10
7,109,112,113,114,115,116,117,118,119,120,121,122,125,126
12 FORX=1TO26:READS(1,X):NEXT:FORX=1TO26:S(2,X)=X:NEXT
14 DATA0,1,3,4,6,8,9,11,0,0,1,1,0,2,4,6,8,12,16,24,32,48,0,0,0,
255
16 FORX=1TO26:READS(3,X):NEXT
18 PRINTV,"Clearing Memory -- Please Wait":FORX=6H5000 TO 6H5F
FF:POKEY,0:NEXT
20 SQ=6H5000-4:SOUND255,1,CLS:PRINTSTRINGS$(32,""):PRINT" C O L
O R Q U A V E R I . 0 ":PRINT" Dennis Bathory Kitsz":PRINT
STRINGS$(32,"-"):PRINT
22 PRINT" <<< O P T I O N S >>>":PRINT
24 PRINT" (1) Build waveform
26 PRINT" (2) Build envelope
28 PRINT" (3) Save waves/envelopes
30 PRINT" (4) Enter or edit music
32 PRINT" (5) Play music
34 PRINT" (6) Load from tape
36 PRINT" (7) Display waveforms"
38 PRINT" (8) Do spectral transform"
40 PRINT" Touch 1 - 8 for selection."
42 A$=INKEY$:IFA$<"1"ORAS>"8":THEN42
44 A$=INKEY$:IFA$<"1"ORAS>"8":THEN42
46 SOUND255,1:ONVAL(A$):GOTO48,58,68,78,140,148,180,212
48 I$="##### Timbre Assignment #####":GOSUB444
50 CLS:PRINTV,"Which voice timbre? (Touch 1-4)
52 A$=INKEY$:IFA$="1"ORAS<"1"ORAS>"4":THEN52
54 T=VAL(A$):IFW(T)=1THENPRINTV,"Timbre #n" has been assigned.
:PRINT" Change it? (Touch Y or N)":ELSE370
56 A$=INKEY$:IFA$="Y"ORAS="Y":THEN370ELSEIFA$="N"ORAS="N":THEN20EL
SE56
58 I$="##### Envelope Assignment #####":GOSUB444
60 CLS:PRINTV,"Which envelope form? (Touch 1-4)
62 A$=INKEY$:IFA$="1"ORAS<"1"ORAS>"4":THEN62
64 T=VAL(A$)+4:IFW(T)=1THENPRINTV,"Envelope #n" is assigne
d.":PRINT" Change it? (Touch Y or N)":ELSE370
66 A$=INKEY$:IFA$="Y"ORAS="Y":THEN370ELSEIFA$="N"ORAS="N":THEN20EL
SE66
68 I$="##### Save All Waveforms #####":GOSUB444

```

more



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```

118 CLS:PRINT@V," <Compile source code>,"PRINT" <Return
to main menu>:"PRINT" Touch C or R "
120 A$=INKEY$:IF A$="C" OR A$="R" THEN 121 ELSE IF A$="R" OR A$="I" THEN 20E
LSE 120
122 ER=0:CLS:PRINT@V,"Compiling Source Code in Memory"
124 X=&H6000
126 PRINT@491,X:GOSUB306:X=X+1:IF X=&H7000 THEN 130 ELSE IF ER=1 THEN
N128 ELSE IF M=1 THEN 130 ELSE 126
128 CLS:IF$="COMPLIATION ABORTED DUE TO ERROR":GOSUB444:GOTO20
130 CLS:IF$="###" THEN 131 ELSE 128
132 CLS:IF$="###" THEN 133 ELSE 130
133 CLS:PRINT@V,"Insert cassette into player and set to record.
Enter file name when ready.":PRINT:INPUT" File Name";
A$
134 CSAVEM A$,&H5000,&H5FFF,&H47F0
136 GOTO20
138 GOTO138
140 IS="###" Music Performance #####:GOSUB444
142 CLS:IF M=0 THEN PRINT@V,"Music has not been compiled yet.":GOS
UB444:GOTO20
144 IF PEK(&H4800)<>H1A OR PEK(&H4801)<>H50 THEN PRINT"Machine
language QUAVER has not been loaded. Please insert the QUAVER t
ape and set to play.
Loading QUAVER . . .":AUDIO ON:CLOADM:AU
DIO OFF:SOUND255 1
146 EXEC&H47F0:GOTO20
148 IS="##" Load waves/music from tape ##:GOSUB444
150 CLS:PRINT@V," Complete Setup Load? " :PRINT" Includes
4 timbres & 4 envelopes":PRINT" Touch Y or N, X for menu"
152 A$=INKEY$:IF A$="Y" OR A$="N" THEN 154 ELSE IF A$="X" THEN 158
ELSE IF A$="X" OR A$="X" THEN 20 ELSE 152
154 CLS:PRINT@V,"Enter file name. If not known, press Enter.":P
RINT:INPUT" File Name";A$:IF A$="" THEN CLOADM ELSE CLOADM A$
:GOSUB444:GOTO20
156 GOTO20
158 CLS:PRINT@V," Load which?":PRINT" <T>mbres"
:PRINT" Touch T, E, or M" <M>usic":PRINT:PRINT
" Envelopes":PRINT"
160 A$=INKEY$:IF A$="T" THEN 162 ELSE IF A$="E" OR A$="M" THEN 162 ELSE IF A$
="E" OR A$="M" THEN 172 ELSE IF A$="M" OR A$="E" THEN 176 ELSE 160
162 SOUND255,1:CLS:PRINT@V,"Load which timbre (voice)?":PRINT" To
uch 1-4 for voice:PRINT" Touch 0 if not known, X to exit.
164 A$=INKEY$:IF A$="0" AND A$<"4" THEN 166 ELSE IF A$="X" OR A$="X" THEN
20 ELSE 164
166 SOUND255,1:V1$=A$:V1=VAL(A$):IF V1=0 THEN 174 ELSE PRINT"Load to
which voice?":PRINT" Touch 1-4"
168 A$=INKEY$:IF A$<"1" OR A$<"4" THEN 168
170 SOUND255,1:V2$=VAL(A$):V3=(V2-V1)*256:N2$="WAVE"+V1$+CLOADM N
2$+V3:GOTO20
172 CLS:PRINT@V,"Enter envelope file name. If not known, pres
s Enter.":PRINT:INPUT" File Name";A$:IF A$="" THEN CLOADM ELS
E CLOADM A$:GOTO20
174 REM
176 CLS:PRINT@V,"Enter music file name. If not known, press En
ter.":PRINT:INPUT" File Name";A$:IF A$="" THEN CLOADM ELSE C
LOADM A$:M=0:GOTO20
178 GOTO20
180 IS="##" Timbre & Envelope Display ##:GOSUB444:CLS:PRINT@V,"
print waveforms <S>eparately or in <T>ransparent overlay?":P
RINT" Touch T or S"
182 A$=INKEY$:IF A$="S" THEN 184 ELSE IF A$="T" OR A$="T" THEN 184
ELSE 182
184 CLS:FOR CC=0 TO 3
186 IS="#"
188 FOR X=QQ+CC*V TO QQ+CC*Y+J:SET(X-(QQ+CC*V),PEEK(X)/FO,5):NEXT
X
190 GOSUB444:IF O=OTHERNCLSU
192 NEXT
194 CLS:O:IF$="
Composite Timbre
196 FOR X=QQ TO QQ+J:XA=(PEEK(X)+PEEK(X+V)+PEEK(X+V*TW)+PEEK(X+V*W
3))/16:SET(X-QQ,XA,5):NEXT:GOSUB444
198 CLS:O:FOR CC=4 TO 7
200 IS="#"
Envelope ##+STR$(CC-3)+""
202 FOR X=QQ+CC*V TO QQ+CC*Y+J:SET(X-(QQ+CC*V),PEEK(X)/FO,5):NEXT
X
204 GOSUB444:IF O=OTHERNCLSU
206 NEXT
208 CLS:O:IF$="
Composite Envelope
" :GOSUB444

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340 POKESQ+TW, TW: POKESQ+3, 0: RETURN: REM 0 (32nd note)
342 POKESQ+TW, FO: POKESQ+3, 0: RETURN: REM 1 (16th note)
344 POKESQ+TW, 6: POKESQ+3, 0: RETURN: REM 2 (dotted 16th note)
346 POKESQ+TW, 8: POKESQ+3, 0: RETURN: REM 3 (8th note)
348 POKESQ+TW, 12: POKESQ+3, 0: RETURN: REM 4 (dotted 8th note)
350 POKESQ+TW, 16: POKESQ+3, 0: RETURN: REM 5 (quarter note)
352 POKESQ+TW, 24: POKESQ+3, 0: RETURN: REM 6 (dotted quarter note)
354 POKESQ+TW, 32: POKESQ+3, 0: RETURN: REM 7 (half note)
356 POKESQ+TW, 48: POKESQ+3, 0: RETURN: REM 8 (dotted half note)
358 POKESQ+TW, 0: POKESQ+3, 0: RETURN: REM 9 (whole note)
360 RETURN
    : REM NATURAL
362 SQ=SQ+FO: POKESQ, 255: POKESQ+1, 255: POKESQ+TW, 255: POKESQ+3, 255
364 IFSQ<H5400 THEN SQ=&H5400-FO: X=&H63FF ELSE IFSQ<&H5800 THEN
SQ=&H5800-FO: X=&H67FF ELSE IFSQ<&H5C00 THEN SQ=&H5C00-FO: X=&H6B
FF ELSE MM=1: RETURN
366 RETURN : REM END OF VOICES
368 STOP
370 Q=QQ+(V*(T-1)): GOSUB374
372 CLS: PRINTEV, "Waveform interpolated & stored.": GOSUB442: GOTO2
0
374 CLS: PRINTEV, "Move joystick to left (beginning of waveform), t
hen press <ENTER>"
376 AS=INKEY$: IFAS<>CHR$(13) THEN376ELSECLS0
378 A=JOYSTK(0): B=JOYSTK(1): SET(A,B/2,5)
380 IFA=AA ANDB=BB THEN386
382 IFG=OTHENRESET(AA, BB/2)
384 AA=A: BB=B: G=0
386 AS=INKEY$: IFAS=" " THEN378ELSEIFAS="S" ORAS="s" THENG=1: GOTO378E
LSEIFAS=CHR$(13) THEN388ELSEG=0: GOTO378
388 IS=" * * * Characterizing * * * " : GOSUB444
390 FORX=1 TOJ: POKEQ=X, 0: NEXT
392 FORX=0 TOJ: POKV=0 TOK
394 IPOINT(X, Y) THEN POKEQ+X, Y: RESET(X, Y) ELSESET(X, Y, 5)
396 NEXT: NEXT: POKEQ+Y, PEEK(Q+X-1)
398 IS=" * * Eliminating Redundancy * * " : GOSUB444

```

Program Listing 3. Random Tunes

```

10 FOR X = &H5000 TO &H5FFF
20 POKE X, RND(12) : NEXT
30 FOR X = &H4000 TO &H403F
40 Q = 4 * (X - &H4000)
50 POKE X, Q : POKE X+256, Q
60 POKE X+512, Q : POKE X+256, Q
70 NEXT
80 FOR X = &H4400 TO&H443F
90 Q = ABS(X - &H4400 - 63)
100 POKE X, Q : POKE X+256, Q
110 POKE X+512, Q : POKE X+768, Q
120 NEXT : POKE &H473F, &HFF
130 EXEC &H47F0

```

```

400 FORX=0 TOJ: FORY=0 TOK: SET(X, Y, 5): NEXT: IFPEEK(Q+X)=0 THENNEXTELS
ERSET(X, PEEK(Q+X)): NEXT
402 IS=" * * * Interpolating * * * " : GOSUB444
404 FORX=1 TOJ: D1=0: A1=PEEK(Q+X-1)
406 IFPEEK(Q+X)=0 THENX1=X: GOTO408: ELSENEXT: GOTO416
408 IFPEEK(Q+X)=0 THENIFX>J THEN412
410 IFPEEK(Q+X)=0 THENX=X+1: D1=D1+1: GOTO408ELSE412
412 X2=X: A2=PEEK(Q+X): AV=(A2-A1)/D1
414 FORI=X1 TOX2: POKEO+I, A1+AV*(I-X1): NEXT: NEXT
416 FORX=0 TOJ: RESET(X, PEEK(Q+X)): NEXT
418 IS=" * * * Completing Waveform * * * " : GOSUB444
420 FORX=0 TOJ
422 IFPEEK(Q+X)>PEEK(Q+X-1) THEN424ELSEIFPEEK(Q+X)+1<PEEK(Q+X-1)
THEN426ELSENEXT: GOTO430
424 FORY=PEEK(Q+X+1) TOPEEK(Q+X)-1: RESET(X, Y): NEXT: GOTO428
426 FORY=PEEK(Q+X+1) TOPEEK(Q+X+1)-1: RESET(X, Y): NEXT
428 NEXT
430 FORX=0 TOJ: POKEQ+X, PEEK(Q+X) *4OR3: NEXT
432 IS="***** Final Waveform #"+STR$(T)+ " *****": GOSUB444: W(T)
=-1
434 IS="Set tape to record, press Enter.": GOSUB444
436 AS=INKEY$: IFAS<>CHR$(13) THENGOSUB442: GOTO434: ELSE438
438 AUDIO ON N15="SCRN"+STR$(T): CSAVEM N15, 1024, 1535, 1024: N2$="W
VFM"+STR$(T): CSAVEM N2$, Q, Q+63, Q: AUDIO OFF
440 GOTO372
442 FORN=1 TO1000: NEXT: RETURN
444 FORX=0 TOK: POKEU+X, PEEK(1024+V+X): NEXT: PRINTEV, IS: : GOSUB442: P
RINTEV, DS: RETURN
446 FORX=&H5000 TO &H5020: PRINTHEX$(PEEK(X)) " " : NEXT
448 PRINT
450 FORX=&H5400 TO &H5420: PRINTHEX$(PEEK(X)) " " : NEXT
452 PRINT
454 FORX=&H5800 TO &H5820: PRINTHEX$(PEEK(X)) " " : NEXT
456 PRINT
458 FORX=&H5C00 TO &H5C20: PRINTHEX$(PEEK(X)) " " : NEXT

```

Program Listing 4. Scale Scurry

```

10 Y=1
20 FORX= &H5000 TO &H5FFF STEP4
30 POKEX, Y: Y=Y+1: IFY>13 THENY=1
40 NEXT
50 FORX= &H5001 TO&H5FFF STEP52
60 Z=Z+1 : IF Z>7 THEN Z=1
70 FORY=X TO X+52 STEP 4: POKEX, Y
80 NEXT : NEXT
90 FORX= &H5002 TO &H5FFF STEP4
100 POKE X, 1 : NEXT
110 FORX=&H5003 TO &H5FFF STEP4
120 POKE X, 128 : NEXT
130 POKE &H5FFF2, 63
140 FORX=&H5FFF4 TO &H5FFF
150 POKE X, 255 : NEXT
160 EXEC &H47F0

```



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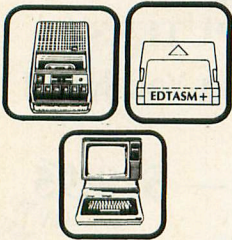
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Unforgettable Characters



The second, and final, part of Bill's bet with Engineer John.



16K Extended Color Basic

Last month, Bill's next-door-neighbor and computer sparring partner, Engineer John, challenged Bill to bring his Color Computer up to snuff (snuff being the user-definable graphics characters available in John's Timex-Sinclair TS2000). The bet revolves around a big prize — one week in a computer camp. Will Bill make it? Read on! — Eds.

I NOW HAD 21 lines down and 32 characters across. Could I get more, to put my neighbor properly in his place? Program Listing 1 shows what I developed for a seven by nine character generator.

It's not easy generating characters that are not even multiples of the eight pixels stored in a byte of the graphics page. Take the case of the seven by nine character, shown in Figure 1. The first character starts on a "byte boundary." The next character, however, starts on the last bit of the first byte, the next on the second to last bit, and so forth. Looks like we have to do some shifting of character data, based on the horizontal position of the character along the line.

The variables in the program are the same as in Listing 2 of last month's article: the character value itself (VV), the X character position (XX), the Y row position (YY), the start of the graphics table

by William Barden, Jr.

(TS), and the start of the graphics page (GP). We now have to calculate the starting bit of the character, however, and then break up each row of the character data into two chunks: one stored in the first byte in the graphics page in which the character appears, and one stored in the next byte in the graphics page. In some cases the character will start on a byte boundary (character positions 0, 8, 16, and so forth). Not only do we have to "align" the character data, we have to allow any preceding character or trailing character to "pass through" and not be overwritten.

In the program, $INT((XX \times 7)/8) + YY \times 288 + GP$ finds the location of the first byte defining the character position (there are 288 bytes per 36 character line and $INT((XX \times 7)/8)$ additional bytes along the line for the X value). The BT expression finds the number of one bit shifts to align the character data. VH and VL hold the character data after alignment. VM and VN hold a "mask value" to allow the graphics data preceding and following the

character position to pass through unmolested.

The driver program for this character generator generates a screenful of all characters as before — this time 21 lines of 36 characters per line.

To Run it, follow the same procedure as before — protect memory, load the graphics table, and then execute the program.

Sad to say, this is about the maximum resolution you can get with a monitorless display on the Color Computer. Still, I was on the way to winning my bet...

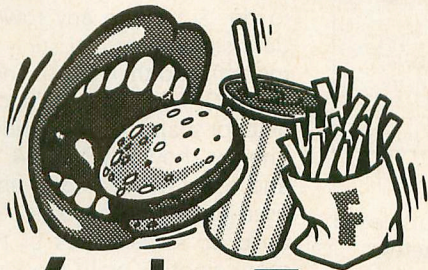
All That Jazz

I'm waiting for the day when the Radio Shack Lisa-like computer appears. It'll have a 1024 by 1024 resolution on the screen, and you'll be able to see exactly what the printed output looks like on the screen via high-resolution dot graphics. Until that time, however, I ginned up a stop-gap measure. It'll let you display character data or shapes from the graphics table anywhere on the graphics screen and even let you superscript, subscript, underline, or even (with a moderate amount of work) proportionally space between characters.

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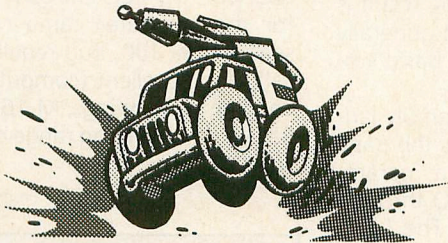


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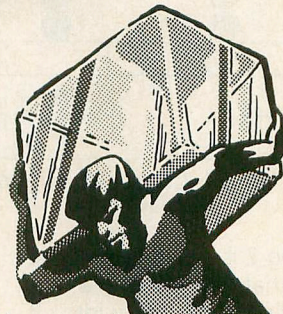
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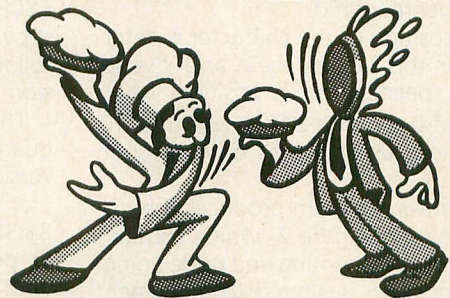


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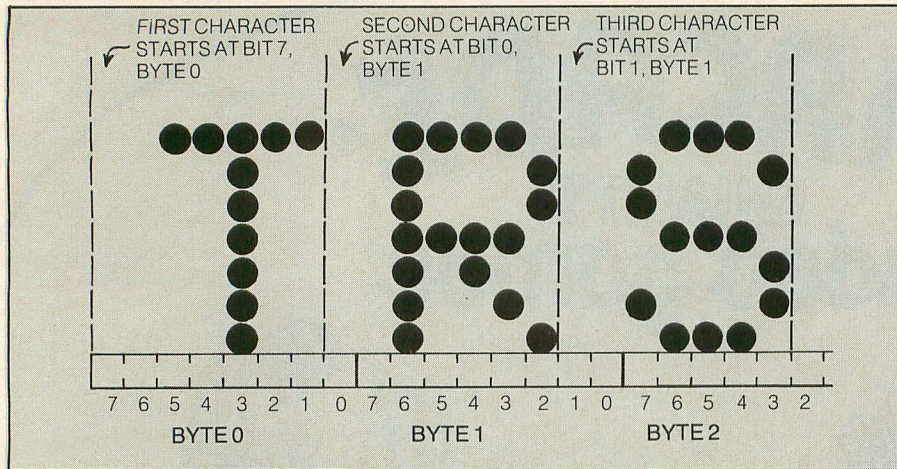


Figure 1. Character Alignment For 7 by 9 Characters

Program Listing 2 is a variation of the last program, in that it works with a variable spacing called WW, for width. If you're using characters from the graphics table we've defined above, stick with a width of eight. However, if you define characters that require less width, such as l's, 1's, or I's, pare down the width variable as required. I'll leave this to your own experimentation...

The position of the character is determined in this case by the X and Y variables. X specifies the X position, using values of 0 through 248. Y specifies the Y position, using values of 0 through 184.

The driver program produces the display shown in Figure 2, which contains super- and subscripting and underlining. The Y position is altered to implement the super- and subscripting. An Up Arrow character signifies "move up four Y units," while a % character signifies "move down four Y units." You can use your own unique characters for these functions by following the program.

The underlining is handled by defining the 0 character as 255,0,0,0,0,0,0. This draws a horizontal bar under each

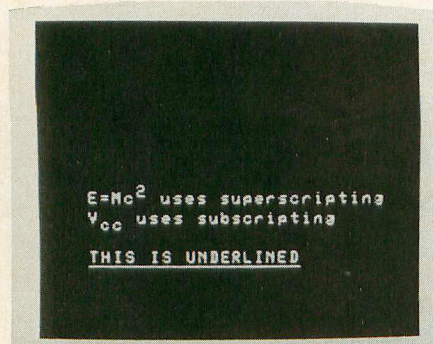


Figure 2. Display For X/Y Character Generator

character position when Y is displaced upwards for the string of 0 characters.

The only drawback to the program above is that it's slow! The exponentiation and other number crunching slows down the speed to about 2½ seconds per character.

More for the machismo of the bet with my neighbor than anything else, I translated the Basic version of the program to 6809E assembly language. The result is shown in Program Listing 3. It generally follows the algorithm of the Basic version.

The parameters for the assembly language version are the same as the Basic version, but they are stored in a "parameter block" located at &H3FF0 through &H3FF7, as shown in Figure 3. The "driver program" operating in conjunction with the assembly language version of the program is shown in Program Listing 4. It reproduces the display shown in Figure 2 exactly, and at 1/20th the elapsed time. (The Basic version takes about 200 seconds, while the assembly language version takes about 10 seconds.)

To run the assembly language version, simply protect memory and load the graphics tables as before, and then execute the Basic program in Listing 4. First it relocates the machine language code of the program into the &H3F70 area, and then calls the program for each char-

3FF0	VV	0-255
3FF1	X	0-255
3FF2	Y	0-191
3FF3	TS	LOCATION OF GRAPHICS TABLE (NORMALLY &H3800)
3FF4	TS	LOCATION OF GRAPHICS TABLE (NORMALLY &H3800)
3FF5	GP	PAGE (NORMALLY &HE00)
3FF6	GP	PAGE (NORMALLY &HE00)
3FF7	WW	WIDTH 1-8

Figure 3. Parameter Block for Variables

acter to be displayed. Note that the last 144 bytes or the last 14 characters of the graphics table are destroyed by locating the program at &H3F70.

Graphics Shapes and Other Characters

If you'd like to define other characters or shapes for the graphics table, it's easy to do. Substitute any row data in the data statements of Listing 1 (from last month), and then use the normal strings or the CHR\$ function to access any character or shape. A lunar lander can be defined as shown in Figure 4, for example, and could be located at any of the unused entries in the table. You can also build up supershapes of two, four, or more eight by eight blocks as shown in the Figure.

And that's the story of how I forsook the built-in hardware graphics of the Color Computer for software graphics. The end result was not displeasing, and is pretty useful for titles and labels embedded in graphics. Most importantly, I had won my bet. I'm currently packing for the computer camp now — let's see...Model 100, bug repellent (biological), bug repellent (computer), acoustic coupler, water wings, M-16, spare disks. See you on the firing range or at the console...

Programs on page 106

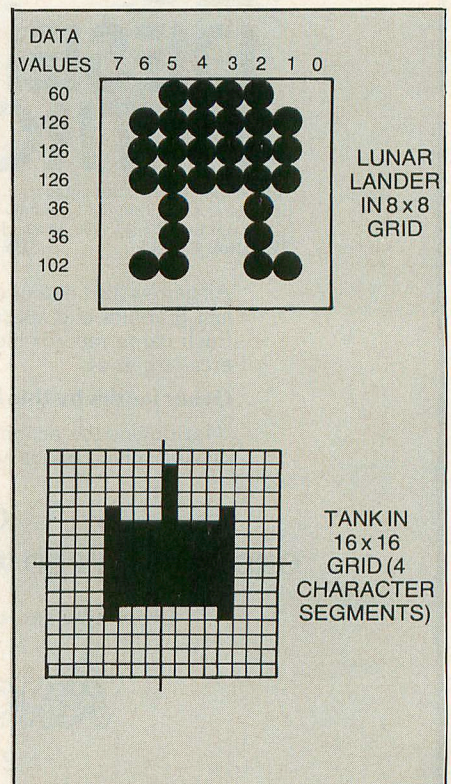


Figure 4. Graphics Shapes And Figures

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By Tim Nelson

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The **VIP Database™** features the **Library** Memory Sense with BANK SWITCHING and selectable lowercase displays for maximum utility. It will handle as many records as fit on your disk or disks. It is structured in a simple and easy to understand menu system with full prompting for easy operation. Your data is stored in records of your own design, each divided into up to 255 fields. Each field will hold up to 255 characters. All files are fully indexed for speed and efficiency. Full sort of records is provided for easy listing of names, figures, addresses, etc., in ascending or descending alphabetic or numeric order. You may also combine files, sort and print mailing lists, print "boiler plate" documents, automatically insert text in standardized forms, address envelopes - the list is endless. The math package even performs arithmetic operations and updates other fields. Create files compatible with the **VIP Writer™** and **VIP Terminal™**. Up to five different print formats are available, and control codes may be imbedded for use with all printers.

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Program Listing 1. Seven By Nine Test Generator

```

100 '7 BY 9 TEST GENERATOR
110 PMODE 4,1
120 SCREEN 1,0
130 PCLS
140 VV=0
150 FOR YY=0 TO 20
160 FOR XX=0 TO 35
170 TS=&H3800:GP=&HE00
180 GOSUB 230
190 VV=VV+1:IF VV=123 THEN VV=0
200 NEXT XX
210 NEXT YY
220 GOTO 220
230 '7 BY 9 CHARACTER GENERATOR
240 ' VV=CHARACTER, 0-255
250 ' XX=CHAR. POSITION, 0-35
260 ' YY=ROW POSITION, 0-20
270 ' TS=START OF CHAR. TABLE
280 ' GP=START OF GRAPHICS PAGE
290 'NOTE: BT=BIT POSITION, VH/V
L=MS/LS BYTE OF CHAR
300 ' VN/VM=MS/LS BYTE OF MASK,
AA/RW ARE TEMP
310 GP=INT((XX*7)/8)+YY*288+GP
320 BT=7-8*((XX*7)/8)-INT((XX*7
)/8))
330 FOR RW=0 TO 7
340 VL=PEEK(TS+VV*8+RW): VM=63
350 VL=INT(VL*2^(BT+1)): VM=INT(
VM*2^(BT+1))
360 VH=INT(VL/256): VN=INT(VM/25
6)
370 VL=VL-VH*256: VM=VM-VN*256
380 VN=NOT(VN):VM=NOT(VM)
390 AA=((PEEK(GP) AND VN) OR VH)
: POKE GP,AA
400 AA=((PEEK(GP+1) AND VM) OR V
L): POKE GP+1,AA
410 GP=GP+32
420 NEXT RW
430 RETURN

```

Program Listing 2. X/Y Character Generator

```

100 'X/Y TEST GENERATOR"
110 PMODE 4,1
120 SCREEN 1,0
130 PCLS
140 POKE &H3800,255
150 A$="E=Mc2 uses superscript
ing"
160 B$="V%cc^ uses subscripting"
170 C$="THIS IS UNDERLINED"
180 D$=STRING$(18,0)
190 Y=100: X=30
200 GOSUB 280
210 Y=112: X=30: A$=B$
220 GOSUB 280
230 Y=136: X=30: A$=C$
240 GOSUB 280
250 Y=145: X=32: A$=D$
260 GOSUB 280
270 GOTO 270
280 FOR I=1 TO LEN(A$)
290 VV=ASC(MID$(A$,I,1))
300 IF VV=94 THEN Y=Y-4:GOTO350
310 IF VV=37 THEN Y=Y+4:GOTO350
320 TS=&H3800: GP=&HE00: WW=8
330 GOSUB 370
340 X=X+8
350 NEXT I
360 RETURN
370 'PROPRTNL SPCNG CHAR. GEN
380 ' VV=CHARACTER, 0-255
390 ' X=X COORDINATE, 0-255
400 ' Y=Y COORDINATE, 0-191
410 ' TS=START OF CHAR. TABLE
420 ' GP=START OF GRAPHICS PAGE
430 ' WW=WIDTH OF CHAR., 3 TO 8
440 ' NOTE: BT=BIT POSITION,
VH/VL=MS/LS BYTE OF CHAR
450 ' VN/VM=MS/LS BYTE OF MASK,
AA/RW ARE TEMP
460 GP=INT(GP+Y*32+(X/8))
470 BT=7-8*((X)/8)-INT((X)/8))
480 FOR RW=0 TO 7
490 VL=PEEK(TS+VV*8+RW) : VM=2^(
WW-1)
500 VL=INT(VL*2^(BT+1)) : VM=INT(
VM*2^(BT+1))
510 VH=INT(VL/256) : VN=INT(VM/2
56)
520 VL=VL-VH*256 : VM=VM-VN*256
530 VN=NOT(VN) : VM=NOT(VM)
540 AA=((PEEK(GP) AND VN) OR VH)
: POKE GP,AA
550 AA=((PEEK(GP+1) AND VM) OR V
L): POKE GP+1,AA
560 GP=GP+32
570 NEXT RW
580 RETURN

```

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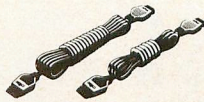
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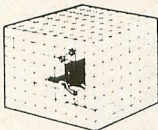


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from Spectral Associates

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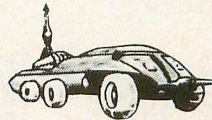


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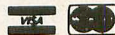
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Program Listing 3. Assembly Language Character Generator

CHARGE	3F70
LOOP1	3FBA
LOOP2	3FC1
LOOP3	3FA5
LOOP4	3FAE

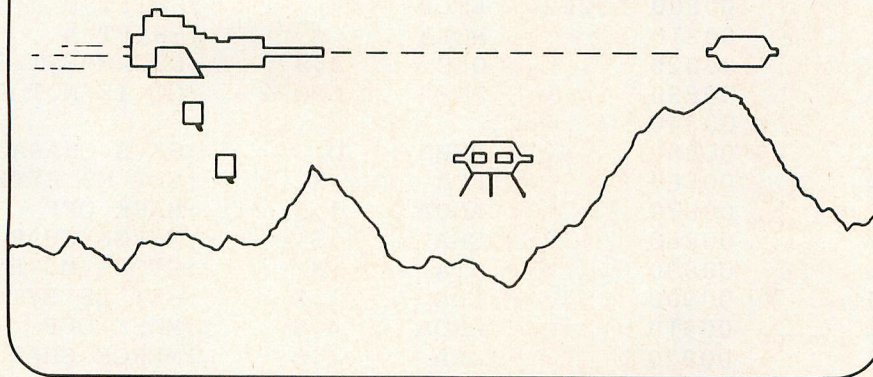
```

00100 *****
00110 *   ASSEMBLY LANGUAGE   *
00120 *   CHARACTER GENERATOR *
00130 *           Entry:      *
00140 *$3FF0=VV -Char 0-255  *
00150 *   1=X -X Coord 0-255 *
00160 *   2=Y -Y Coord 0-191 *
00170 *   3,4=TS -Chr Tbl Strt *
00180 *   5,6=GP -Grph Pg Strt *
00190 *   7=WW -Dot Width 1-8*
00200 *****
3F70          00220          ORG          $3F70
00230
3F70 CE      3FF0      00240 CHARGE   LDU          #$3FF0   ;PARAMETER BLOCK
3F73 A6      42        00250          LDA          2,U      ;GET Y
3F75 C6      20        00260          LDB          #32      ;32
3F77 3D          00270          MUL          ;Y*32
3F78 E3      45        00280          ADDD         5,U      ;GP+Y*32
3F7A 34      06        00290          PSHS         D
00300
3F7C E6      41        00310          LDB          1,U      ;GET X
3F7E 54          00320          LSRB         X/8
3F7F 54          00330          LSRB
3F80 54          00340          LSRB
3F81 4F          00350          CLRA         ;NOW IN D
3F82 E3      E1        00360          ADDD         ,S++     ;GP+Y*32+X/8
3F84 1F      01        00370          TFR          D,X      ;GP POSITION POINTER
00380
3F86 E6      41        00390          LDB          1,U      ;GET X
3F88 C4      07        00400          ANDB         #7        ;BIT POSITION 0-7
3F8A 34      04        00410          PSHS         B        ;SAVE
3F8C C6      07        00420          LDB          #7
3F8E E0      E0        00430          SUBB         ,S+      ;# OF SHIFTS 7-0
3F90 5C          00440          INCB         ;# OF SHIFTS 8-1
3F91 34      04        00450          PSHS         B        ;SAVE
3F93 34      04        00460          PSHS         B        ;TWICE
00470
3F95 E6      C4        00480          LDB          ,U      ;GET VV
3F97 4F          00490          CLRA
3F98 58          00500          LSLB         ;*2
3F99 49          00510          ROLA
3F9A 58          00520          LSLB         ;*4
3F9B 49          00530          ROLA
3F9C 58          00540          LSLB         ;*8
3F9D 49          00550          ROLA
3F9E E3      43        00560          ADDD         3,U      ;TS+VV*8
3FA0 1F      02        00570          TFR          D,Y      ;CHARACTER POINTER
00580
3FA2 5F          00590          CLRB         ;0 TO B
3FA3 A6      47        00600          LDA          7,U      ;GET WIDTH
3FA5 59          00610 LOOP3     ROLB         ;SHIFT
3FA6 CA      01        00620          ORB          #1        ;SET LS BIT
3FA8 4A          00630          DECA         ;DECREMENT COUNT
3FA9 26      FA        00640          BNE          LOOP3   ;GO IF NOT DONE
00650
3FAB 53          00660          COMB         ;INVERT
3FAC 86      FF        00670          LDA          #$FF     ;ALL ONES
3FAE 58          00680 LOOP4     LSLB         ;SHIFT B
3FAF 49          00690          ROLA         ;SHIFT A
3FB0 6A      E4        00700          DEC          ,S      ;DECREMENT SHIFT COUNT

```

more

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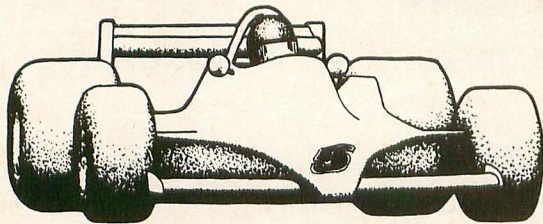
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```

3FB2 26 FA 00710 BNE LOOP4 ;GO IF NOT DONE
00720
3FB4 34 06 00730 PSHS D ;SAVE MASK
3FB6 C6 08 00740 LDB #8 ;8 ROWS FOR CHARACTER
3FB8 34 04 00750 PSHS B ;SAVE COUNT
3FBA A6 64 00760 LOOP1 LDA 4,S
3FBC A7 63 00770 STA 3,S ;INITIALIZE SHIFT COUNT
3FBE E6 A0 00780 LDB ,Y+ ;GET ROW CHARACTER
3FC0 4F 00790 CLRA
3FC1 58 00800 LOOP2 LSLB ;SHIFT B
3FC2 49 00810 ROLA ;SHIFT A
3FC3 6A 63 00820 DEC 3,S ;DECREMENT SHIFT COUNT
3FC5 26 FA 00830 BNE LOOP2 ;GO IF NOT DONE
00840
3FC7 34 06 00850 PSHS D ;SAVE CHARACTER ROW
3FC9 A6 84 00860 LDA ,X ;GET MS BYTE
3FCB A4 63 00870 ANDA 3,S ;MASK OFF
3FCD AA E4 00880 ORA ,S ;MERGE CHAR BITS
3FCF A7 84 00890 STA ,X ;STORE MS BYTE
3FD1 A6 01 00900 LDA 1,X ;GET LS BYTE
3FD3 A4 64 00910 ANDA 4,S ;MASK OFF
3FD5 AA 61 00920 ORA 1,S ;MERGE CHAR BITS
3FD7 A7 01 00930 STA 1,X ;STORE LS BYTE
3FD9 30 88 20 00940 LEAX 32,X ;POINT TO NEXT ROW
3FDC 32 62 00950 LEAS 2,S ;RESET
3FDE 6A E4 00960 DEC ,S ;DECREMENT SHIFT COUNT
3FE0 26 D8 00970 BNE LOOP1 ;GO IF NOT DONE
00980
3FE2 35 B2 00990 PULS A,X,Y,PC ;RETURN
0000 01000 END
00000 TOTAL ERRORS

```

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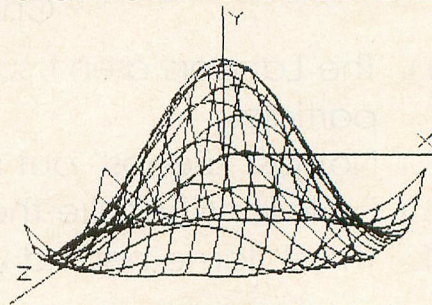
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Program Listing 4. Assembly Language Character Generator In Basic

```

110 DATA 206,63,240,166,66,198,3
2,61,227,69,52,6,230,65,84,84
120 DATA 84,79,227,225,31,1,230,
65,196,7,52,4,198,7,224,224
130 DATA 92,52,4,52,4,230,196,79
,88,73,88,73,88,73,227,67
140 DATA 31,2,95,166,71,89,202,1
,74,38,250,83,134,255,88,73
150 DATA 106,228,38,250,52,6,198
,8,52,4,166,100,167,99,230,160
160 DATA 79,88,73,106,99,38,250,
52,6,166,132,164,99,170,228,167
170 DATA 132,166,1,164,100,170,9
7,167,1,48,136,32,50,98,106,228
180 DATA 38,216,53,178
190 FOR I=&H3F70 TO &H3FE3
200 READ A:POKE I,A
210 NEXT I
220 PMODE 4,1
230 SCREEN 1,0
240 PCLS
250 DEFUSR0=&H3F70
260 POKE &H3800,255
270 A$="E=Mc^2% uses superscript
ing"
280 B$="V%cc^ uses subscripting"

```

```

290 C$="THIS IS UNDERLINED"
300 D$=STRING$(18,0)
310 Y=100: X=30
320 GOSUB 400
330 Y=112: X=30: A$=B$
340 GOSUB 400
350 Y=136: X=30: A$=C$
360 GOSUB 400
370 Y=145: X=32: A$=D$
380 GOSUB 400
390 GOTO 390
400 FOR I=1 TO LEN(A$)
410 VV=ASC(MID$(A$,I,1))
420 IF VV=94 THEN Y=Y-4:GOTO510
430 IF VV=37 THEN Y=Y+4:GOTO510
440 TS=&H3800: GP=&HE00: WW=8
450 POKE&H3FF0,VV:POKE&H3FF1,X
460 POKE&H3FF2,Y:POKE&H3FF7,WW
470 POKE&H3FF3,INT(TS/256):POKE&
H3FF4,TS-INT(TS/256)*256
480 POKE &H3FF5,INT(GP/256):POKE
&H3FF6,GP-INT(GP/256)*256
490 A=USR0(0)
500 X=X+8
510 NEXT I
520 RETURN

```

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Here's a program that will put you on your colorful way.

BY NOW YOU HAVE a good grasp of the fundamental graphics commands and techniques employed by the Color Computer. Those of you who are still confused by the bevy of syntax and parameters we've covered thus far, or who are worried you may have difficulty remembering all the rules and specifications, *don't worry!* Although the graphics commands are involved, they are not really complicated — once you get used to them, they will make pretty good sense.

If you've totally forgotten the order of parameters in a certain command, for instance, the Circle command, and you can't locate your manual, it is helpful to ask yourself: "What order would make sense?" For the Circle command, the computer first needs to know where the circle is to be drawn (the x-y coordinates of the center), then what the radius is to be, etc... If you look up the syntax of the Circle command, you'll see the format follows this logic exactly.

Fine, you say, but how can I use these Draw, Line and Circle commands in some coordinated fashion that will yield a recognizable design? How can I get some practice now, and enjoy my computer before I become an expert? In short, how can I draw a picture on my computer?

Here is a program called "DRAWBORD" that should answer this request.

DRAWBORD will let you use all the Color Computer's graphics capabilities without requiring you to write any Basic code. Its real purpose is to give you some experience with the parameters so you will be able to start writing your own game program variant without lots of trouble.

Type the program in exactly as it is. Don't add any extra spaces or leave any out, or it may not work properly. Check everything over carefully and CSAVE to tape what you've typed before you Run it.

by Scott L. Bain and Andrea R. Chartier

When you Run the program you should see a graphics screen full of random "garbage" with a small dot flashing in the middle of the mess. The Color Computer powers up this way, so it's important to enter PCLS, which will clear the screen, before you start any graphics work. In the DRAWBORD program screen clearing is accomplished by pushing the Shift and Clear keys simultaneously. Using the Shift key here is to help you avoid clearing the screen accidentally.

The Cursor

That flashing dot on your screen is very important. It's called a *cursor*, and its location will be used by most of the sub-routines in the program. You can easily move it by pressing the arrow keys or 1, 2, W, or Q keys (for diagonals).

The cursor location indicates one point on the screen. Many graphics commands, like the Line command, need two locations or endpoints to specify their function. The E command in DRAWBORD solves this problem by setting an endpoint dot on the screen that can be used in conjunction with the cursor for several graphics functions.

As an example, move the cursor to any location on the screen and press E. Now move the cursor to some other location. You'll notice a small dot remains in the first location. This is the endpoint dot. Now press the L key, which will cause the program to execute a Line command, using the cursor and the endpoint dot as endpoints. Move the cursor again and hit L. Another line is drawn using the new cursor position and the old endpoint dot — in fact, the endpoint dot will remain stationary until you hit E again.

Now try the same procedure, but press C instead of L. As you might have guessed, you'll get a circle instead of a line, using the endpoint dot as the center and the distance between it and the cursor as the radius.

Control

The Circle command has many options (such as height, start, and finish) the user would want to control. The same is true for Get (G), Put (P), Color, and many of the other commands. The program has a format menu that can be reached by pressing the M key. In the menu you can easily set any of these special parameters, as well as changing the PMODE, the Page, the Screen etc... by just pressing the key indicated on the menu and answering the questions that follow. The menu will also list all current values for the parameters and will remind you of your current cursor coordinates (and tell you the color of the pixel the cursor is currently on).

Once you set a parameter to a certain value, it is important to remember it will stay that way until you change it again. Also, you must use legal entries in the option menu. The program will not correct mistakes (like using four colors in a two-color mode), although it will warn you if you make a syntax error (like asking for color 9 when there is no such color). X will take you back to the graphics screen.

If you get confused at any time, press H (for help) and a list of the commands will be summarized for you.

One note before you start: this program does support the Paint command,

▶ more



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but since P is already used to generate Put, z will indicate the Paint command.

DRAWBORD Commands

The following keys are used for commands with DRAWBORD:

+ — cursor begins leaving a trail.
- — cursor begins erasing (leaving a "background color" trail).
0 — cursor begins normal movement (will not affect any pixels it moves through).
E — set the endpoint dot for future use.
L — draw a line between the cursor and the endpoint dot.
B — create a box using the cursor and endpoint dot as corners.

F — same as B, but a filled box.
C — create a circle with the endpoint dot as the center and the cursor as a point along the circle.
G — Get area in rectangle defined by the cursor and endpoint dot. If you try to Get an area that is too large, a tone will sound.
P — Put the array created by G at cursor position.
D — Draw current draw string at cursor position.
M — go to format menu.
K — toggle endpoint dot. If the dot is "on" this will turn it "off" and vice versa. Note that the dot really remains the same; this merely determines whether it is visible.
Z — Paint, beginning at the cursor.
H — go to help screen.

We could spend a lot more time teaching you how to use this program, but it will be more instructive (and a *whole* lot more fun) for you to simply play with it until you get a feel for the way it works.

Of course, this is far from the absolute limit of the Color Computer's graphics capabilities. Techniques for quicker animation, putting four colors in high resolution, etc... are being developed constantly. The best way to keep up with it all is to stay current on articles and by all means, *experiment*. Keep in mind that nothing you can do in Basic will ever harm your machine. The worst that can happen is that you'll get unpredictable results and have to start again from scratch.

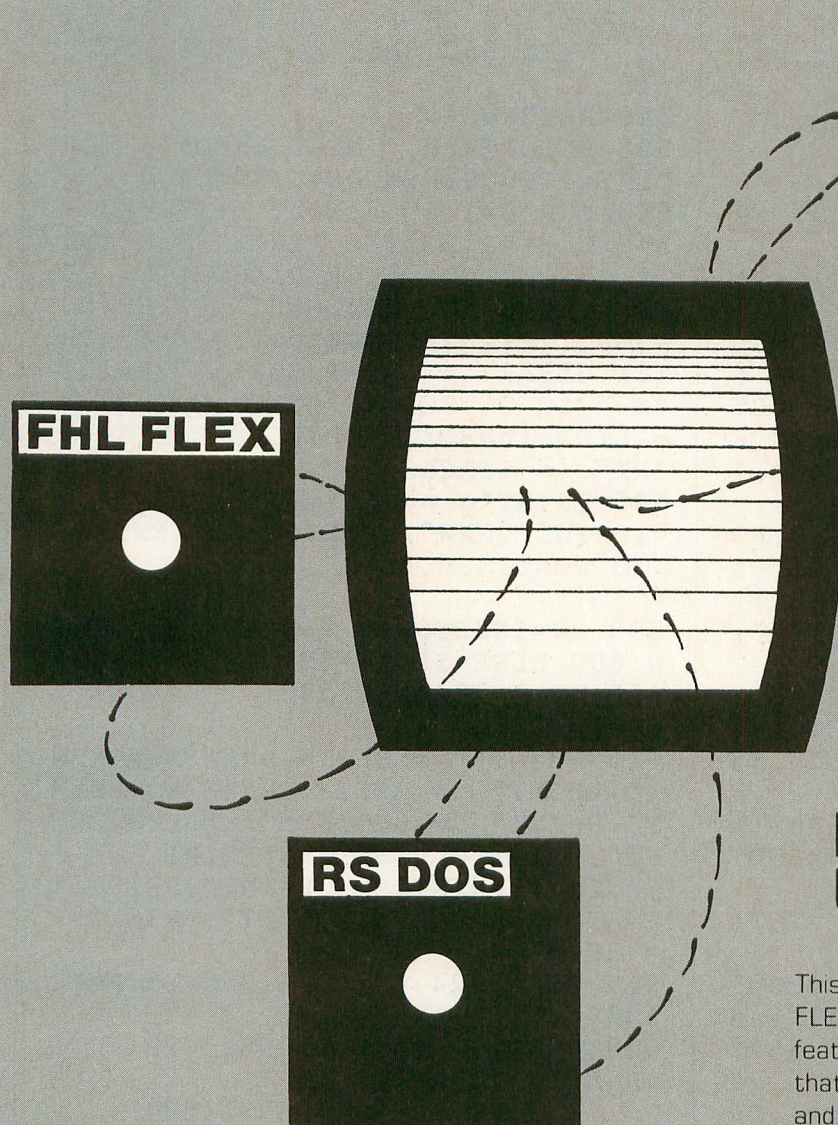
And, that wouldn't be so bad, would it? ■ ■ ■

Program Listing. DRAWBORD

```
10 PM=3:PG=1:CS=0:FC=3:BC=2:CC=3
:CH=1:SC=1:CE=1:D$="U5R5D5L5":GX
=10:GY=10:GP=0:PC=3:PB=3:DIMAR(1
00):XC=128:YC=96:XE=XC:YE=YC:SZ=
100
20 GCOM$="^2"+CHR$(9)+"W"+CHR$(1
0)+"Q"+CHR$(8)+"L"+CHR$(92)+"MLB
FCDGP+-0EZHK":MCOM$="1234CDOPXHJ
"
30 PMODE PM,PG:COLOR FC,BC:SCREE
N1,CS:IFPM=4THENCX=1:CY=1:N=40EL
SEIFPM=3THENCX=2:CY=1:N=40ELSE I
FPM=2THENCX=2:CY=1:N=80ELSEIFPM=
1THENCX=2:CY=2:N=80ELSECX=2:CY=2
:N=160
40 OC=PPOINT(XC,YC)
50 FORK=338 TO 345:POKEK,255:NEX
T
60 PSET(XC,YC,FC):GOSUB560:A$=IN
KEY$:PSET(XC,YC,BC):GOSUB560:IFA
$<>" THEN70ELSE60
70 PSET(XC,YC,OC)
80 ON INSTR(GCOM$,A$)+1 GOTO 50,
90,100,110,120,130,140,150,160,2
00,210,220,230,240,250,260,270,2
90,350,360,370,380,390,570,280
90 YC=YC-CY:GOTO170
100 YC=YC-CY:XC=XC+CX:GOTO170
110 XC=XC+CX:GOTO170
120 XC=XC+CX:YC=YC+CY:GOTO170
130 YC=YC+CY:GOTO170
140 XC=XC-CX:YC=YC+CY:GOTO170
150 XC=XC-CX:GOTO170
160 XC=XC-CX:YC=YC-CY
170 IFXC<0THENXC=256ELSEIFXC>256
THENXC=0
180 IFYC<0THENYC=198ELSEIFYC>198
THENYC=0
190 IF DW=-1THEN PSET(XC,YC,BC):
GOTO40 ELSE IF DW=1 THEN PSET(XC
,YC,FC):GOTO40 ELSE GOTO 40
200 PCLSBC:GOTO40
210 GOSUB400:GOTO30
220 LINE(XC,YC)-(XE,YE),PSET:GOT
O40
230 LINE(XC,YC)-(XE,YE),PSET,B:G
OTO40
240 LINE(XC,YC)-(XE,YE),PSET,BF:
GOTO40
250 CIRCLE(XE,YE),SQR((XC-XE)^2+
(YC-YE)^2),CC,CH,SC,CE:GOTO40
260 DRAW "BM"+STR$(XC)+", "+STR$(
YC)+D$:GOTO40
270 X=((ABS(XC-XE)*ABS(YC-YE))-1
)/N:IF X>SZ THEN SOUND 200,10:GO
TO40 ELSE GET(XC,YC)-(XE,YE),AR,
G:GX=(XE-XC):GY=(YE-YC):GOTO40
280 IF PPOINT(XE,YE)=FC THEN PSE
T(XE,YE,BC):GOTO 40ELSE PSET(XE,
YE,FC):GOTO40
290 X1=XC+GX:Y1=YC+GY:ON GP+1 GO
TO 300,310,320,330,340
300 PUT(XC,YC)-(X1,Y1),AR,PSET:G
OTO40
310 PUT(XC,YC)-(X1,Y1),AR,PRESET
:GOTO40
320 PJT(XC,YC)-(X1,Y1),AR,AND:GO
TO40
330 PUT(XC,YC)-(X1,Y1),AR,OR:GOT
O40
```

◆ to page 116

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```

340 PUT(XC,YC)-(X1,Y1),AR,NOT:GO
TO40
350 DW=1:GOTO 190
360 DW=-1:GOTO190
370 DW=0:GOTO 190

380 XE=XC:YE=YC:OC=FC:GOTO50
390 IF PB=FC THEN PSET(XC,YC,BC)
ELSE PSET(XC,YC,FC)
395 PAINT (XC,YC),PC,PB:GOTO 40

400 'MENU
410 CLS:PRINT"pixel"CHR$(128)"te
st=";OC;
420 PRINT@32, " -PMODE("PM")":PR
INT" -PAGE("PG")":PRINT" -FGRND,
BCKGRND("FC","BC")":PRINT" -COLO
R SET("CS")":PRINT"jUMP CURSOR (
";XC;","YC;")":PRINT"circle("CC"
,"CH","SC","CE")":PRINT"option F
OR PUT("GP")":PRINT"pAINT("PC","
PB")":PRINT"dRAW STRING("D$")
425 POKE 1056,49:POKE 1088,50:PO
KE 1120,51:POKE 1152,52
430 PRINT"EXIT TO SCREEN":PRINT
STRING$(32,CHR$(131));:PRINT">";

440 A$=INKEY$:IFA$=""THEN440
450 ON INSTR(MCOM$,A$)+1 GOTO 44
0,460,470,480,490,500,510,520,53
0,540,570,535
460 INPUT"PMODE";X:IFX>4OR ABS(X
)<>INT(X) THEN 550 ELSE PM=X:GOT
O410
470 INPUT"PAGE";X:IFABS(X)<>INT(
X)THEN550ELSE PG=X:GOTO410
480 INPUT"FOREGROUND/BACKGROUND"
;X,Y:IF X>8 OR Y>8 OR INT(X)<>AB
S(X) OR INT(Y)<>ABS(Y) THEN 550
ELSE FC=X:BC=Y:GOTO410
490 INPUT"COLOR SET";X:IF X>1 OR
INT(X)<>ABS(X) THEN 550 ELSE CS
=X:GOTO410
500 INPUT "circle COLOR";X:INPUT
"circle HEIGHT";Y:INPUT"circle S
TART";Z:INPUT"circle END";Z1:IF
X>8 OR Z>1 OR Z1>1 OR INT(X)<>AB
S(X)THEN 550 ELSE CC=X:CH=Y:SC=Z
:CE=Z1:GOTO410
510 PRINT "dRAW STRING ->";:LINE
INPUT D$:GOTO410
520 INPUT"option FOR PUT (0=PSET
,l=PRESET,2=AND,3=OR,4=NOT)";X:I
FX>4 OR INT(X)<>ABS(X) THEN 550
ELSE GP=X:GOTO410

```

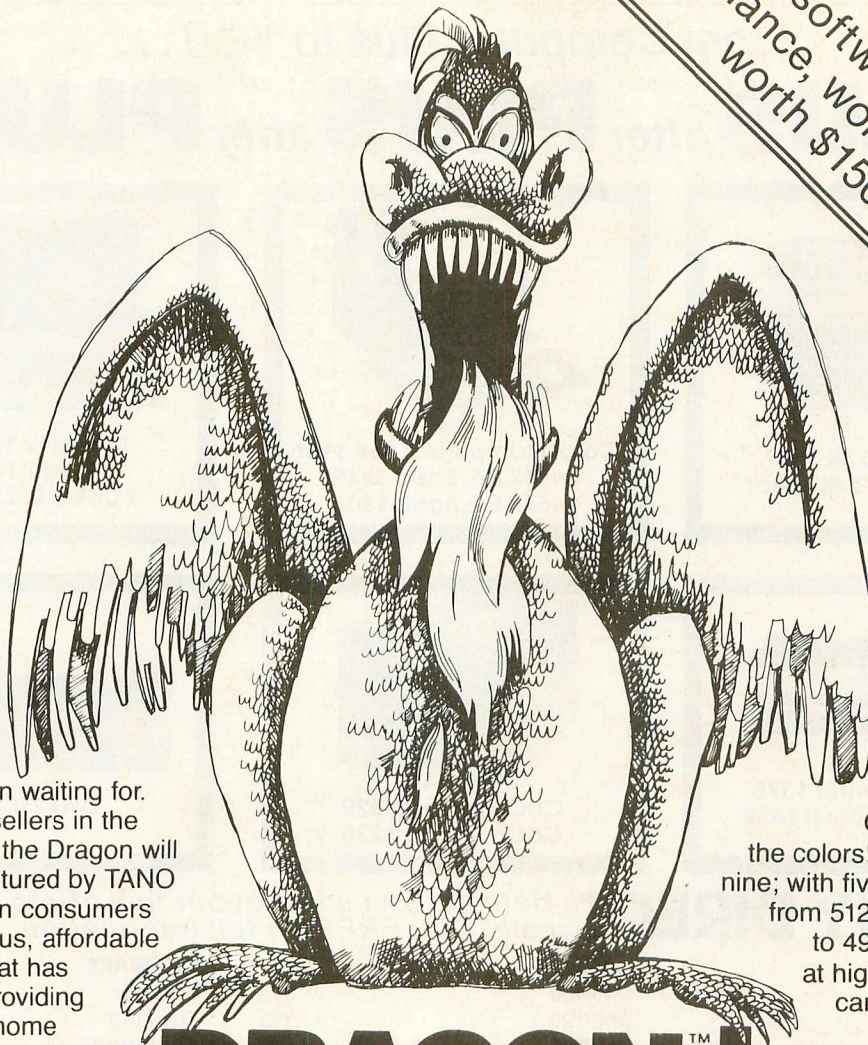
```

530 INPUT"pAINT COLOR, BORDER CO
LOR";X,Y:IFX>8 OR Y>8 OR ABS(X)<
>INT(X) OR ABS(Y)<>INT(Y) THEN 5
50 ELSE PC=X:PB=Y:GOTO410
535 INPUT "jUMP CURSOR TO ";X,Y:
IF X>256 OR X<0 OR INT(X)<>ABS(X
) OR Y>192 OR Y<0 OR INT(Y)<>ABS
(Y) THEN 550 ELSE XC=X:YC=Y:GOTO
410
540 RETURN
550 PRINT@480,"INPUT ERROR";:FOR
DLAY=1TO800:NEXTDLAY:GOTO410
560 FOR D=1 TO 5:NEXT D:RETURN
570 CLS:PRINT"THE ARROW KEYS AND
1, 2, W, Q (FOR DIAGONALS) CO
NTROL THE MOVEMENT OF THE CU
RSOR.":PRINT"commands":PRINT"<SH
IFT CLEAR> = CLEAR SCREEN":PRINT
"m = GO TO FORMAT MENU":PRINT"l
= LINE (b=BOX, f=FILLED BOX)":PR
INT"c = CIRCLE"
580 PRINT"g = GET":PRINT"p = PUT
":PRINT"dRAW":PRINT@480,"<ENTER>
TO CONTINUE.";

590 A$=INKEY$:IF A$=CHR$(13) THE
N 600 ELSE IF A$="M" THEN GOSUB
400:GOTO 30 ELSE 590
600 CLS
610 PRINT" = BEGIN DRAW MOVEMEN
T":PRINT" = BEGIN ERASE MOVEMEN
T":PRINT" = BEGIN NORMAL MOVEME
NT":PRINT"e = SET ENDPOINT FOR l
,b,f,c":PRINT"z = PAINT":PRINT"k
= TOGGLE ENDPOINT DOT":PRINT"h
= HELP"
615 POKE1024,43:POKE1056,45:POKE
1088,48
620 PRINT:PRINT"COLORS:":PRINT"0
BLACK "CHR$(128)"
1 GREEN "CHR$(143)"
5 BUFF "CHR$(207)" 2 Y
ELLOW "CHR$(159)" 6 CYAN
"CHR$(223)" 3 BLUE "CHR$(
175)" 7 MAGENTA "CHR$(239)"
";
625 PRINT"4 RED "CHR$(191)"
8 ORANGE "CHR$(255)
630 PRINT@480,"EXIT TO SCREEN";
640 A$=INKEY$:IF A$="X"THEN 30 E
LSE IF A$="H" THEN 570 ELSE IF A
$="M" THEN GOSUB 400:GOTO 30 ELS
E 640
650 IF INKEY$=""THEN650ELSERETUR
N

```


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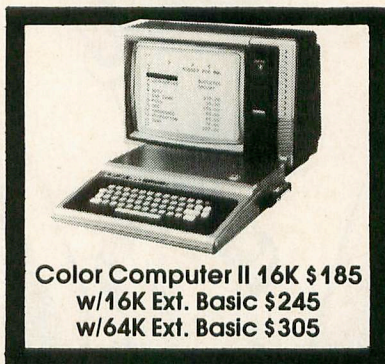
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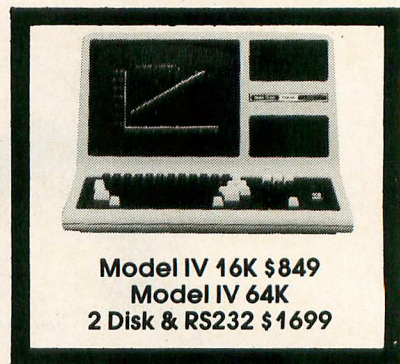
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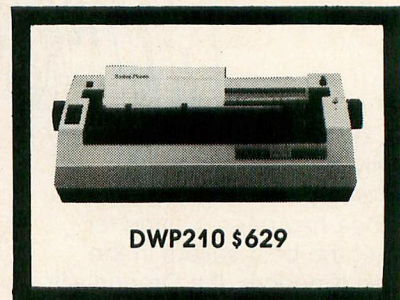
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SINCE 1973 —

Disk-X Utility

Examine, extract and store data on disk.

by Bruce K. Bell, O.D.

THE DISK-X UTILITY lets you examine, extract, and salvage data on disk. It is especially useful when a disk's data is damaged, or when the directory has "crashed."

At the heart of this utility is the powerful Disk Basic command `DSKI$`. This command allows input from the disk in the form of two 128-byte strings; the data may come from any given sector. Its syntax is: `DSKIN,T,S,A,B$` where `N` is the drive number, `T` is the track number, `S` is the sector number, and `A$` and `B$` receive the data.

The internal function of the program is fairly straightforward. The variables are requested, with error traps for values too large or too small. If only one track and sector have been chosen, operation is directed to the disk examine subroutine where the gran number is calculated. If the directory (track 17) is displayed, then the gran is displayed as `DR`. If all tracks or sectors are desired, then operation loops through Lines 200 and 300, respectively.

Disk Extended Color Basic divides a 5 1/4 inch single-sided disk into 34 data tracks. Each track is divided into two granules (grans for short). Each gran is composed of nine sectors of 256 data bytes each. Hence, there are 34 data tracks, 68 grans, 612 sectors, and 156,672 data bytes per disk. Additionally, the disk directory is found in track 17, which may be divided into 18 ad-

ditional sectors. This track is not assigned a granule number. DISK-X is a utility designed to examine any or all of a disk's data.

After typing in the program and Running it, insert a disk with programs or files already saved. Enter Track 17 and Sector 2. You'll probably see a screen full of gibberish with one or two barely familiar phrases. This is because the directory and programs (unless saved in ASCII format) are stored in binary code. The `DSKI$` command does not decode the data. If you examine disk contents stored in ASCII format (with a `SAVE,A` command for program or disk files) then the data is already recognizable.

Operation

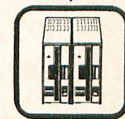
Program operation is simple. After you Run the program, you are asked for the track number you want. If `@` is entered, all tracks and sectors are examined beginning with `T=0`. After a numerical entry for the track, the desired sec-

tor is entered. Again, `@` will examine all sectors of a given track. After this information is entered, the sector data is displayed with a blue bar separating `A$` and `B$`.

The program is exited through what I call the *end button*, otherwise known as the Break key.

```
1 CLEAR400
10 CLS: PRINT"DISK-X UTILITY 1.0
  ", "COPYRIGHT (C) 1983 BRUCE BELL
  ", "DISK EXTENDED COLOR BASIC"
20 PRINT
30 PRINT"ENTER TRACK & SECTOR TO
  EXAMINE", "<@> FOR ALL TRACKS OR
  SECTORS": PRINT
50 INPUT"TRACK";T$: T=VAL(T$)
55 IF T<0 OR T>34 THEN 50
60 IF T$="@" THEN200
70 INPUT"SECTOR";S$: S=VAL(S$)
75 IF S$="@" THEN300
80 IF S<1 OR S>18 THEN70
100 GOSUB500
110 PRINT@490,"";: INPUT"<ENTER>
  TO RESTART";R$: RUN
```

```
200 FOR T=0 TO 34: GOTO300
210 NEXT T:RUN
300 FOR S=1 TO 18: GOSUB500
310 PRINT@489,"";: INPUT"<ENTER>
  TO CONTINUE";R$: NEXT S
320 IF T$="@" THEN 210 ELSE RUN
500 DSKI$0,T,S,A$,B$: CLS
505 IF T<17 THEN G=2*T+INT(S/10)
  ELSE G=2*T+INT(S/10)-2
507 IF T=17 THEN G$="DR" ELSE G$
  =STR$(G)
510 PRINT"TRACK="T TAB(11)"GRAN=
  "G$ TAB(21)"SECTOR="S: PRINT
515 PRINT A$
520 PRINT STRING$(32,175)
525 PRINT B$:RETURN
```



16K Extended
Color Basic

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GRAN PRIX

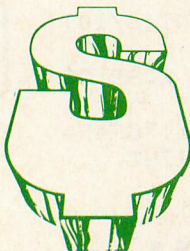
Dynamic racing action with graphics & sound.

32K Cass \$21⁹⁵
32K Disk \$26⁹⁵

SHARK TREASURE

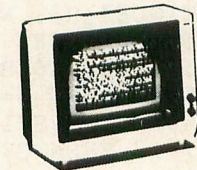
Dive through shark infested waters to get the treasure.

16K Cass \$24⁹⁵
16K Disk \$27⁹⁵



ATTRACTIVE AUTHORSHIP PROGRAM

for independent programmers who want to turn software into cash!
Call or write for details.



MONITORS

Hi-res green screen \$104⁹⁵
Hi-res amber screen \$129⁹⁵
13" color w/audio \$349⁹⁵

SYNTHET 77 COLLECT A LIBRARY OF MUSIC

Turn your Color Computer into a musical instrument with Synther77. No special hardware is required except a TV or video monitor with an audio amplifier. (The sound is available at the cassette port as well.) The many features of Synther77 include:

- The **SEQUENCER** is available! This feature allows you to SAVE the music you are playing to memory. Once saved, you can play it back, edit it, or save it to cassette or disk for later playback. There is room for nearly 2000 individual notes to be stored.
- Two octave keyboard with twelve octaves to choose from.
- User controls Vibrato, Bender, Boing factor and Volume level.
- User controls Vibrato pattern, Bender Rate and Attack Mode.
- User modifiable attack, sustain, decay and release rates allow virtually any ASDR envelope.
- Fifty stops available. All may be changed and renamed by the user and saved for later use.
- Can be fine-tuned to match other instruments or other Color Computers. You could start a band!
- Really easy to use — play it like a piano!

32K Cass \$27⁹⁵
32K Disk \$30⁹⁵



VERSA MAIL™

sophisticated mail list manager

- Mail Merge inserts mailing list data into a form letter & prints it automatically
- File can bridge disks. Over 800 names on one disk, over 2500 with 4 drives
- 8 pre-defined address fields. 12 user defined fields
- Logical selection on any field for labels & reports
- Both reports and user defined label format
- Perfect for any group that sends a mailing to its members

(requires 64K disk) \$39⁹⁵



The COLOR CONNECTION



THE COLOR CONNECTION is the easiest and most complete modem software package available on the Color Computer! It is so easy to use that you will save valuable on-line time.

- Supports both full and half duplex
- You designate the required parity
- MACROS for quick log-on and auto dial modems
- Requires only 16K
- Big buffer allows downloading from other computers and uploading to another computer — (The buffer is 25K on a 32K machine.)
- The display does not break words when wrapping a line
- 300 baud
- 32x24 or 51x24 hi-res display with upper & lower case and command line
- Upload & download text files — set parameters such as start & end character, etc.

16K Cass \$29⁹⁵ 32K Disk \$39⁹⁵

OS-9 SOFTWARE!

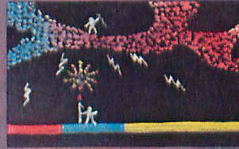
Macro Assembler, Editor, Random Basic, & Business Applications

WE CARRY: Mark Data, Tom Mix, Frank Hogg, Botek, Kraft, WICO, Star Kits, Dugger's Growing System, Amdek, Signalman, C. Itoh, Compu-Serve, Comrex, Taxan, Gorilla & More! Books Galore! Largest selection of CoCo Products from One Company!

Circle No. 75 on Reader Service Card

AARDVARK Action Software

PRESENTS...



ZEUS

WITHOUT QUESTION, ABSOLUTELY —

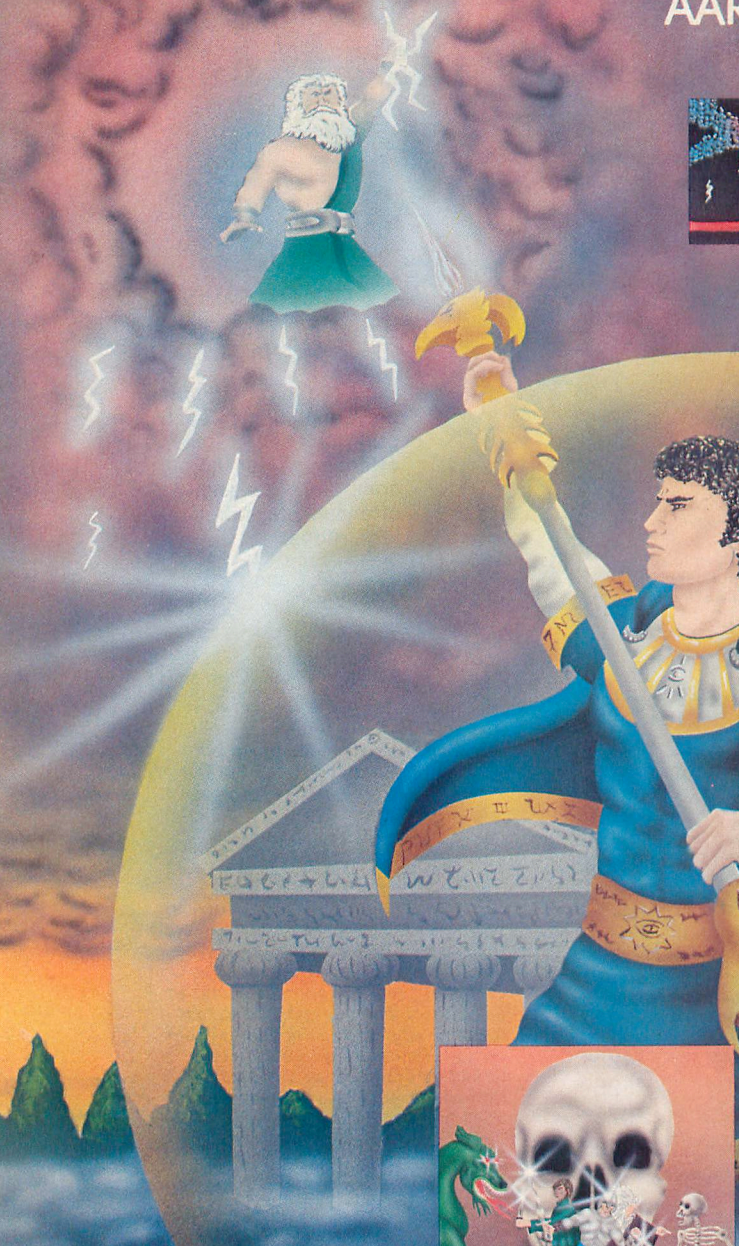
The Fastest

ARCADE STYLE GAME

AVAILABLE, THAT WE KNOW OF.

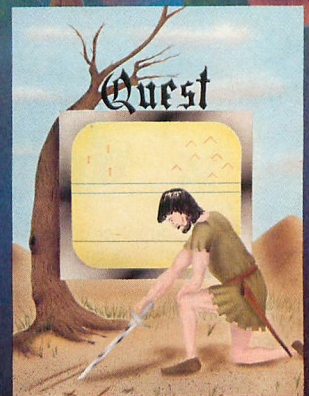
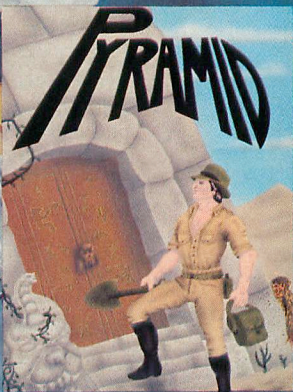
FAST AND FURIOUS. You become the wizard fighting off the thunderbolts of an angry Zeus. Multiple action. Are you good enough to keep up as the difficulty increases wave after wave. Hours of challenging fun. This is one game you may never completely master.

**AVAILABLE ON: TRS-80C(16K), CMD 64, VIC 20(13K)
STOCK #1007 TAPE:\$24.95 DISK: \$29.95**



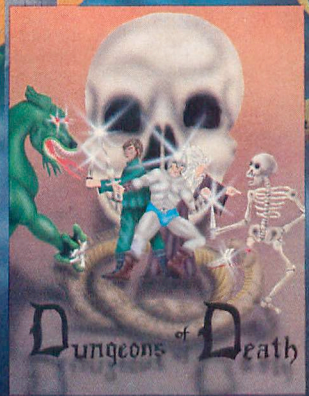
PYRAMID... Our toughest and most intriguing adventure. Average time through the pyramid is 50-70 hours. Clues everywhere and some very ingenious problems. This one is popular around the world.

**AVAILABLE ON: TRS-80C (16K) CMD 64
VIC 20 (13K) TIMEX/SINCLAIR T1/99-4A
STOCK #5002 TAPE: \$19.95 DISK \$24.95**



DUNGEONS OF DEATH. ...A serious D & D type game for you up to 6 players at a time. You get a choice of race and character, on screen mapping of the maze, a chance to grow from game to game, and a 15 page manual. Requires extended basic on TRS-80C.

**AVAILABLE ON: TRS-80C(16K), CMD 64, VIC 20(13K),
TRS-80C 32K DISC
STOCK #7001 TAPE: \$19.95 DISK: \$24.95**



QUEST... A different kind of adventure. Played on a computer generated map of Alesia. You lead a small band of explorers on a mission to conquer the Citadel of Moorlock. Takes 2-5 hours to play and is completely different each time.

**AVAILABLE ON: TRS-80C(16K) CMD 64
VIC 20(13K) TIMEX/SINCLAIR T199/4A,
EXTENDED BASIC REQUIRED ON TI
STOCK # 7007 TAPE: \$19.95 DISK: \$24.95**

Quest is also available on TRS-80C as a 32K extra memory, extra fun adventure. It's a little more difficult and will test the most experienced explorer of the kingdom.
STOCK #7006 TAPE: \$24.95 DISK: \$29.95

AARDVARK Action Software

IS AVAILABLE AT SOFTWARE RETAILERS EVERYWHERE. IF YOUR LOCAL COMPUTER OR SOFTWARE STORE DOES NOT CARRY IT — ASK THEM WHY NOT. SEND ONE DOLLAR FOR ILLUSTRATED CATALOG. DEALER INQUIRES INVITED.

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The End of Summer

(But not the Summer Programming Project)

IM WRITING THIS in September, but you won't read it 'til December. December is the month all you Summer Programming Project entrants have been waiting for — to find out who won all the goodies so long promised.

We are *really* happy with response we got to the Project — over 300 game entries and some are very good. The response was so good, that we (three very overworked editors) haven't yet chosen a winner.

But here's a promise: February will be a special Game issue; not only will we announce the winners, but their games will be printed so all can play them!

Just to remind you, and whet your appetite once again, here's the list of prizes:



GAME PRIZES

Aardvark Software	(2) \$100 gift certificates	Prickley Pear Software	(2) \$50 gift certificates
Adventure International	(2) \$125 gift certificates		(2) T-shirts
Avalon Hill	Shoot Out at the OK Galaxy# Breakthru +	The Program Store	(2) \$25 gift certificates
Chattanooga Choo Choo	(2) \$25 gift certificates	Radio Shack	(2) Drive 0 disk drives with controller
Cer Comp	\$100 gift certificate#	Real Softw	(2) \$100 gift certificates
Chromasette Magazine	(2) six-month subscriptions	Soft City	(2) US Robotics Micro Link 300 direct connect modems with cable
Cognitec	(2) Telewriter 64 word processors	Spectral Associates	
The Color Computer Magazine	(2) paid publication, one- year subscription	Spectrum Projects	(2) \$25 gift certificates
Computerware		Sugar Software	(2) \$25 gift certificates
The Data Man	(2) \$25 gift certificates	T & D Software	(2) half-year subscription to software service
DSL Computer Products	(2) Visualizer program writing aids	TCE Programs	(2) Packages of three programs
Eigen Systems	(2) Blank keyboard overlays	Tom Mix Software	(2) \$50 gift certificates
Harmonycs	Cassette player/recorder#	Zeta Software	Wormtube game#
Homebase Computer Systems	Colorcom/E terminal program# Basic Aid +		
Inter + Action	(2) \$25 gift certificates		
International CC Club	(2) \$75 packages of all Homebase products		
Intercolor Communications	(2) 2-year memberships		
Jarb Inc.	Colorpede#		
Micro School Programs	Gemini X printer#		
The Micro Works	Color Text +		
Micro Technical Products	\$50 gift certificate +		
Nelson Software Systems	Rommel game#		
	(2) Adventure Trilogy games		

Machine language winner only
+ Basic winner only

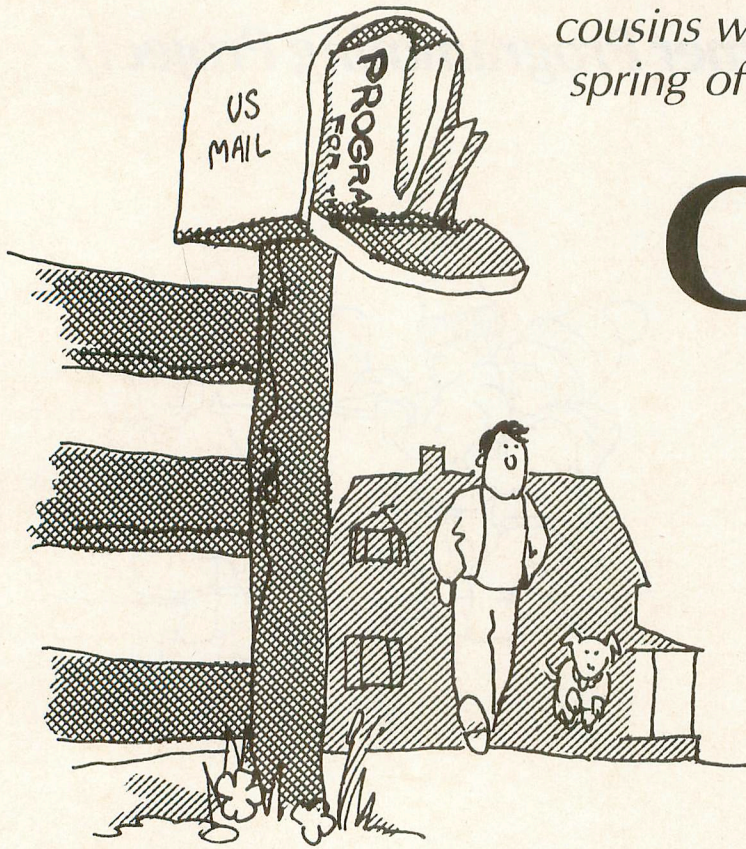
1st Runners-up
Paid publication and a one-year subscription to
The Color Computer Magazine.

Prickley Pear T-shirt

2nd Runners-up

Paid publication in The Color Computer Magazine.
Prickley Pear T-Shirt

How do you keep up with your city cousins when you live far from a well-spring of state-of-the-art technology?



Country Cousin

by John C. Grier

YOU MIGHT BENEFIT from my experience as a member of a large but silent minority in the Color Computer community: the rural, or otherwise technically-isolated, user. My town (and I use the term loosely) had a population of about 250 in 1980. My

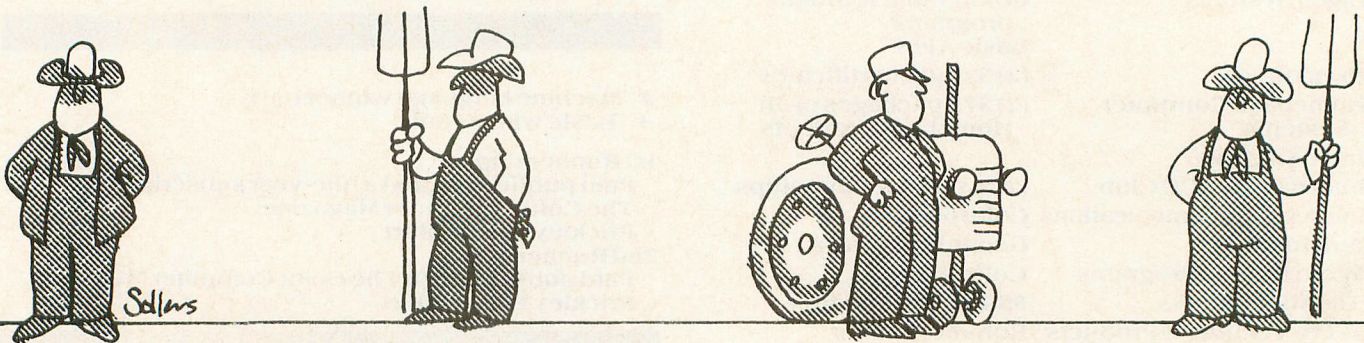
computer and I have been very lonely for company of *our* kind!

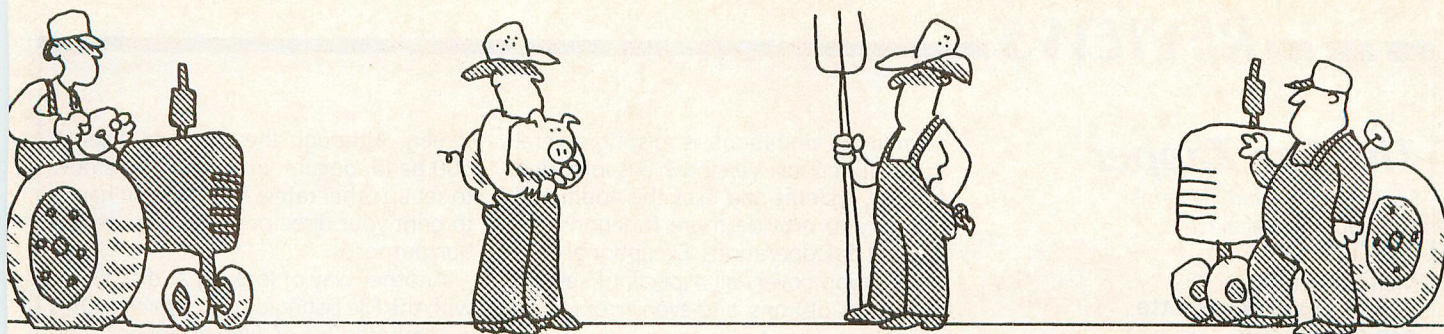
I recently convinced a friend who lives nearby to buy a Color Computer, but the nearest technical *help* is still 23 miles away, at a non-Computer Center Radio Shack that has a computer department. They have tapes, cables, disks, ROMpaks, and Tandy-oriented advice, but not much else. Fortunately, the manager is a friend of mine and a fellow Color Computer user, so we go in the back room and discuss many products and procedures not available from Radio Shack.

Any other contact I have with the technically-enlightened world is via the telephone (costly) or the mailbox (slow). I would like to offer some hard-won and time-tested advice to other isolated users, about how to get the information and services they need to fully enjoy computing.

Publications

If you have been able to get a copy of this magazine, you've made the first, biggest step. The most important thing





you should do is subscribe to magazines. I subscribe to most of the publications (there are at least five) dedicated to the Color Computer, and consider them essential to keeping up on new products and procedures. Most the magazines run ads for each other, so if you can get a copy of one, you can get in touch with the rest. Save *all* the issues for future reference, and consider ordering back issues. Most magazines offer articles for users with a wide range of skill levels; if you save all the issues, what you may not understand or find useful now, could be just what you need six months from now.

Reviews of books and programs are a real comfort to those of us who resent buying a "pig in a poke." Without reviews, there is no way to know anything about a program but its title and price. The reviews in most publications come from typical users, and really cover the plusses and minuses of the programs reviewed. There are also reviews of Color Computer-compatible hardware. This is a real advantage if the only computer store within a reasonable distance is a Radio Shack. The information you'll find about printers, modems, and disk drives can save you money and help you purchase a better computer system.

Clubs

For most of us, a local computer club is out of the question, because we can't

find enough members within a reasonable distance. The largest Color Computer Club in this country is in Texas. They call themselves the "International Color Computer Club Inc.," and have members from all over the U.S. and Canada, as well as other countries. The current dues are \$30.00 per year. New members receive a new member tape with several programs on it, a bi-monthly newsletter (80 pages or so), discounts on hardware and software, access to a library containing member-written programs, books, ROMpaks, and hardware. Other members can offer advice about problems you may have with your computer, or problems with Color Computer applications. If you live in a spot like I do, and most people living around you think a bit belongs in a horse's mouth, ICCI Inc. may be good for you.

Books and Companies

When you finally decide to learn machine language, there are several excellent books on the subject, as well as utility software that will make the process easier. The pages of your computer magazines advertise everything you need. The best source of information about the CPU and the other mega-chips in your Color Computer is Motorola, the manufacturer of all the Large Scale Integration (LSI) parts used. They are happy to provide free information about their products if you call or write them.

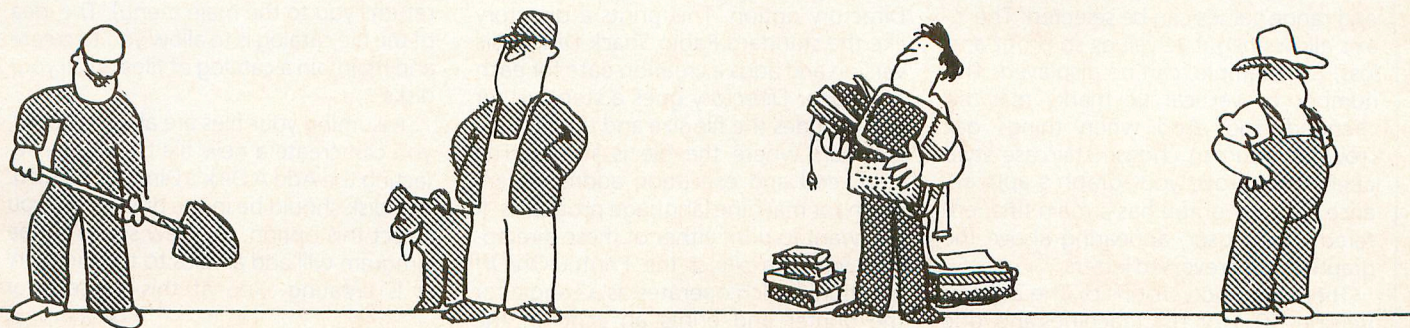
Mail Order

I have not ordered any major hardware, like printers or disk drives, via mail order, but my experience with it has been good. I prefer to order COD when I can, and most companies will ship COD. Personal checks take a long time to clear when you send a check drawn on the Farmers Bank and Trust located in Mudslide, Arkansas to some outfit in San LaWierdo, California. Phone orders shipped COD go coast to coast in about a week; I assume credit card service would be the same.

I have not lost money or had problems yet with mail-order houses. The programs you receive may not have a colorful packaging, and the instructions may be mimeographed, but that doesn't bother me. Any of the fancier packaging would probably cost more.

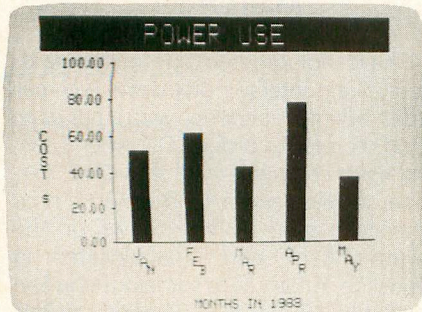
I doubt any company would allow a refund if you simply don't like their program, so research your choices carefully before you buy. You can do this by looking for reviews of the product, as well as for any similar product which might do the same job. A call to some software companies will put you directly in contact with either the author of the products or his wife, who are usually happy to answer questions if it's your nickel.

Sometimes the manual for very expensive products can be purchased separately. Buying and reading the manual will tell you if the product is what you want, and save you lots of money if it isn't. ■ ■ ■



The Bar Zapper

Southern Software Systems
485 South Tropical Trail
Suite 109
Merritt Island, FL 32952
\$15.95 16K-32K cassette
\$19.95 32K disk



A BAR GRAPH has always been the easiest way to represent a list of figures. The Bar Zapper makes creating custom bar graphs on your computer a breeze.

The Bar Zapper uses the Color Computer's highest resolution to provide the sharpest possible graphs. Up to 24 bars may be used in five styles; solid, solid with horizontal lines, open, open with horizontal lines, and open with slanted lines. You may choose a plain graph or one with horizontal lines at each vertical tic mark. Graph styles may be changed without loss of data. In addition, you can define sub-bars for each entry. The 16K version allows up to three sub-bars, the 32K version allows up to five.

The Bar Zapper contains an editor to allow easy entry, listing, and correction of data. A smart file handler is included so data can be saved and loaded from cassette or disk. Completed graphs or data alone can be stored on tape or disk for retrieval. There is an option to print data out as well.

The X-axis and Y-axis can be labeled and range values can be selected. The Y-axis allows negative values so profit and loss, for example, can be displayed. The number of vertical tic marks may be changed, too. And when things get crowded you can choose staircase-style labels to improve your graph's appearance. The bar graph has a main title, entered by the user, appearing above the graph in large reversed letters.

There are two versions of The Zapper. Version 1.0 is for 16K machines and, due

to memory limitations, is missing several minor functions. Version 2.0 is intended for 32K systems and uses the additional memory to provide more functions, including disk operations. Exceptional documentation covers all aspects of set-up, operation, options, and even error recovery.

One drawback is the lack of a screen print routine. Documentation lists a source for obtaining and incorporating such a program, but it would have been better had one been included. The variety of options and features overshadows this inconvenience, however.

—M.K. Marston

The Disk Manager

Prickly Pear Software
9234 E. 30th St.
Tucson, AZ 85710

Extended Disk Basic 16K or 32K
\$29.95 cassette

IF YOU HAVE a disk system and find it increasingly difficult to keep track of your growing files, The Disk Manager may be the answer. This utility accomplishes a number of tasks to help you manage your disk-based files. It will create a comprehensive directory, restore killed files, recover damaged disk directories and locate catalogued files.

The Disk Manager is supplied on cassette for 16K and 32K machines and uses Extended Disk Basic. The 16K version does the same work as the 32K version, but productivity is split to fit the smaller memory size. The program is menu driven, so selection of options is easy.

The lengthy main menu has 12 options, including the exit. The first is the Directory option. This prints a directory like the standard Radio Shack Disk Basic version and adds a creation date for each file. Super Directory goes a step further and includes the file size and the granule numbers where the file is stored. The start, end and execution addresses are given for machine language programs. If you want to print either of these directories, you can select the Printer On/Off function, which operates as a toggle for the printer and prints an echo of the

screen. Although the program is set at 600 baud, documentation explains how to set up other rates. This makes it handy to print your directories for documentation purposes.

Another way of looking at disk files is with the File Listing option, which causes a numbered list of files to appear. You may then select one of them, by number, to be loaded and run. In essence, this acts as an execution menu for a disk.

Often the need arises to know exactly which granules of a disk are currently being used. The Granule Use Table option will print a table showing specific granule usage on the target disk.

One feature that I have found quite useful is the Add Date To Files option. The current date (input at the beginning of the Disk Manager session) is placed on all files on the target disk that have not had dates put on them. Each time a save is made to a disk, the date is left open. When adding dates, the program searches for files with open dates and inserts the current date. The date is actually placed in an unused part of the disk directory. This option also creates a backup copy of the directory, which can be valuable when recovery from disk damage is desired.

For multiple disk systems, the program will default to drive 0. If you wish to change the default, you can select the Number Default Drive option and change it for the rest of the session.

Sometimes I have needed the start, end and execution addresses of a machine language program. Finding addresses is made simple with the Locations option, which asks for a file name and returns the desired addresses.

Recover Lost Files is a complex option, but is explained well in the documentation. It lets you restore a "killed" file or a damaged disk directory.

The major feature of The Disk Manager is the Catalog option. Selecting Catalog will result in a whole new menu display. The new File Catalog Menu option contains 10 options (including Exit, which returns you to the main menu). The idea of the file catalog is to allow you to create and maintain a catalog of files on all your disks.

Assuming your files are already dated, you can create a new file catalog by selecting the Add A Disk's Directory option. The disk should be in the drive when you select this option. In a few seconds, the program will add all files to the directory it is creating. Repeat this process for

♦ to page 131

COLOR COMPUTER SOFTWARE

GAME PRICES
Cassettes \$24.95
Disc \$27.95

EL BANDITO—El Bandito has to be a crafty little hombre to stay alive as he loots the local countryside. Challenging fun 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.

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.

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.

SUPER SCREEN

SUPER SCREEN
Cassette \$29.95
Disc \$32.95

- SPACE RAIDERS**—A sensational rendition of the arcade classic. No collection is complete without this invaders type game. Great sounds and tense action. We think it's the best. **Cassette—\$24.95 / Disc \$27.95.**
- CAVE HUNTER**—Maneuver your way to the bottom of a spooky old cave to retrieve the treasures. It's fun but not easy! Passages lead in all directions and angry cave creatures pursue you relentlessly. A fast paced arcade game. **Cassette—\$24.95 / Disc \$27.95.**
- ASTRO BLAST**—Wave after wave of alien attackers—each one different and unique. A great space "shoot-em-up" with hi-res graphics, lots of color and dramatic sound effects. A continuing best seller. **Cassette—\$24.95 / Disc \$27.95.**
- HAYWIRE**—This challenging combination of angry robots and the evil menace will provide many hours of fun and excitement. Haywire is the best Color Computer version of the Berzerk arcade game you can get. **Cassette—\$24.95 / Disc \$27.95.**
- BLACK SANCTUM**—If you enjoy suspense, you'll love this one. Encounter the forces of black magic as you roam around an old 18th century monastery. Watch out for the black hooded figures! **Cassette—\$19.95.**
- CALIXTO ISLAND**—A challenging puzzle with an occasional twist of humor. You'll visit a secret laboratory, a Mayan pyramid and you'll meet crazy Trader Jack who adds to the fun. **Cassette—\$19.95.**



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- Professional, low profile, finished appearance.
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- Smooth "Touch Typist" feel—no sagging.

Rainbow, April '83

A fine piece of hardware from Mark Data Products... It is super and it is professional too... If you are searching for a replacement keyboard, it is an excellent buy...

Hot CoCo, August '83

Like putting leather upholstery in your Volkswagen... Very impressed with the appearance and performance... Could easily pass as original equipment... Installation is very simple...

Color Computer Magazine, June '83

The installation procedure is well detailed and quite simple... Has a professional feel, reacts well to the touch... has held up to some purposeful pounding...

Color Computer News, June '83

Mark Data Products is well known to us "longtimers"... Every bit as finished as if Tandy had done it... The Mark Data Super-Pro is your best buy... The one that is in my CoCo to stay...

Great Computer Software Also

- Adventure Games
- Arcade Games and Utility Software



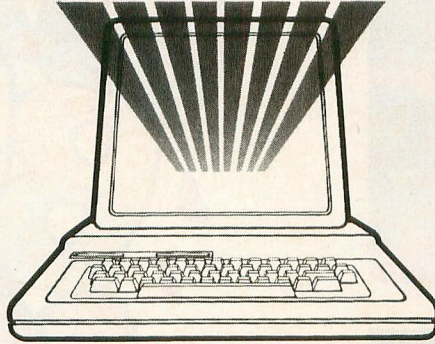
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SUPER SCREEN

the Color Computer Supercharger



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

51 CHARACTER BY 24 LINE DISPLAY

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

COMBINE TEXT WITH HI-RES GRAPHICS

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

PRINT @ IS FULLY IMPLEMENTED

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

ON ERROR GOTO

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

AUTO KEY REPEAT

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

CONTROL CODES FOR ADDITIONAL FUNCTIONS

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

AND MORE GOOD NEWS...

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



Mark Data Products

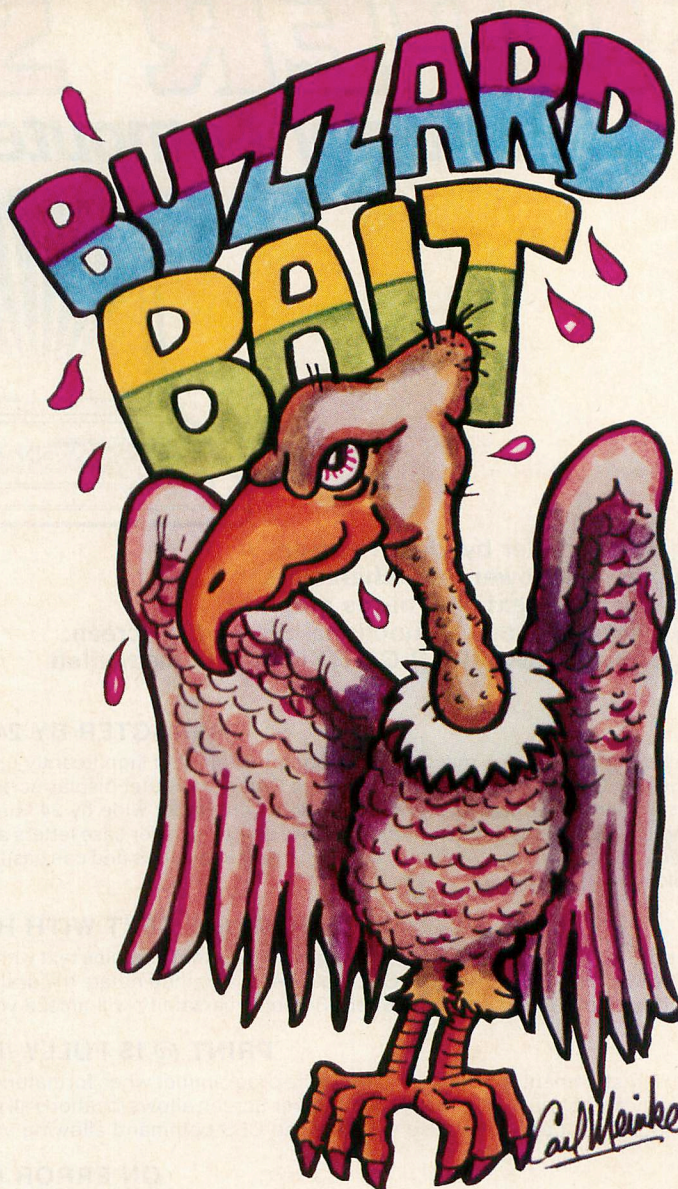
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ARCADE ACTION GAMES



◆ from page 126

every disk you want on the file catalog. Up to 360 files can fit on a 32K computer. When you have completed this process, the directory can be written to disk via the Write Catalog To Disk option. You may select a name for the output file.

Now let us suppose that, sometime later, you have made some changes on one of your disks (killed some files and added some files). You want to update your file catalog to reflect those changes. First select Read Catalog From Disk to read the catalog in. Next, use Delete Directory For This Disk, which will delete all old catalog entries for the currently inserted disk. Then select Add A Disk's Directory to re-enter the current (updated) disk directory. Finally, select the Write Catalog To Disk option to write the new, updated catalog to disk. Another File Catalog menu option is Find A File, which lets you look for a specific file in the catalog. If you want to print your catalog to screen or printer, select the List To Screen or List To Printer options.

A Sort option lets you sort the catalog before Listing. You can sort the catalog by file name, extension, date, disk number or disk name. I have a catalog of some 190 files, and the sorts generally take about a minute. This feature is what I see as the program's outstanding feature. The master file catalog is very useful when you are trying to determine which disk a particular file is on.

Six pages of documentation come with the program. Generally, it's adequate. It took care of my problems, with three exceptions.

Once I discovered how to use the file catalog, I wanted to put all my disks on it. It wasn't until the next day, when I tried to run Disk Color Scripts, that I realized Scripts's use of the directory is not compatible with The Disk Manager's use of the directory. The "unused part of the disk directory" referred to in The Disk Manager's documentation is used by Scripts. Using The Disk Manager on a Scripts disk will render the Scripts programs and text files unreadable. After many hours trying to restore the files, I gave up in frustration. Later I learned how to catalog Scripts disks without messing them up: catalog the disk number, but not a name, and nothing will be written on the target disk. Admittedly, that hint is in the documentation, but with no mention that Scripts files specifically might be damaged. Since many disk users use Disk Color Scripts, I would

recommend that Prickly Pear add that warning to its documentation.

My second problem occurred when I tried to load a file catalog that did not exist (I entered the wrong file name). I got the familiar NE ERROR message. According to the documentation, any time this program aborts with an error, you should "immediately type GOTO 10000 Enter" to recover. I did that, and the main menu appeared. The trouble was that it wouldn't recognize my selection input. I have crashed several other times and have never been able to get the recovery to work.

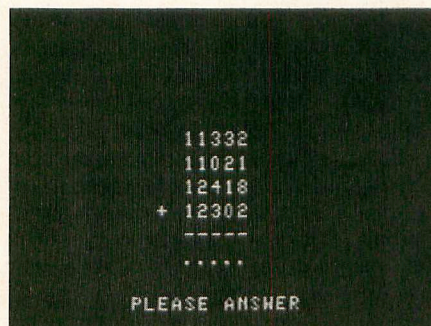
My third problem popped up when I was trying to update my file catalog. I wanted to update entries from a particular disk, so I loaded the file catalog, inserted the target disk, and selected D (Delete Directory For This Disk). That should have deleted all old file entries for that disk. Then I selected A (Add A Disk's Directory) and added the updated disk directory. When I printed the catalog, I noticed that two files previously killed were still on the catalog. No matter what I tried, I could not purge them. I ended up doing the entire file catalog from scratch so those two stray files would not appear.

In spite of my problems, I consider The Disk Manager a good utility. It is a powerful, useful program. It can keep disk file maintenance from getting out of hand, by giving you fast cross-referencing and a wealth of information on your disk data sets.

—by Norman Garrett

Color Math

Radio Shack
One Tandy Center
Fort Worth, TX 76102
\$25



RADIO SHACK is making its popular K-8 math program, originally de-

veloped for Model III users, available to Color Computer users. "Color Math" is a practical program for either home or school use. It will run on a 16K computer.

"Color Math" is intended for children in grades one through eight. Within this general guideline, the program has a variety of skill levels. It consists of the four basic math operations: addition, subtraction, multiplication and division. Placement, skill building lessons and testing are options available in each operation.

When first using "Color Math" it is advisable to use the placement option. This option lets children work with lessons appropriate to their skill levels. When the option appears on the screen, you are given a choice of lessons from which to select. Lesson content sheets are contained in the appendix of the manual and provide a selection guideline. If you are uncertain about choosing the right lesson you can begin with lesson one and the computer will randomly find an appropriate placement for the student.

If a student provides the correct response on the first try, a smiling face appears on the screen and a beep sounds. An incorrect answer elicits no response but students get one more try. If they still can't provide the correct answer, it is printed on the screen. Then the next problem appears. Students must respond to problems within 30 seconds. If they don't, PLEASE ANSWER will appear on the screen.

The lesson option lets users modify the program. For example, you may select the maximum number of problems you want made available — a particularly fine feature because it allows lessons to be designed for a student's anticipated attention span. However, in the lesson format an incorrect response prevents the user from going to the next problem, unlike the format for incorrect responses in the placement option.

At the end of each lesson a summary is provided. The summary includes the number of problems worked, how many were correct and on which attempt, and average response time. The summary lets teachers and parents review their students mastery levels and indicates where students need help.

The final menu option lets the user take a test on the lessons. In this mode you can enter the number of problems you want to appear on the test. During the test only one chance is given to enter the correct answer. I suggest that stu-

◆ more

dents be allowed use of pencil and paper during the test. In the test mode there is no instant response to problems. Rather, a summary of the number of problems worked, the number of correct answers, and the percentage of correct answers is given.

Other useful features of "Color Math" include the opportunity to review a lesson before all the problems are completed. This is done very simply by typing R and then T. The disadvantage of using this option is that you cannot return to your lesson; you must start over again.

As usual, Radio Shack has provided excellent documentation. The user should be able to review the manual and get right to work with the program. Sample record sheets are included.

Perhaps the finest feature of all is a cross-reference sheet which lets you coordinate "Color Math" with six major elementary math textbooks published by: Addison-Wesley; Harcourt-Brace-Jovanovich; D.D. Heath; Holt, Rinehart, and Winston; Scott Foresman; and Silver Burdette.

I recommend "Color Math" without hesitation. It is a utilitarian program that will be helpful to anyone who works with students on math.

—by Paul Kimmelman

Assembly Language Graphics For The TRS-80 Color Computer

by Don and Kurt Inman
Prentice-Hall, Inc., distributor
Englewood Cliffs, NJ 07632
\$14.95 paperback

THE FIRST BOOK on assembly language for the Color Computer is out and as such, *Assembly Language Graphics for the Color Computer* will capture a wide audience by default.

Assembly Language Graphics has no program that can be considered a finished product. Its programs are meant for study and modification. Everything is a starting point, a basis for experimentation.

After starting with simple demonstrations of SAM and PIA manipulation, the

book zips ahead to discuss several animation techniques. A brief look at keyboard-reading theory, with an example, is given. Then sound, animation with sound, joystick animation, and interrupts are covered. One good section tells how a rudimentary word processor is developed, bit by bit, to the point where high-resolution graphics are used to display text. But on the whole the book suffers from a lack of completeness.

Assembly Language Graphics was prepared using the Microworks SDS-80C, which was the first full-blown Color Computer assembler available. Users of other assemblers may have to improvise in spots. For instance, the instruction ABA is used at one point. This is actually a 6800 instruction that the "standard" 6809 assembler will translate into PSHS B: ADDA ,S+. EDTASM+ doesn't recognize ABA, and gives back a "Bad Opcode" error. (One appendix in the book lists the 6809 instruction set, but ABA isn't included.) The SDS-80C also supports multiple data per FCB, which is not allowed on all assemblers.

There are eight appendices, three of which (tape commands for the SDS-80C and forward and backward branch tables) are superfluous. The other five, however, are very useful, and include ASCII and screen codes, SAM and VDG settings, descriptions of the graphics modes, screen offsets, and the 6809 instruction set.

The text was hastily prepared. For example, on page 72, it says "data actually stored in [the SAM registers] does not matter. But you must load or store data in them to set those registers..." This is, at best, unclear. It implies that one can program the SAM by reading from it (in 6809 syntax, Load is always a memory read). Another example: "We will use a ROM subroutine that we will call JOYSTK. Its entry point is \$A00A." Later in the text we come across JSR JOYSTK. The program listing correctly uses JSR [JOYSTK]. But the fact that \$A00A contains the address of JOYSTK and is not itself the address is not made clear to the reader. A discussion of the square brackets and what they mean should also have been included.

Finally, typographical errors abound — this, in a subject that demands exactitude, is inexcusable. A sampling: LDA F0 appears where LDA #F0 is meant. LDX INTRPT replaces LDX #INTRPT, a typo that will send your computer on a trip to nowhere. Then there's ADDA #HOLD for ADDA HOLD.

So, who can this book benefit? If you want to learn the 6809, or assembly language in general, this book won't teach

you. But, if you have the Color Computer technical manual and a good 6809 primer in your lap, *Assembly Language Graphics* offers a foundation in practical techniques you can use to develop fast, spectacular programs. Just be sure to check the text against the listings.

—by Stephen P. Allen

TeeOff

Prickly Pear Software
9234 E 30th St.
Tucson, AZ 85710
16K Extended Basic
\$24.95 cassette
\$29.95 disk

TEEEOFF IS AN ACTION golf game, written in machine language, that lets one to four players play on a nine-hole course.

The course is strewn with water hazards, sandtraps, and saguaro cacti. The spikey snatchers nearly did me in until I figured how to deal with them.

The whole thing starts with a simple set of instructions that tells you about using the joystick to walk to the ball, set up for the shot, and to stroke. The backswing goes counterclockwise and the stroke is clockwise — that took about three holes to figure out. Many a time I sent the ball winging back to the tee.

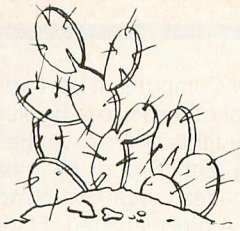
The instructions also explain that there are 24 different clubs to choose from. By setting your club in different ways on the ball, you select the club. I could only tell the difference between two clubs and could only select them depending on my position. Choice is basically predetermined by your shooting position.

So you take a shot — and into a cactus it goes. How to get it out? Waste about 10 shots blasting all around it until you figure out you have to hit it back the way it came. This is true most of the time, but as you get better, you learn that you can indeed nudge the ball away from the plant with short shots.

The water hazards and sand traps were confusing. Sometimes I blasted right out, other times I crawled out of trouble. That depended on which club I was using, I think.

The graphics are not breathtaking. However, the game runs smoothly and

◆ more



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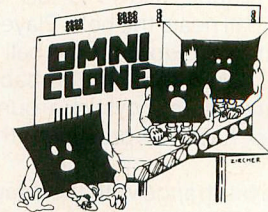
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Omni Clone

If you have a disk drive, you know how important it is to back up your disks. Virtually every book on computers tells you to back everything up, and many recommend at least two backups. This is simply good computer practice. However, the BACKUP command on the color computer will only handle disks with a standard format, so many disks could not be backed up.

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REVIEW\$

the animation is pretty good, even though the golfer is a bit on the stick-figure side. A nice feature puts a different screen up when you get on the green.

The putting routine allows a bit of latitude as the ball nears the hole. Players get the benefit of the doubt if the ball is near the hole. I liked that — I probably would have wrapped my joystick around a tree if my luck hadn't improved on the greens.

Things got a bit strange with the wrap-around feature. This is necessary to let you swing the club when near the edges — but it does look a bit odd to see part of your golfer on the other side of the screen.

Another weird aspect of play involved the out of bounds areas. Large black areas of no-man's-land bound the fairways. If the ball went to these spots, it merely sidled up to the edge and slid along, something like sliding along a wall.

There is a sheet included with the game that says if you have a 16K machine you must PCLEAR1 : CLEAR 200,7700 before you load the tape.

Overall, TeeeOff is a good game. The motion is good; with a bit of practice the

game becomes one of skill — not just belligerent luck. The graphics are adequate and, as machine language graphics, they're fast. Each course is drawn quickly and the ball's flight is smooth and fast. The skill needed to control the joystick (Radio Shack model) may be beyond very young players.

I would recommend the game for adults and nifty-fingered adolescents. Now I'm going back for another round and see if I can make par.

— by Leslie Venable

The Switcher

Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
\$99.95

A COMPUTER OWNER should spend time computing, not wrestling with cables and jacks. Spectrum Projects obviously agrees, and offers relief with a product called "The Switcher."

The Switcher is a user-selectable, two port switch box for the expansion port of

the Color Computer. It lets two ROM cartridges, or other devices, be plugged in at the same time. Users have the option of selecting either port by means of a spring-loaded toggle switch mounted on the box. A green and red LED (light emitting diode) next to the toggle switch indicates which port has been selected. Users may also disable the auto-start function by operating the other spring-loaded toggle switch. Again, a green and red LED indicates whether auto-start is enabled or disabled.

The Switcher comes with 22 inches of ribbon cable, which allows the switch box to be conveniently located. The box itself is 8 by 4 1/2 by 3/4 inches, with the edge card connector for the ribbon cable at one end and the jacks on the other. The toggle switches and their LEDs are on the top.

The Switcher must be plugged in to the expansion port before power is applied to the computer, and turns on with port A selected and auto-start enabled. Switching may be done on-line, since pressing either toggle switch forces the computer into a reset state until the switch is released.

ROM cartridges or devices that store data will lose data during switching.

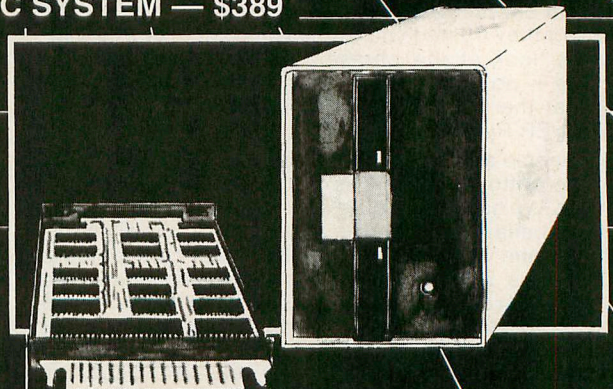
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Spectrum has a program called Restore available which solves this problem.

Power for the LEDs comes from the expansion port of the computer through the ribbon cable.

If you're tired of plugging and unplugging and you want to do more computing instead, try "The Switcher" for a little relief.

—by M.K. Marston

Shaft

by Loren Seng
Prickly Pear Software
Tucson, AZ

\$24.95 cassette, \$29.95 disk

SHAFT IS THE TYPE of game that creates chronic fears of real-life situations. I'll never again go in a building that has more than one floor. Or, maybe I'll just stick to stairs.

This machine language program pits you against killer elevators. You are trying to go across the elevator shafts on the screen, avoid ascending and de-

scending elevators, and catch the elevator to the next floor — only to come parachuting down and have to do it again. You can only move sideways to avoid the elevators, and each success creates faster and meaner elevators.

It takes a bit of practice to get through the first floor, but after a while that level becomes routine. However, there are places on the second and third levels I found impossible to get through. This may have been a flaw in the program, a flaw in me, or a flaw in the joystick — but my bet goes to the program. More than one of us tried the game and no one could get through these tough spots. But no complaints: I'll cheerfully sacrifice one of my four Private Eyes to the elevators if it means a chance to catch the parachute that brings you whizzing down.

The opening title graphics are nice, with the title, "Shaft," displayed in multi-colored layers on a horizontally scrolling screen. But the rest of the graphics in Shaft are glitchy. There is a lot of screen flicker caused by memory updating that could have been avoided, but the game would have most likely moved slower. The flicker is annoying — especially when you move your man to the next shaft. As soon as he moves, the screen

freezes momentarily. It doesn't affect the game but is disturbing.

The graphics used to convey the smushing of your man are simple; a strange sound and the word ZAP. When one of your players gets crunched, the configuration changes. I got to know which set-up was useless to fight, so I would sacrifice one of my boys.

There are two modes of play, slow and fast. There are eight shafts. Depending on the configuration of the elevators and their positions, the trip across can be very easy or impossible.

The instruction sheet is short and simple. It contains just what you need to know about loading and playing. One thing that would be nice though, is a note on how scoring is figured. Scores show up on the bottom of the screen but the reasoning behind them is less than obvious. It also would have been nice to have a box of cumulative scores. According to the instruction sheet, Prickly Pear's highest score was 15,330. They did very well. I got to 9975 and felt rather proud.

I liked the game — even found it addicting. Got nothing to do? Play Shaft — it will keep you amused and busy for a solid afternoon.

—by Leslie Venable

■ ■ ■

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

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PRICE: \$129.95

COLORSOFT™ SMALL BUSINESS ACCOUNTING

The COLORSOFT™ Small Business Accounting package is ideal for the small businessman who wants to take advantage of the time saving benefits of computerized accounting procedures. This package is designed with this person in mind and as such, extensive computer or accounting experience is not required. The feature and options of this package are comparable to much higher priced software.

FEATURES

- *** USER FRIENDLY AND FULLY MENU DRIVEN ***
- *** USER DOES NOT NEED TO BE AN ACCOUNTANT ***
- *** UP TO 32 USER DEFINABLE RECORD CATEGORIES ***
- *** DETAILED USER'S MANUAL WITH SAMPLE TRANSACTIONS ***
- *** USER IS PROMPTED FOR COMPANION ENTRIES AS REQUIRED ***
- *** APPROXIMATELY 800 ACCOUNTS RECEIVABLE/PAYABLE FILES ***
- *** MENU PROMPTS MAKE ENTRIES EASY, FAST, AND EFFICIENT ***

COLORSOFT™ Small Business Accounting is an integrated, ledgerless accounting package for a small business that includes Accounts Payable, Accounts Receivable, Sales, and Purchase Order programs. Outputs of the system include an income statement, balance sheet, check register, accounts payable and receivable status lists, and accounts payable and receivable aging reports. During each user established accounting period (monthly, quarterly, annually, etc.), it will handle sales of up to \$1,000,000.00 and approximately 800 accounts payable/receivable. Accounts are automatically numbered and each transaction is carried separately such that an account number will correspond to a specific purchase rather than a specific vendor/customer.

Requires 16K and a Single Disk Drive.
PRICE: \$149.95

COLORSOFT™ MANAGEMENT SKILLS SERIES I: BEING BOSS

"BEING BOSS" is a collection of six programs and is the first in an ongoing series of computer assisted management development tools. Those who can benefit include corporate executives, managers, heads of teams, group leaders, supervisors, foremen, teachers, and parents. In fact, anyone who must take a leadership role can benefit from these programs.

- A. REFLECTIONS - a self evaluation guide
- B. ASSERTIVENESS - taking control as a leader
- C. MANAGEMENT STYLES - how to approach the leadership role
- D. DECISION MAKING - how to handle decision making
- E. COUNSELING - helping others solve personal problems
- F. STRESS CONTROL - taking care of yourself

Each program is in a multiple choice questionnaire format where the user is queried as to a response to a specified management situation. Tutorials help the user learn new management skills and insights. The programs include voice annotation from the author, Mr. Terry Barker. "BEING BOSS" is based in part on his forthcoming management books "BOSS TALK" and "THEORY C."

The series, "BEING BOSS", offers to the user the latest in management skill development concepts and should prove to be an invaluable TOOL for anyone who wishes to reach their full potential as a leader. The author has condensed week long intensive workshop material into this outstanding package. The accompanying user's manual is very well written and is easily understood by anyone.

Requires 16K and cassette.
PRICE \$89.95

COLORSOFT™ ACCOUNTS RECEIVABLE

COLORSOFT™ Accounts Receivable is a full stand-alone accounts receivable system. It is also suited for integration into the COLORSOFT™ Small Business Accounting package. Accounts Receivable does not require the user to be an accountant; in fact, this is a highly user friendly system designed for daily use by the small businessman. The features and options of this system compare favorably with much higher priced software.

FEATURES

- *** PROVIDES ACCOUNT AUDIT TRAIL ***
- *** ACCOUNTS ARE CARRIED BY CUSTOMER ***
- *** USER FRIENDLY AND FULLY MENU DRIVEN ***
- *** PREPARES INVOICES AND MAILING LABELS ***
- *** USER DOES NOT NEED TO BE AN ACCOUNTANT ***
- *** DETAILED USER'S MANUAL WITH SAMPLE TRANSACTIONS ***
- *** MENU PROMPTS MAKE ENTRIES EASY, FAST, AND EFFICIENT ***

COLORSOFT™ Accounts Receivable provides the user with detailed audit trails and history files on all transactions by a customer. It also prepares invoices, mailing labels, aging lists, customer history reports, and an alphabetized customer listing. The user can define discount/net terms for commercial accounts and finance charge and minimum payments for revolving accounts.

Requires 16K and a Single Disk Drive.
PRICE: \$89.95

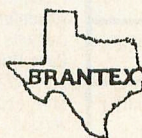
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BEWARE of products that do not work in all versions of the CoCo. We guarantee ours will.

BEWARE of products that do not work with all expansion units. We guarantee ours will.

BEWARE of products that do not work with disk systems. Many won't, but ours will because they are fully decoded. Remember, even if you don't own a disk now, you will someday and you don't want to be stuck.

BEWARE

BEWARE of products that are housed in cheap plastic. Ours are encased in a sturdy metal case to eliminate TV interference.

BEWARE of manufacturers that do not offer software support. The library of music and speech synthesis programs shown below is only the beginning of our support.

BEWARE of manufacturers that try to cut corners. Our boards have gold plated fingers and important IC's are socketed.



MUSICA



THE VOICE

Speech Systems was the first to offer the CoCo community 4 voice music with the **COMPOSER**. We now offer you an incredible 4 voice music program that contains features typically only available on hardware music synthesizers costing 10 times the price.

- The notes are displayed on the screen in high resolution graphics.
- Treble and bass staves are shown individually.
- Notes are input using keyboard arrow keys or joysticks.
- You probably don't believe that. It's true, you can input notes using a joystick. Up or down movement positions the note on a staff, right or left motion makes it a flat or a sharp.
- You can insert a few notes and listen to it immediately.
- You can stop and start the music at any point for editing or crucial analysis.
- You can develop an unlimited number of timbre definitions using a super-fast waveform synthesis option.
- You probably don't believe that one either. But it's true.
- The tempo can be varied during compositions.
- Music may be saved and loaded and may even be called from your own BASIC program.
- The music may be directed to the TV speaker or the **STEREO COMPOSER** (see below).
- Special effects include chorus and 3-position stereo with three voices, and exchanging stereo channels during execution (see **STEREO COMPOSER**).
- **MUSICA** automatically adjusts to 16K and 32K machines.
- **MUSICA** is a machine language program that performs all functions super fast.
- **MUSICA** is completely software, no need for additional hardware.
- We guarantee **MUSICA** is the best music program you can buy for the Color Computer.

MUSICA (Cassette) \$34.95
MUSICA (Disk) \$39.95



THE COMPOSER



The **COMPOSER** is a 4 voice music compiler with a 7 octave range. A unique waveshape is provided for each voice. Dotted and double dotted notes are supported, as well as sixteenth and thirty-second notes.

The **COMPOSER** allows music to be played at any tempo in any key. While the music plays, a changing random kaleidoscope pattern is displayed. This may be disabled to allow the user to display anything including the words to a song.

Music compiled using the **COMPOSER** may be played independent of all other software. The **COMPOSER** is menu driven making it extremely easy to use. Nearly 20 minutes of music is provided.

For reviews see June '83 *Rainbow*, p. 192 and May '83 *Color Computer News*, p. 74.

COMPOSER (16K or 32K Cassette) \$24.95
COMPOSER (32K Disk) \$29.95



THE STEREO COMPOSER

The **STEREO COMPOSER** is a hardware music synthesizer that plugs into the cartridge slot of the CoCo. The **STEREO COMPOSER** contains two 8 bit digital to analog converters and two separate audio power amplifiers with separate volume controls to drive external speakers directly or your own home stereo system. The advantage of being able to use external speakers rather than the TV's built-in speaker is obvious. Using high quality D/A converters and two channels further increases music realism.

The **STEREO COMPOSER** comes assembled, tested, burned in, with all the necessary hardware and software and a 90 day warranty. All features of the **COMPOSER** software are included. You may purchase **MUSICA** and add even more features.

STEREO COMPOSER (Cassette or Disk) \$79.95- \$69.95
STEREO COMPOSER (50 page manual for evaluation) \$ 4.00

PLEASE PIRATE THIS TAPE

Yes you read that correctly. In order to give you the opportunity to hear our products, we are offering you a standard stereo audio cassette. Over 30 minutes of music developed using the **COMPOSER**, **STEREO COMPOSER**, and **MUSICA** are included. Your announcer is of course the **VOICE**. So listen before you buy if you must and spread the word by copying the tape for a friend. This is an audio cassette for your stereo system, not a digital cassette for CoCo.

Demonstration Tape (Stereo Audio Cassette) \$4.00

The **VOICE** is a hardware speech synthesizer that plugs into the Color Computer's cartridge slot. It uses the sophisticated SC-01 by VOTRAX to reproduce any word in English as well as other languages.

The **VOICE** has two outputs. Speech may be heard through the TV speaker or the built-in audio power amplifier with volume control may be connected to your own external speaker.

The **VOICE** comes assembled, tested, burned in, with all the necessary hardware and software, and a 90-day warranty. Runs in 16K, 32K, or 64K machines.

BINGO The **VOICE** announces the BINGO tiles while you play the game.

MATH TUTOR The **VOICE** tutors your child in learning arithmetic.

HIGH LOW The **VOICE** gives you hints in guessing a number it has picked.

EDITOR This utility program will help you develop words phonetically.

THE VOICE (Hardware and programs above, Cassette or Disk) ~~\$149.95~~ \$79.95

THE VOICE (40 page manual for evaluation) \$ 4.00

THE TRANSLATOR

The translator is a machine language program that uses a sophisticated algorithm and exception table to automatically convert text to speech. For example, A\$ = "THIS IS ALMOST TOO EASY" followed by calling a USR will allow the **VOICE** to speak. The translator will even allow you to type words in one language (i.e. French) and have the **VOICE** speak in another (i.e. German).

REACTION Test your reflexes as the **VOICE** gives you commands.

SIMON Test your memory for numbers spoken by the **VOICE**.

THE TRANSLATOR (With programs above, Cassette or Disk) \$29.95

ESTHER

ESTHER is ELIZA plus. **ESTHER** illustrates the high level of artificial intelligence that computers have achieved. Perhaps you have heard of ELIZA that was developed at MIT in which the computer plays psychologist. In our version, the **VOICE** speaks just as the doctor would. And because it is completely machine language, responses are immediate. You'll be amazed!

* **ESTHER** (32K Cassette or Disk) \$24.95

EDUCATION PACK 1

This package of 3 programs is intended for the pre-schooler.

ALPHABET The **VOICE** speaks the A, B, C's as they are displayed enlarged.

NUMBERS Enlarged numbers are displayed while the **VOICE** speaks them.

COLORS The **VOICE** teaches your child the basic colors.

* Educational Pack 1 (16K or 32K Cassette or Disk) \$24.95

EDUCATION PACK 2

This package of 3 programs is intended for the elementary school child.

HANGMAN The **VOICE** adds a new dimension to this favorite spelling game.

SPELLING Test your spelling ability with the **VOICE**.

CALENDAR Test your knowledge of the days of the week, months, etc.

* Educational Pack 2 (16K or 32K Cassette or Disk) \$24.95

EDUCATION PACK 3

This package of 3 programs is intended for grades 5 through 8.

STATES The **VOICE** tests your spelling ability of the states.

CAPITALS So you think you know the capitals, let the **VOICE** see.

PRESIDENTS Even adults will find this one challenging.

* Educational Pack 3 (32K Cassette or Disk) \$24.95

TERMTALK

TERMTALK is an intelligent talking terminal program. Features such as uploading and down loading files from tape or disk are available with many other features which are selected from a menu so it is easy to use. If you have the **VOICE**, what you see on the screen will also be spoken just like in the movie **WAR GAMES**. If you don't have the **VOICE**, you can still purchase **TERMTALK** and have the best intelligent terminal program available. **TERMTALK** also comes in a DUMB version that only talks and does not support intelligent features.

TERMTALK (Intelligent Cassette, Disk) \$39.95, \$49.95
TERMTALK (Dumb Cassette, Disk) \$24.95, \$29.95

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Illinois residents add 5 1/4% sales tax for the **STEREO COMPOSER** or **THE VOICE**.

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Screen above is unretouched photograph of ColorMate display. Disk Extended BASIC is not required.

COLORMATE is \$495.00. Includes 400+ pages of documentation. Radio Shack floppy controller and floppy disk drive not included. Word processing, accounting, and Winchester disk drives are available. Write or call for details. Dealer inquiries invited.

See us at ColorExpo'83
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SDOS is a registered trademark of Software Dynamics.
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COMPUTER SYSTEMS DISTRIBUTORS

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(714) 772-1390

Time Tutor

Programming
Research Office
47 Wilcox Ave.
Yonkers, NY

This program lets anyone with 16K Extended Basic teach children how to tell time by turning the microcomputer into a running clock, either analog or digital. Minute speed can be set from one-eighteenth of a standard minute up for elapsed time demonstrations. Hands can be set to any time, and the screen will display digitally any time typed in. Time remains set until another time is wanted. Hands are then randomly set and children must type in the correct time. A smiling clock face with a jingle signifies a correct answer; a frown indicates an error. The frown will be followed by the correct answer. There are six levels of difficulty, from hours only to minutes. Program contains scoring. Time Tutor is available for \$13.95.

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Dual Interface Printer

Smith-Corona
65 Locust Ave.
New Cannan, CT 06840
(203)972-1471

Smith Corona's new TP-II dual interface, letter-quality printer features both RS232 serial and Centronics parallel interface ports to make it compatible with virtually all computers. The TP-II offers easily set operating characteristics and can print program listings with an ASCII 10/12 pitch printwheel. Smith-Corona's suggested retail price is \$895.

Circle No. 91 on Reader Service Card

Data-Dubler

Comp-Fidence Mfg.
P.O. Box 14
Moraga, CA 94556
(415)376-3003

The Data-Dubler consists of simple tools and illustrated

instructions and will work with single-sided 5-1/4 inch disk drive, regardless of density. It modifies floppy disks so they can store twice as much data as usual. Anyone able to use a pair of scissors can use the Data-Dubler. It pays for itself with the first seven disks modified, and, according to its manufacturer, will not affect system warranties. The complete kit costs \$19.95. Documentation costs only \$9.95 and is applicable as credit against a complete kit.

Circle No. 92 on Reader Service Card

Memory Upgrade Kits

Dynamic Electronics Inc.
P.O. Box 896
Hartselle, AL 35640
(205)773-2758

A complete set of D.E.I. memory expansion kits for the Color Computer upgrades the D, E, and F series to 16K, 32K, and 64K. The kits are solderless and are warranted for one year. Prices are: ME-1 4K to 16K, \$19.95; ME-3 16K to 32K, \$39.95; ME-2 4K to 32K, \$59.95; ME-4F F version to 64K, \$89.95; ME-4 D&E versions to 64K, \$99.95.

Circle No. 93 on Reader Service Card

Integrated Accounting System

Universal Data Research Inc.
2457 Wehrle Drive
Buffalo, NY 14221
(716)631-3011

Universal Data Research, Inc. has a completely integrated accounting system for the Color Computer using the Flex operating system. Packages are menu driven, create and maintain their own data files, and are designed to eliminate unnecessary re-entry of information. Numerous reports can be generated from menu choices or through the UDRI Data Base Manager. All the programs were written through the DBM and can be modified to fit specific needs. Accounts Receivable, Accounts Payable, Inventory, Bill of Materials, Payroll, and General Ledger packages are included. The general ledger package is the focus of the accounting system: all processes provide information to it. General ledger features include complete audit trails; on-line posting of transactions; departmental, divisional or group reporting; manual entry balancing and

pre-posting review; user defined flexible chart of accounts; budget comparative reports; and history for current month, quarter, three previous quarters, year-to date, and last year. The system requires 64K RAM, a Flex operating system, Extended Basic, and at least two disk drives. A printer is recommended for report generation. The system may be modified with the UDRI Data Base managers or customized by UDRI.

Circle No. 94 on Reader Service Card

Database Mailer/ Letter Writer

EV Systems Engineering Co.
9528 Miramar Rd., Suite 35
San Diego, CA 92126
(619)566-6013

EVS has a Database/Mailer and Letter Writer with Mailmerge and Form Letter capability for the Color Computer. Both programs are available for \$89.90 and both tape and disk versions are available for 16K or 32K Extended or non-Extended Basic.

Circle No. 95 on Reader Service Card

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Smith-Corona's Dual Interface Printer.

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(203)972-1471

A plug-in interface unit transforms Smith-Corona electronic portable typewriters into letter-quality computer printers, compatible with all computers. As a typewriter, the new Smith-Corona

Memory Correct III Messenger features time-saving conveniences like one-touch, full-line correction; automatic relocation after corrections are made; multiple pitch for 10, 12, or 15 characters per inch spacing; reverse tab; automatic centering; automatic underlining, and more. Smith-Corona's suggested retail price is \$599, plus \$170 for the Messenger module.

Circle No. 96 on Reader Service Card

Educators' Card Reader

Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102
(817)390-3885

The new TRS-80 CR-510 Card Reader by Radio Shack reads data from punched or marked cards and transfers it to a TRS-80 computer for use with an appropriate applications program. This capability makes the CR-510 a time-saving tool for education administrators. The CR-510 operates on a photoelectric cell principle using reflective light to read from cards measuring at least six inches long. Once a card is read, the data is sent to the computer via serial I/O ports and can be compiled according to the application program for use in evaluating surveys and polls, keeping attendance records or recording grade reports and test scores. Designed for use with a TRS-80 disk based computer that has a RS-232C port, the CR

510 reads cards in single feed, demand feed or continuous feed modes. The unit can read up to 150 cards a minute and can be controlled either manually or through the applications program. The card reader is available for \$1595. General Purpose Standard Cards are available in packages of 200 for \$4.95. Special "driver" software is required to operate the CR-510 with TRS-80 computers and is available at no cost. The CR-510 Card Reader measures 3/4 x 6 7/8 x 12 inches, weighs 16 1/2 pounds and operates at 115 Vac.

Circle No. 97 on Reader Service Card

Upgrade

Flexible Computer Solutions
1410 W. North Loop #108
Austin, TX 78756
(512)458-9783

FCS will install 64K of memory in your Color Computer for \$89 plus \$5 shipping. This offer applies to 4K, 16K, or 32K D or E boards or to 16K F boards, and comes with a

90 day guarantee. Add \$30 if you have the Basic 1.0 ROM. Type EXEC 41175 to see which Basic ROM you have. FCS will also include a program to copy your ROM(s) to RAM and instructions on how to turn the upper 32K of RAM on and off. Extended Basic and Disk Basic are not required. Your upgraded 64K machine will behave like a standard 32K machine as far as Basic is concerned, except that you will be able to copy the ROM(s) to RAM and then PEEK and POKE to the RAM that Basic does not sit in. You can also modify Basic, if you wish. Programs set up to use 64K, such as Flex and Master Writer, will have access to the full 64K. FCS will also do repairs and invites telephone calls for estimates or more information.

Circle No. 98 on Reader Service Card

Hyper Zone

Computerware
Box 668
Encinitas, CA 92024
(619)436-3512

From the cockpit of your space ship you see the real 3-D field of hyper space. Dodge oncoming space debris and destroy attacking enemies as 3-D graphics keep your head dodging approaching objects. Listen to things whiz past your windshield. Hyper Zone requires 32K and costs \$26.95 on cassette or \$29.95 on disk.

Circle No. 99 on Reader Service Card

Super Screen

Mark Data Products
24001 Alicia Pkwy., No.207
Mission Viejo, CA 92691
(714)768-1551

Super Screen is a machine language program that can replace your old 32 character by 16 line display with a brand new 51 character wide by 24 line display including a full upper and lower case character set.

Super Screen supports the CLS and PRINT@ BASIC commands, making it easy to format business and personal programs.

You can also combine text characters with graphics created using the BASIC DRAW, CIRCLE and LINE commands. Super Screen allows full implementation of the ON ERROR GOTO statement, including the ERL and ERR functions. Now you can trap errors and take corrective action to prevent crashed programs and lost data using the same syntax as many other computers. This addition to the Basic instruction set allows you to write "user friendly" programs and greatly enhances the capability of your Color Computer to handle serious tasks. Another important feature is the Key Press Auto-Repeat. No more frustration as you edit a long line in your Basic program; just hold the space bar down and automatically step to the desired position in the line. Super Screen is usable with and automatically adjusts to 16K, 32K or 64K extended or Disc Basic Color Computers. Available on cassette (\$29.95) or disk (\$32.95) at your dealer or from Mark Data.

Circle No. 100 on Reader Service Card

Dyfin

Dynamic Electronics, Inc.
P.O. Box 896
Hartselle, AL 35640
(205)773-2758

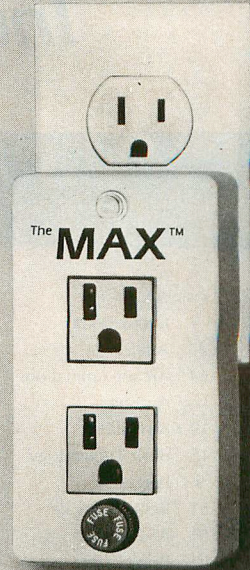
Dyfin can be used to add money and numbers, or to help balance your checkbook. It is designed to aid in the planning of loans, savings, annuities, investments and retirements. It calculates monthly payments for loans and gives the return for money invested over a period of years. A 500-year calendar feature that displays any month of any year is also included. Extended Basic is required. Dyfin is available on cassette for \$19.95 and is disk compatible.

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Questar Blaster

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Woodhaven, NY 11421
(212)441-2807

Questar Blaster, a plug-in adjustable speed auto-fire module, converts the firing of any Atari-like joystick into high speed machine gun action. Speed is adjustable from 1 to 20 shots per second, so shoot-em-up games can be played at a higher level. The Blaster equalizes players, too, by allowing handicaps. A Wico Command Control adapter is required for the Color Computer. The Blaster costs \$14.95.

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Voice Pak

Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
(212)441-2807

The Voice Pak uses the Votrax SCO1 synthesizer chip in a cartridge style pak. It provides an unlimited vocabulary with automatic or user-supplied inflection, a variable voice level adjustment, plus four programmable levels of pitch. With a single line of code, the Voice Pak adds speech to any Basic program in minutes. The system comes complete with a user instruction manual, software cassette with demo programs, text to speech scanner and a word manager that constructs custom user dictionaries. The unit is fully assembled, tested and ready to plug in and talk. The Voice Pak can be used with any prompting application in education, speech therapy, games, robotics and security. It costs \$69.95.

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Great USA

Sugar Software
2154 Leah Lane
Reynoldsburg, OH 43068
(614)861-0565

The Great USA is an educational game written for grades four and up. Players will learn the abbreviations for the 50 states, their capitals, shapes, relative

sizes, locations, and their official birds, trees, and flowers. One cassette contains the 16K and 32K versions. The 32K version includes two color maps, one of the eastern and one of the western USA. The price is \$19.95.

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Soft Sell

Associated Technology
Box 448
Estill Springs, TN 37330
(205)837-4718

Associated Technology is offering a freebie, an eight-page booklet on how to sell your software creations. Included is information on how to get hold of national directory listings, how to price a new product, how to locate and qualify advertisers, how to write a users manual, and how to operate a mail order service.

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Morse Code Teacher

Cynwyn
4791 Broadway, Suite 2F
New York, NY 10034
(212)567-8493

Cynwyn now offers TRS-80 Color Computer and TDP-100 owners Morse Code Teacher. Morse Code Teacher requires 16K RAM and Extended Color Basic, and is available on cassette for \$15 postpaid from Cynwyn.

Morse Code Teacher features three practice routines to promote familiarity with the code and increase copying or auditory recognition speed to up to five words per minute. In the introductory routine, whenever any letter or number on the computer keyboard is pressed, the program responds with the equivalent character in Morse code. The second routine generates and sends characters one at a time from predetermined letter/number groups and displays them on the screen for checking. In the final routine, random characters are sent at either three or five words per minute for copying sessions of one minute, and are then displayed on the screen at the end of the session.

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WHIRLYBIRD RUN

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END OF FILE



Ho, ho, ho. The holiday season is tough; every year my family forces a buying moratorium on me. Their logic is I might buy myself something that Santa has already assigned to the elves in charge of Santa's Maine district. I understand the reasoning, but it's difficult to wait two months for a much desired (if not totally needed) Color Computer accessory. But, far be it from me to mess up Santa's bookkeeping. Last year I actually found a lump of coal in my stocking, and all I did was buy plastic covers for my computer equipment two weeks before Christmas. I guess it doesn't take much to make Santa angry.

I'm sure many of us are looking forward to the gift giving (and receiving) season with nervous anticipation, wondering if we'll get what we want when ripping into the gifts piled under Christmas trees, stuffed into stockings, or piled around the menorah. I've developed a system for ensuring that what we find is what we want.

Make a very long list of desired goodies and pad it with expensive items you don't want. A selection from my last year's list included an IBM PC, a hard disk drive for my Model III, a selection of three very expensive modems, a second Color disk drive, 10 Color Computer software items, a replacement keyboard, etc. I didn't want the PC, the hard drive, or the expensive modems. Unfortunately, I also didn't get the second Color drive. But I did get four pieces of software, the keyboard, and some other goodies. The logic behind padding the list with expensive don't-wants is that Santa will feel bad about not getting them for you, which increases your chances of getting the ones you do want.

Occasionally the plan backfires. Santa will decide to splurge and get you one of the expensive items, knowing you'll understand its expense prohibited him from coming through with the rest of your list. You wind up with an expensive don't-want item and have to go out and buy the do-wants yourself. And, of course, that will have to wait until you've paid off the bills for the presents you bought for everyone else. If you're willing to take the risk, I highly recommend the padded list technique.

On to more important matters. *Byte* was the first magazine solely devoted to the use of microcomputers. *Byte's* first issue appeared way back in September, 1975. What is most impressive has been the magazine's ability to endure the vast changes that have taken place in the industry. Now, eight years later, *Byte* is still the most respected general-interest computer magazine in the field.

What has enabled *Byte* to maintain its premier status in the ever-changing world of microcomputers has been its emphasis on technical excellence and its ability to recognize and encourage worthy new technologies. So, it is with extreme pleasure that I introduce Curtis P. Feigel to you as **The Color Computer Magazine's** latest staff addition. Curt was with *Byte* during the microcomputer explosion, from February 1980 until August 1983. As one of *Byte's* technical editors, he helped the magazine maintain its position as the most au-

thoritative source of microcomputer information. Curt joins **The Color Computer Magazine** as our senior technical editor. We're sure you'll enjoy his tenure with us.

Two other staff additions you may have noticed recently are Steve Bjork and Wayne Day. Steve joins **The Color Computer Magazine** as a contributing editor along with Dennis Kitsz, Jake Commander and Bill Barden. Steve's software credits run longer than I have room to tell. They include DataSoft's "Zaxxon," "Sands of Egypt," and many other fine graphic games.

Wayne Day has become our communications editor. Wayne is System Operator (SYSOP) of CompuServe's Color Computer Special Interest Group (SIG). For those of you not familiar with Wayne's work, access his SIG by connecting to CompuServe and then typing GO PCS 126 at the command prompt. The SIG offers you the opportunity to make Color Computer friends, get advice, give advice, obtain free programs in the SIG's database, participate in on-line conferences, and many other telecommunication activities. If you haven't yet sampled your Color Computer's communications abilities, you're missing out on one of the fastest growing aspects of personal computing.

Although you're reading this after ColorExpo '83 in Pasadena, the event is still a few months off at this writing. I'm sure we all had a good time. More on what happened after it happens. Happy Holidays.

—K.L., Editor

FOR...NEXT (01,84)



OH GOSH — soon it'll be Christmas and you will have your brand-new, shiny Color Computers — or upgrades — or peripherals — or spending money, and you won't be able to wait to put each to work! But, what to try out first? What nifty new program to buy? What disk controller to purchase? What — what — what —?

Let us help you out, with our extra-special, jam-packed Review issue. We'll look at games and business software, hardware, peripherals, and more. You won't have to worry whether that subscription to CompuServe or that Dragon-Cruncher program is money well-spent — you'll know, because our reviewers will tell you!

Don't miss this issue — it could save you lots of time and worry!

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“It’s also a serious learning tool.” Right again, Isaac. Kids can learn to type, sharpen math skills, become artists, compose music and improve reading. And our entertaining tutorial manual shows how easy it is to program with color and sound.



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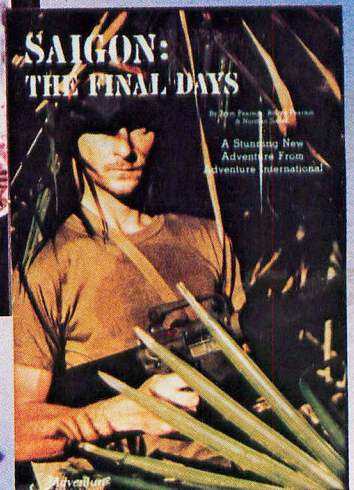
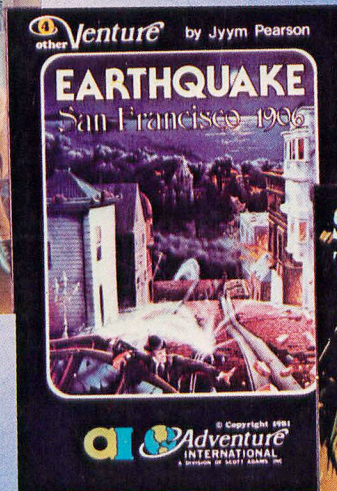
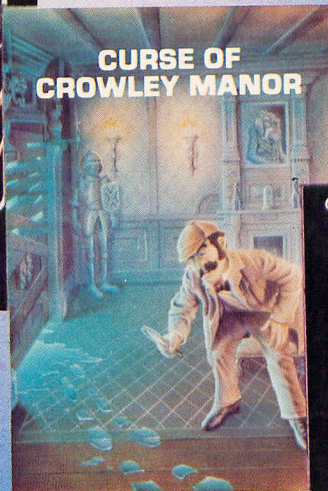
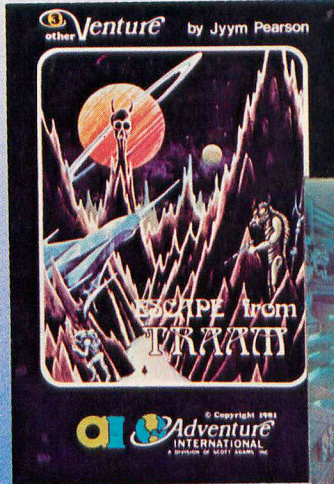
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