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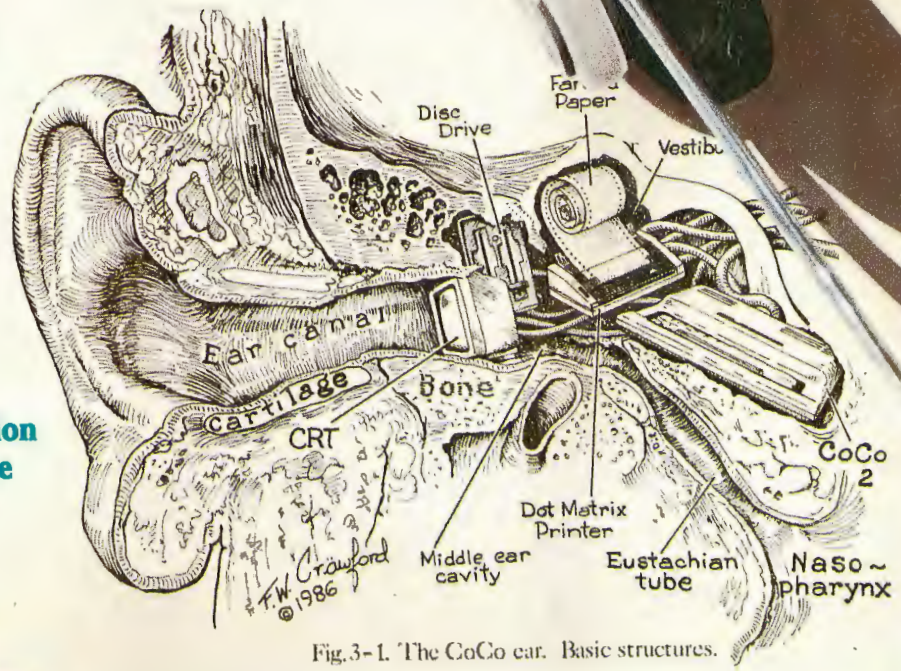

Fig. 3-1. The CoCo ear. Basic structures.

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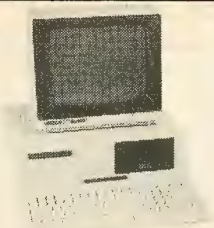

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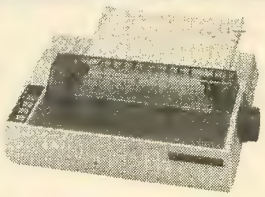

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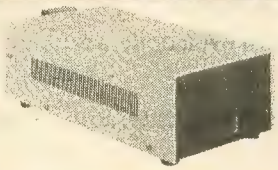

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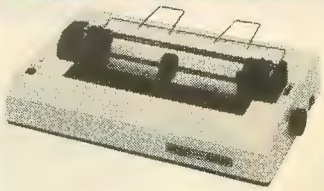

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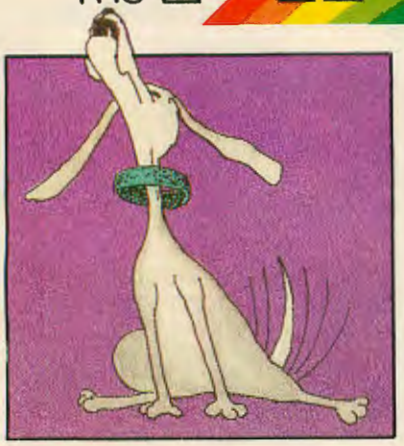

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The small cassette tape symbols beside features and regular columns indicate that the program listings with those articles are on this month's RAINBOW ON TAPE, ready to CLOAD and RUN. For full details, check our RAINBOW ON TAPE ad on Page 180.

NEXT MONTH: Can it be true? THE RAINBOW turns 5! Our Fifth Anniversary edition will heat up your summer with a festival of features to make the CoCo sparkle, columns that sizzle with hot new ideas and scintillating reviews to spark your interest.

Look for some exhilarating birthday highlights and an extra-special anniversary surprise. We'll also include a complete index to the past year of THE RAINBOW, plus our usual array of games, utilities and graphics.

Don't miss the Fifth Anniversary RAINBOW — come celebrate with us!

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June 1986 Vol. V No. 11

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LETTERS TO THE RAINBOW

Questions? . . . We have the Answers!

Editor:

I am retired and have been paying into an IRA account. How much is this account worth now? I am going to sell the house that I bought in 1974. How much is it worth today? I need to pour concrete. How much will it take?

All three questions were answered by the April 1986 RAINBOW. Thanks CoCo and RAINBOW.

W.E. Pendergrass
Danville, KY

Editor's Note: Glad you liked our Home Help Issue. Programs referred to can be found on pages 70, 79 and 162.

BACK TALK

Editor:

This is in response to M.S. McPherson's letter in the April 1986 issue [Page 9] about the program by the Delbourgos that creates the image of the earth's rotation (August 1985, Page 73). The spinning of the earth can be easily adjusted by a slight change of Line 180 of Listing 2 (*Pageturn*). By changing the number 40 in the section of the line that says, `"FORT=1TO40"`, you can speed up or slow down the rotation. The smaller the number, the faster the rotation. My preference is `"FORT=1TO190"`. I hope this helps slow down the spinning of Mr. McPherson's world.

Barb Karr
Risingsun, OH

$C0 can be Valid

Editor:

In "A Disk Tinker's Device" in the March 1986 issue (Page 88) Martin Goodman questions the validity of $C0 in the GAT. There are two situations where $C0 is valid.

The first situation occurs when a BASIC program opens two sequential output files for the first time. File number one's first GAT byte is initially $FF. This makes sense because file number one's size is initially undefined. A problem arises upon opening sequential output file number two. The routine that scans the GAT for free granules ($FF's) might accidentally assign to file number two the same granule that was assigned to file number one. To avoid this, file number one's GAT byte is changed to $C0. Its granule is no longer marked free. If the file is closed before any data has been written to it, the first GAT byte will be $C1 because EOF information is written to the file.

Direct access files are similar except that $C0 is initially assigned as the file's first GAT byte. Unlike sequential files, when a direct access file is closed the GAT byte can still be a $C0. Why? A record doesn't have to occupy an entire sector, its size is user definable and a file can have zero records in it, thus occupying no space. A $C0 GAT byte reserves the granule for the file until the first record is written. Why did they choose this method? Disk BASIC design philosophy stressed speed. The GAT is loaded into and read from RAM to speed up GAT intensive operations. The fastest way to define a zero record count and reserve additional granules using only the GAT is by marking them $C0.

On another subject, I have written several professional grade programs for the DISTO 80-column adapter. Interested parties may write to me at P.O. Box 126, 06403, or call (203) 723-8237.

John C. Gazy
Beacon Falls, CT

Cold Shoulder for *EDTASM+*?

Editor:

Thank you for William Frame's letter in the April 1986 issue [Page 7]. I have well over $2,000 in my CoCo and all I see is more money going out.

EDTASM is a good program. I've used all of Mr. Schrag's patches, so I have Disk *EDTASM+*. But, what good is it? All that time and I can't use the *Digital Aquarium* program. Heck, I can't even use D. Lendowski's Vaders!

Maybe what this shows is that Tandy makes the computer but that's it. Face it, a beginner *is* going to choose *EDTASM* because of the cost. We are not all machine language programmers.

I can't say anything bad here. You do what you must, but there are thousands of us with *EDTASM+* only.

When Bill Barden, Jr. says *EDTASM+* is what we're going to use . . . well, that shows me the program is not junk and it deserves more respect than it gets.

Will Computerware's Macro Assembler plus *XREF* (Disk BASIC) allow me to assemble the *Digital Aquarium* listing, which was written on the Micro Works 80C? How do I get *Micro Illustrator* to `SAVEM` to another disk or get the pictures dumped to my CGP-220? I have OS-9. Do I have to get OS-9 screen print utilities? There's nothing in the instructions or program that tells how to get a printer dump. Please help! My address is 525 6th Avenue N #1, 59401.

Jay Thomas
Great Falls, MT

RAINBOWfest Praised

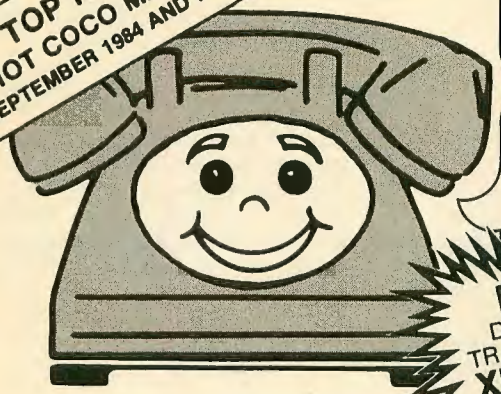
Editor:

This is to say thanks for having RAINBOWfest in Palo Alto. That made it possible for my daughter and me to attend our first one. We enjoyed seeing some of the faces that go with the names on the articles we read. Please don't let the unfortunate weather keep you from having another one in northern California.

I want everyone to know about Moreton Bay Software. John Nielson and his company put customer service and satisfaction above everything else, whether in person or over the phone. You can count on them to resolve any problems. The *Hotslot* program is great fun for us would-be high-rollers!

Norma V. Doyle
Alameda, CA

TOP RATINGS
HOT COCO MAGAZINE
SEPTEMBER 1984 AND MAY 1985



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"The AUTOTERM buffer system is the most sophisticated — and one of the easiest to use..."
Banta, *HOT CoCo*, 9/84

"Almost a full featured word processor..."
Ellers, *RAINBOW*, 11/84

"AUTOTERM's excellent error-handling routines, thorough documentation, and logical, easy-to-use command structure make it stand out."
Parker, *HOT CoCo*, 5/85

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HINTS AND TIPS

Editor:

I would like to inform Canadian CoCo users of the ACCESS Timesharing System. It is similar to Delphi and CompuServe only it's Canadian and much cheaper. The cost is $5.95 an hour CDN including all charges. There is a special CoCo SIG on the system so we can all communicate. To log on, call up your local Datapac number and type the following:

```
49700019 (ENTER)
(ENTER)
HELLO DEMO.DEMO (ENTER)
```

This gives a description of the system and the option of signing up online. You may also call them at (514) 342-8147. I hope to see more CoCo users on the system soon.

Kanti Dinda
Kingston, Ontario

Printer Upgrades Available

Editor:

RAINBOW is great! In the March issue you printed my question and soon after I got five good answers.

I asked for information on an upgrade for the Epson RX-80 printer to allow it to print near-letter quality as in the current LX-80 model. Here's where you can get an upgrade kit for $59.95: Dresselhaus Computer Products, 837 E. Alosta Ave., Glendora, CA 91740, phone (818) 914-5831. The product is called the "Fingerprint Letterwriter." Kits are also available for the Epson FX series for $79.95.

Paul Whiting
Madison, WI

Timing Subroutines

Editor:

Here's a tip on timing subroutines. First, type in and run:

```
10 TIMER = 0
20 X = TIMER
30 PRINT X
```

This gives a readout in $^1/_{60}$ seconds of how much overhead the test lines take. Write it down. Insert program subroutine between lines 10 and 20 (put them into the program at odd-numbered positions so they can be removed later). Subtract the overhead (first figure obtained) from the second figure. This tells how long the routine takes to run in $^1/_{60}$ seconds. Multiply by 60 to get seconds. This could be included in Line 30.

B.R. Pogue
Lake Havasu City, AZ

RAINBOW ON DISK Vote

Editor:

I heartily endorse the suggestion to have a RAINBOW ON DISK subscription. I also request that you publish a comparison chart for database manager programs, similar to that done for printers a few issues back.

James M. Green
Jacksonville, FL

Belated Congratulations

Editor:

What happened to "CoCo Cat" in the April 1986 issue of RAINBOW? Has he run away? I see that Jerry McKiernan has been promoted from assistant art director to art director beginning with the February 1986 issue. A belated congratulations!

William T. Grace
St. Joseph, MI

REQUEST HOTLINE

Editor:

I am interested in purchasing any trivia on cassette tapes. I have searched all over and can only find them on floppy disks. Please help. Write to me at 25517 Yale, 48125.

Steve S. Massey
Dearborn Heights, MI

Can You 'Spare' any Bowling Software?

Editor:

I am trying to locate software to handle my bowling league records. I would also like to be able to keep records for tournaments in which three, four or five games are bowled. I have a 64K CoCo. If you or any of your readers have such a program or know where this type of software is available please let me know. I would be interested in hearing about or seeing a sample printout of bowling league software. My address is 2416 Main Street, P.O. Box 78, 44856.

Nancy F. James
North Robinson, OH

Ups and Downs

Editor:

I have been following biorhythms for several years now using a book written by Bernard Gittelson entitled *Biorhythms — A Personal Science*. I have found several programs in other computer magazines that profess they have a program for biorhythms, but to no avail. These programs don't even come close to comparing to the charts in Gittelson's book. Perhaps you have a past issue of your magazine that has a program for a biorhythm chart. My address is 1101 Tyler, #23, 66612.

R.D. Phillips
Topeka, KS

Editor's Note: See the reviews "Biorhythm and Mine Field" February 1982, Page 10 and "Biorhythm" June 1982, Page 52. Also "How's Your Day? Need Biorhythm help?" November 1981, Page 6.

Family Ties

Editor:

I am looking for a good genealogy program for a 64K Color Computer 2 . . .

Kyle Johnson
Cantoment, FL

Editor's Note: We suggest "All in the Family Tree," February 1984, Page 78 or *Ancestors 2.0* from Autumn Color Software, which was reviewed on Page 218 of the November 1984 issue.

New Address

Editor:

If anyone has questions about or wants a copy of my program, *Guppy Graphics*, from the October 1985 issue, Page 106, send $6 to my new address: 739a 16th Avenue, 94118. I'm sorry the RAINBOW ON TAPE version didn't work. Also, I hope you put out RAINBOW ON DISK soon.

Jim Kent
Dancing Flame Software
San Francisco, CA

Delphi Line

```
From: BOSIB::COLOR
To:   EDITORS
Subj: IDEA

How about a section for "K-BYTERS"? They are small programs like one-liners, but can have any amount of lines in them and can only take up 1K of memory.

                                Royal O'Brien
                                Riverside, NJ
```

INFORMATION PLEASE

Editor:

After many hours of trying to modify the screen dump for the excellent *CoCocad* program by Peter Kerckhoff (October 1985, Page 130), I give up.

Mr. Kerckhoff was of great help in sending me the modifications for the DMP-type printers, however, even those did not work with my DMP-105. The modification printed in THE RAINBOW (February 1986) will not work using my DMP-105 printer. I would like to know if anyone has made a machine language print routine that works using the DMP-105 printer for *CoCocad*. My address is 1137 Caddock, 68008.

R.W. Harper
Blair, NE

A Touching Request

Editor:

I just purchased a touch pad. They come with almost no documentation. I would greatly appreciate it if someone could send

me some information and/or program suggestions. Send information to 741 Alicia Walk, Apt. E, 44306.

Keith Selbee
Akron, OH

Editor's Note: See "Joysticks, Touch Pads and Digitizing the World" on Page 224 of the January 1986 issue.

OS-9 Upgrade

Editor:

I bought my 64K Extended BASIC CoCo 2 about five months ago. Your magazine has encouraged me to upgrade with an FD-500 disk drive and a DMP-105 printer. And I have also made the commitment to OS-9.

I am using the tape version of *Elite* Word* and I plan to upgrade to the OS-9 version soon. But, there are times when the program hangs up and I see a rampant cursor bar flashing back and forth on the last line of text. If anyone is using *Elite* Word* OS-9, I would appreciate hearing from them, since I am not sure which OS-9 word processor to use. Write to me at 10-B Summer Street, 94102.

Shawn Thomas
San Francisco, CA

Get in Touch

Editor:

I would like to contact someone who has a communication program for the DCM-3 modem. I have the *Color Disk Scripsit* for the DMP-105 printer, and I also have some games for the CoCo. Anyone interested please write to me at 4421 NW Second, 33126.

Walter Traini
Miami, FL

Editor's Note: Any communications package should work.

Voltage Change

Editor:

I now have a Disk Extended Color BASIC 1.0, 32K CoCo. I bought a new CoCo 2 and cannot get my disk to operate. I understand they have changed the voltage to the control. Is there some way I can adapt my old control to operate with the new CoCo 2?

Ronald M. Pierce
Ft. Lauderdale, FL

Editor's Note: Tony DiStefano describes how to build a 12-volt power supply for the CoCo 2 in the April 1984 issue on Page 149.

Using DMP-105 Fonts

Editor:

I have found Tandy's *Color Scripsit* to be very useful. However, I was disappointed when I found it impossible to utilize the various fonts available from my DMP-105 printer. Am I missing the obvious or has anyone found a way around this problem?

Jerry Dummer
Los Alamos, NM

Editor's Note: You might try poking control codes to the printer immediately before running *Scripsit*. This assumes you are using the disk version of *Scripsit*.

Calling Modem Programmers

Editor:

I recently bought a Radio Shack DCM-5 modem. The manual says the modem can be programmed for automatic operation. It describes automatic as "having the modem call another computer at a desired time." I would like to use this feature to transmit files, but I don't know how. I don't know assembly language and the modem can only be programmed when it is in a terminal program with the settings at seven data bits and full duplex. If anyone knows how to do this, please let me know. My address is 435 8th Street NE, 33881, phone (813) 293-5648.

Thomas C. King
Winter Haven, FL

Double Duty Drive

Editor:

Please tell me if it is possible to use both sides of a double-sided disk in a single-sided disk drive. I have a Radio Shack slim-line Drive 0 and I've tried cutting the write-protect notch on the opposite side of the disk. I've been able to cut a pretty good duplicate of the notch on the other side and in the correct location. My 64K CoCo keeps telling me I/O Error when I try to format that side of the disk. I've heard of people who have single-sided disk drives using both sides of double-sided disks. How can this be done?

Jose Garcia
Mooresville, NC

Editor's Note: See "Downloads," April 1986, Page 225, for the answer to this question in reply to a letter from Kevin Gibson.

EPROM Changes

Editor:

Is there any program for the CoCo so when it is turned on it automatically loads a program from disk? If anyone has any program like this, I can be reached at #8 Sylvan Heights, 52601.

Scott Lindsey
Burlington, IA

Editor's Note: Check out our "Cooking with CoCo" series beginning in July 1984 and ending in February 1985. What you want will require that the changes this series makes be burned into an EPROM.

Reading Bar Codes

Editor:

Where can I get a Bar Code reader that is usable on my upgraded CoCo 2 with double disk drive? I prefer a wand, although other versions might do. I want to scan, then print out information with a small Tandy thermal printer. Write to me at 2927 Allen, 63104.

Barbara Gardner
St. Louis, MO

Selling Programs

Editor:

I am an assembler at an electronics firm and have written a program to print the disk directory. I would like to sell the program but I don't know how to go about it. Any advice would be a great help.

James C. Anderson
Ft. Atkinson, WI

Editor's Note: We suggest you call or write to the various software houses. You might find one who might be interested. You are always invited to send it to us. See "Submitting Material to Rainbow" on Page 120 of this issue.

KUDOS

Editor:

A special thanks to Fred Scerbo for his *Title Maker* program [Page 157] in the March 1986 issue. I had been unsuccessfully trying to do that with joystick and keyboard programs. I am the membership director for the London CoConuts Computer Club and we promote your magazine whenever possible.

Doug Tompkins
London, Ontario

BULLETIN BOARD SYSTEMS

Editor:

I would like to inform your readers of my COBB's BBS #41. It is online from 8 a.m.-8 p.m., CST, seven days a week, 300 Baud, no parity, eight bits and one stop bit. The number to call is (501) 857-3138.

Perry Parsons
Corning, AR

• This is to announce a new BBS. The Classified Connection is online 24 hours a day at (619) 566-1745. Users may access 300 Baud only. The board is primarily dedicated to TRS-80 Color Computer users. The emphasis being buy/sell/trade hardware and public domain software and assorted other articles in a swap-and-shop forum. There is a unique art forum for the submission of public domain artwork written by Color Computer users and downloadable in XMODEM format.

Bill Kennon
San Diego, CA

• Our TBBS is running 11 various CoCo sub-boards with four separate up/download software bases. Members receive a monthly newsletter that contains a BBS list, pokes page, news section with the latest happenings from CompuServe, Delphi and other branches of the CoCo world. We will also be holding monthly meetings where

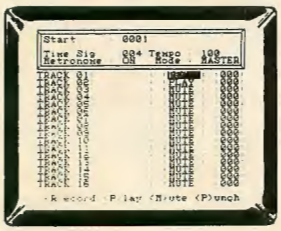
What Happens When You Own A
COLORCHESTRA™ MIDI SEQUENCER?

All Of A Sudden, Synthesized Music Production, Editing And Recording Becomes Very, Very Simple.

COLORCHESTRA, (from the author of CoCo MIDI), links together your Tandy 64K Color Computer and MIDI equipped keyboard synthesizer or rhythm drum machine and makes it simple to create masterpieces of music.

By incorporating menus and graphic icons, all there is to recording in real time is pushing a few keys.

A. Select track recording icon.



B. Select starting measure, time signature, tempo and recording track.

C. Simply play keyboard and hit break key when done.

THAT'S IT!

Once the track is entered, auto correction, transposing, and filtering may be implemented. And **COLORCHESTRA™** works with you to record up to **8,000 notes** utilizing as many as **16 tracks**...awesome.

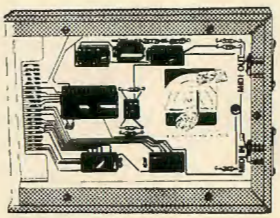
But it doesn't stop here - **COLORCHESTRA™** is crammed with a myriad of other outstanding professional features...

- ✓ Solo capabilities on any track.
- ✓ Tempo range from 30-250 beats per minute
- ✓ Audible and visual metronome
- ✓ Programmable measure locator
- ✓ Sequencer will record from any MIDI Channel (1-16)
- ✓ Each track can output to any MIDI channel (1-16)
- ✓ Records full spectrum of MIDI data including program changes, pitch bends, all 128 MIDI controllers (modulation wheel, breath controller, sustain pedal, etc.)
- ✓ Will sync to drum machines
- ✓ MIDI thru on input
- ✓ Programmable time signature
- ✓ Track looping capability
- ✓ Real time velocity modification
- ✓ All 16 tracks can be titled
- ✓ Software filter removes specific MIDI parameters from recorded music such as pitch bend, program change, velocity data, modulation wheel, MIDI controller
- ✓ Simple music text editor
- ✓ Transposition of notes up or down any number of octaves in half steps
- ✓ Auto correct feature for timing errors
- ✓ Stores composed music on tape or diskette
- ✓ Works with any disk operating system (Radio Shack, JDOS, ADOS, etc.)

THE COLORCHESTRA SYSTEM PACKAGE

HARDWARE

Encased between clear plastic panels and hand finished american walnut is **COLORCHESTRA's** sequencer board. Not just the edge connector, but every circuit trace is plated in 7mil gold for optimum interface connection.



Two dependable, heavy duty 8' MIDI cables with metal jacketed end connectors are included.

SOFTWARE MEDIA

In addition to the hardware cartridge and cables, the **COLORCHESTRA™** System Package includes type set documentation in its own ring binder for easy reference and updating.

And for your convenience, both tape and diskette are supplied-so, if you need a back up it'll be there.

COLORCHESTRA™. A simple answer to your MIDI music production and HORIZON puts it all together for an introductory price of **149.95.....**

COLORCHESTRA™ system complete - $149.95. Call any day (ex. Sun.) to order. We ship same day. We accept check, COD, Visa, Master Card. Shipping add 3.00, COD add 2.00. Louisiana residents add 7.8 sales tax. Call for audio demonstration.

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HORIZON

SOFTWARE CORPORATION

318-942-1938 P.O. Box 289 Opelousas, Louisiana 70570

members can access our program library. For more information call (408) 867-2823 (Allan Schaffer), (408) 923-2967 (John Say) or our TBBS at (408) 253-6293.

John Say
San Jose, CA

• Would you please announce the completion of The French Underground BBS. Its down time is weekdays 3 p.m.-7 p.m. (Central time zone) and weekends 10 am.-7 p.m. The number is (319) 388-0381.

Dave France
Davenport, IA

• Fast Trackin' BBS has a new phone number. Call me at (502) 365-7771. We are still in operation 24 hours a day; currently running at 300 Baud.

David Guess
Princeton, KY

• Bob's Corner BBS is up 24 hours a day. It is a Colorama Version 3.04 and has been running over a year. It has a small users log of 70 callers. We have online games, up/downloads, full magazine, graphics, story, large message base, open club section and a sub-BBS for amateur radio operators. Call (617) 889-0777 BBS, (617) 889-0056 Voice.

Bob Bohn
Chelsea, MA

• The Frisky CoCo BBS is a 300/1200 Baud system, online 24 hours a day, seven days a week and has downloads of all kinds. It is an extensively modifed Colorama (Ceretek Inc.). Call (816) 436-2904.

Jerry Oliver
Kansas City, MO

• Introducing Colorama, online from 7 p.m. to 12 midnight daily. Call (601) 795-8915. For more information call before 7 p.m. for voice.

Joe Polk
Poplarville, MS

• My BBS runs on a 64K 'E' CoCo, four drives, Deluxe Pak, Hayes 1200 and a homemade hardware clock. ASCII and XMODEM transfer is available with 30-40 programs online for downloading along with hints, reviews, bulletins, games and trivia. New users are not limited to any activity except writing on the system. We are up and running 24 hours a day, seven days a week, 300/1200 Baud, eight data bits and can be reached at (603) 485-8682.

Dave Bean
Allenstown, NH

• The Hotel BBS operates 24 hours a day, seven days a week. We feature SIG sections such as a health, gourmet, magazine, want ads and a great download section that has Mike Ward's *Mikeyterm 4.0* (c) online to download. Give us a call at (718) 381-2209.

Mike Sileo, Jr.
Glendale, NY

• I would like to inform your readers of a BBS in the Westchester-Rockland-Putnam area. The BBS supports a variety of systems including CoCo. It includes many SIGs and even a UFO section. The boards are up from 6 p.m.-7 a.m. weekdays and 24 hours on weekends; has a download section for CoCo and IBM. Call (914) 776-2424.

Jolly Roger
Lake Carmel, NY

• Announcing The Utopia Network #1 BBS. We are using our own written software. To log on use 300 Baud, full duplex and even parity. We have over 200 programs available for download and several other features. The hours of the BBS are from 7 p.m. to 6 a.m. every evening.

Bruce Uher
Coshocton, OH

• I would like to announce a BBS called the FUN BBS. It has movie reviews, top 10 music, supports up/downloading, has online games and more. It runs on a three-drive CoCo with 64K. The number is (412) 378-7825 and is usually up 24 hours a day.

Robert Chalupa
Aliquipa, PA

• I would like to announce the changing of CoCo Palace's number. The new number is (615) 581-9752. Voice calls will be taken on (615) 581-2904. I am changing to a new BBS program. I am also interested in starting a national club for SysOps. Address all correspondence to 936 Hall Drive, 31784.

Marty Cline
Morristown, TN

• The Salt City CoCo Club announces it has a BBS — runs 24 hours a day, seven days a week, 300 Baud, seven bit, no parity. Call The Data Warehouse at (801) 487-6787.

Salt Lake City CoCo Club
Salt Lake City, UT

• Announcing the online operation of the Bellingham CoCo Bulletin board from 10 p.m. to 7 a.m., seven days a week. Call (206) 734-5806.

Roger Alexander
Bellingham, WA

• Announcing Uncle Dave's BBS in operation at 300 Baud, 24 hours a day, seven days a week. Supports up/downloading and various message bases. Call (414) 843-4029.

David Buehn
Salem, WI

• I would like to announce the start of the Wizard's Keep BBS. The number is (604) 752-2480. It runs 24 hours a day at 300/1200 Baud.

Jason Cikaluk
Qualicum Beach, British Columbia

• I would like to inform your readers of the all new Micro Ads BBS. We operate 24 hours a day, seven days a week. Parameters are 300 Baud, eight data bits, one stop bit and no parity. Phone (604) 832-8772.

David Coldwell
Salmon Arm, British Columbia

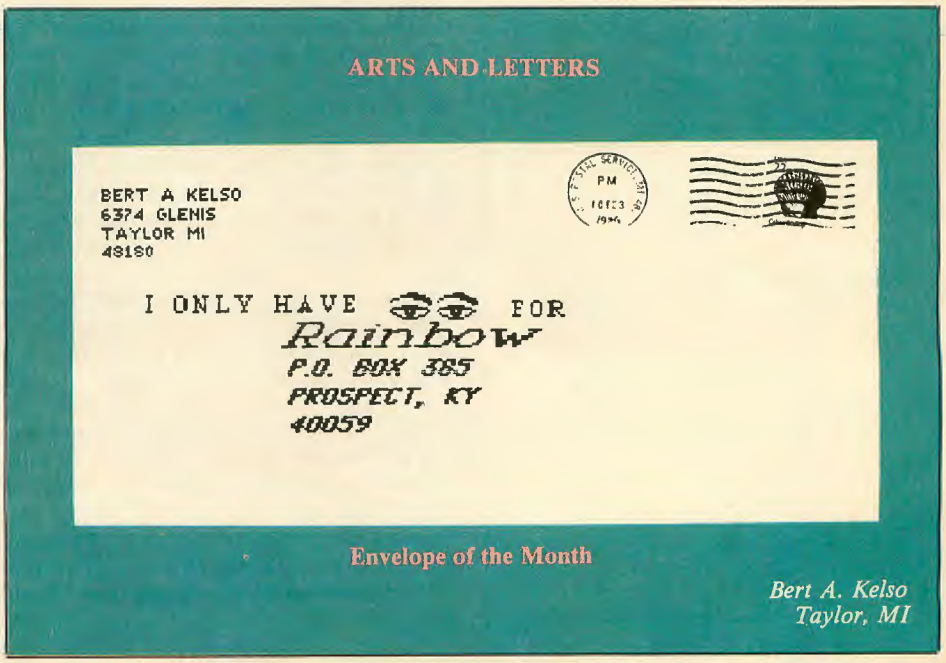
• CoBBS #63 is online and running 24 hours a day. This system supports up/downloading, two message bases, for sale sections and much more. Call (705) 328-0703. If the system is down for housekeeping, etc., the phone online is not answered to ensure charges are not made.

Bud Melless
Lindsay, Ontario

THE RAINBOW welcomes letters to the editors. Mail should be addressed to: Letters to Rainbow, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. Letters should include the writer's full name and address. Letters may be edited for purposes of clarity or space.

Letters to the editors may also be sent to us through the MAIL section of our Delphi CoCo SIG. From the CoCo SIG> prompt, pick MAIL, then type SEND and address to: EDITORS.

ARTS AND LETTERS



Envelope of the Month

Bert A. Kelso
Taylor, MI

PRINT#-2,

I have seen a great deal about "desktop publishing" in the past months and, I suppose, the ultimate bombardment came just the other day when we received a baker's dozen promotions for Apple's new Macintosh.

I don't know what it cost to produce the package, but — based on what we pay for much more modest mail campaigns — I would guess it was in the neighborhood of $10 each. That means Apple spent about $130 sending Falsoft and its associated companies promotion material trying to convince us that the Mac could be used in place of our typesetting equipment. With the exception of a few printing shops, I know of almost no one who uses the still-very-slow Mac for typesetting.

Hooked up to an Apple LaserWriter printer (which, incidentally, costs much more than an HP or Corona LaserJet) you can get acceptable "type," but at a slow speed. And digitized images are a poor second to photographs. Color? Forget it.

There is, however, a magazine that was founded on the general principle of desktop publishing. You are reading it. For the first year, THE RAINBOW was done entirely with a Color Computer and a dot-matrix printer. Can you still do this? Well, ask all the people who use their CoCo for newsletters of all types.

After several years, I see Apple as still trying to find a niche for its Mac. So far, no go. A computer, after all, has two purposes. The first is to make things easier for its human companion. The second is to make things enjoyable. No one will ever convince me that a Mac does these things best — simply because it works so slowly. And, if it is slow to react, I can hardly say it is enjoyable. Many of Mac's games are good, but good games don't suffice for lack of other attributes.

I think Apple should just let Mac go away quietly. Or reduce the price drastically. And that would be easy: I could have saved them $130 just by telling them not to send us 13 mailers for something we are hardly interested in using.

* * *

Speaking of mailings, our policy is that we make just one for subscription renewals. No, we're not like some other magazines that run a series of six or so mailings to get your renewal. I always find those renewal notices a bore and "tune out" on them after a while. After all, I figure that, eventually, they make their "last, best offer" and it is silly to renew before then.

We don't take that attitude. Instead, we figure you like THE RAINBOW (most of you seem to) and if you get a notice to renew, you will. We do include a note that says the notice you're getting is the *only* one you'll receive.

Since we seem to have one of the best renewal rates in the industry, maybe we do something right. On the other hand, every month we get notes from people who let their subscription lapse and want us to pick it back up with the issue after the last one they got. This frequently happens when someone sees the new issue on the newsstand or at a friend's home.

We can't do that. The reason we are able to keep our subscription price where it is is because we mail all our magazines at the same time on a second class permit. It costs a couple of dollars to mail one first class — and that's more than the profit on a whole year. (Yes, we will mail first class when you miss an issue.)

So, please, send in your renewal notice when you get it. That way, you'll be sure to keep THE RAINBOW coming without a break.

* * *

A few months ago I made a comment in our sister publication, **PCM**, that our cover story (December 1985) on the Tandy 3000 and 600 marked the first time I knew of that Tandy Chairman John Roach had appeared on the cover of a computer magazine.

I was jumped all over by Eric Maloney, editor of *80-Micro*, because his magazine had Roach on the cover a couple of years ago. A correction was duly made in **PCM**. Eric's letter was to the point on the need for accuracy in journalism.

So, it seems fair-to-middlin' strange to see *80-Micro* describe a simple upgrade for the Color Computer as the "long-awaited successor to the Color Computer 2" in its May issue. Talk about negative commentary: *80* went through a short list of all the things Tandy did not change.

One phone call, Eric, would have told you this was not the new Color Computer. It is just an upgrade. Seems everyone knew about it but you.

I am sorry to see this happen, since it reinforces the magazine's disinterest with the CoCo, which dates back years to the time *80-Micro*'s founder and then publisher Wayne Green forecast the "death" of the machine that went on to be Tandy's top seller. I am even more sorry because now that *Hot CoCo* has folded, *80* purports to support the CoCo.

To paraphrase Henny Youngman: "Support like this, I don't need."

— Lonnie Falk

Telewriter-64™

the Color Computer Word Processor

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

THE ORIGINAL

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

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

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

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

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

TELEWRITER-64

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

64K COMPATIBLE

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

64 COLUMNS (AND 85!)

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

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

RIGHT JUSTIFICATION & HYPHENATION

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

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

FEATURES & SPECIFICATIONS:

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

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

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

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

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

RAINBOW CERTIFICATION SEAL

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

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

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

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

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

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

PROFESSIONAL WORD PROCESSING

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

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

To order, send check or money order to:

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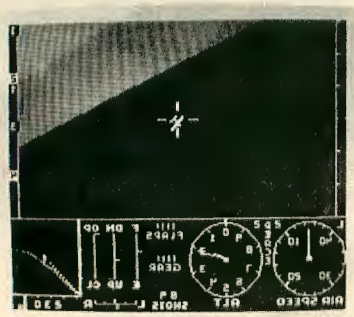

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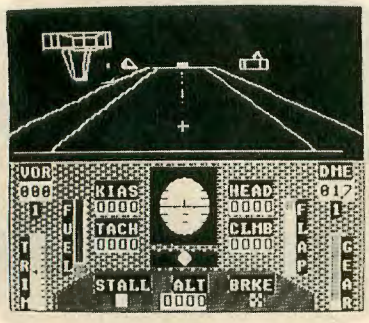

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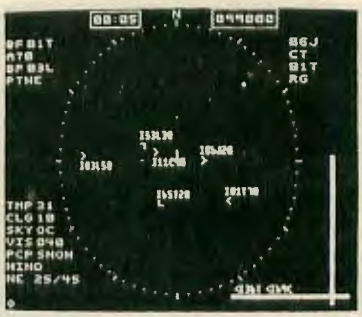

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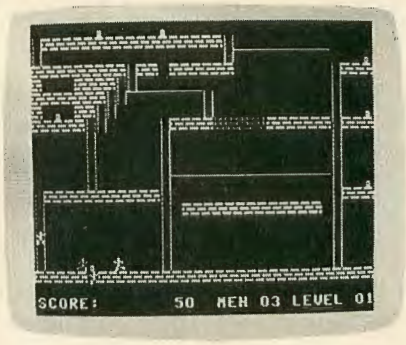

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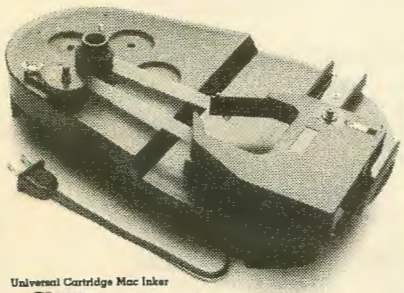

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BUILDING JUNE'S RAINBOW

Welcome to CoCo Country

Recently, we were calling people throughout the building to come hear some movin', groovin' CoCo musical arrangements. I taunted the managing editors of our sister publications with, "Let's see your machine match that!" Rock 'n' Roll!

Truly, I had not realized any computer could jam that way — I'm talking driving-beat, get-down sound. CoCo's musical state of the art is a long way from PLAY statement Chopsticks. Unfortunately, for several selections, the "listing" (if one even existed) would run many magazine pages and would be helpful only to those who happen to have a given CoCo composer program.

Luckily, we also have solid material that can be shared. But, since these arrangements are all quite long, what we have done is run enough of the program code in the magazine to play the first few bars, to show you how it's done, and then included the entire file on RAINBOW ON TAPE. We don't like to put anything on RAINBOW ON TAPE that isn't in the magazine, but we believe you'll understand and forgive us this slight transgression, since doing otherwise would deprive you of some great stuff.

Carrying our departure from the norm a bit further, we also included some non-CoCo-generated music on this month's RAINBOW ON TAPE. We think that "Shadow of the Rings" by Becky and Dave Matthews is quite well done and, since it is their own original work, we have reproduced it on our tape service to go along with the graphics they also created. A quite intriguing, off-the-wall, multi-media work, I think you'll agree.

So, music takes many forms with the CoCo. One area that seems to be overlooked, however, is music about the CoCo! I mean, why not? I have an entire record album of C.B. radio songs that are so hokey I consider them classics. And, every time our Music and Sound issue of THE RAINBOW rolls around, I chide myself for not having written at least one tongue-in-cheek, just-for-fun CoCo song.

You see, I do have some songwriting credentials — however shaky or suspect they may be. A decade ago, former RAINBOW senior editor Courtney W. Noe and I put our middle names together and the country music team of Willard and Earl was born. Out of that concerted, two-week venture came "Come on Over for a Pick-Me-Up, My Woman Just Put Me Down" and the ever-popular "They Got Tums for the Tummy, and Contact for Your Cold, But There Ain't No Pain Reliever for the Soul," plus some lesser-known hits.

My creative inspirations always lean toward that lyin', dyin', cheatin', cryin' life-in-the-emergency-lane music. And, the way we carry on about our CoCo, it's time we set our words to music. How about "Ballad of the CoCo Widow," or "I'm Proud to be a CoCo-Loco's Daughter," huh, huh? Let's see, "The Keyboard Bounce Blues"? Maybe not. Or, "Send Me the EPROM You Just Burned In." Whew, baby. Heavy stuff, eh! Here's a bound for glory classic, for sure: "I Dreamed I Was There in Hardware Hacker Heaven."

No, this isn't a contest. But, if you send in a goody, and Lonnie's out of town a few days, it just might get printed. Heck, send us just the title if you want; if it brings a chuckle, or twangs the old heart strings, we'll share it with the CoCo World. No reason it has to be country, but don't count on getting into the Tom T. Hall of Fame with some punk rock stuff!

Yee-Hah! I'm on a roll now, "These Boots Are Made for DOSes," or "I've Forgotten More Than You'll Ever Know About C." Look out Nashville! "You Gotta Walk That Silicon Valley" sounds Top 40 to me. How about "Does RFI Sometimes Waver Through the Bedposts Late at Night?" Or, "I'm Proud to be a CoCo-ee from Muskogee." Or . . .

Ending with my usual refrain: To keep up with the beat and in tune with the times, I invite you to join with those who subscribe to THE RAINBOW (Use our new *orders only* toll free number: 800-847-0309). We celebrate our fifth anniversary next month — We were CoCo when CoCo wasn't Cool!

— Jim Reed

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Nothing Phone-y about It: Ma Bell Trips the Light Fantastic

By Becky F. Matthews

Welcome to CCTV (CoCo TV)! Before loading this program type PCLEAR 8 (to free two Hi-Res graphics screens), then load *OnHold*, run it, and feel free to sing along. This is a simple animation program with telephones dancing to music, but the results are quite entertaining. The speed-up POKE is used in Line 10, so be sure to delete it if your computer won't handle it. There are two kinds of music statements and two kinds of animation used in *OnHold*.

Lines 55-85 use the text screen to print the words to the song chorus and sound the appropriate note for each word.

Lines 90-190 draw one telephone on Hi-Res graphics screen PMODE 4,1. GET it and use PUT to "stamp" seven more phones on the screen. Lines 125-135 paint the phones. Line 145 copies the phones to the second graphics screen, PMODE 4,5. Line 160 draws straight legs on the PMODE 4,5 phones. Lines 170-180 draw legs in various dance positions on the PMODE 4,1 phones.

Lines 195-250 comprise the "slow dance" routine. This routine is performed four times (Variable P in Line 200). Using GET, a phone is chosen randomly from the PMODE 4,1 screen (lines 200-205) and is "stamped" using PUT (Line 225) to each phone position in PMODE 4,5. Each time this routine takes place, 'Y' is decremented by two (Line 210). This moves the rows of telephones higher on the screen. When 'Y' is less than 33, the screen is cleared with Color C (Line 215) and the next phones return to their original screen position (Y = 40). Line 230 sets 'Y' up to PUT the bottom row of phones. Line 235 sets 'Y' back to the top row of phones.

Lines 255-265 make up the "fast dance" routine, which simply flips between PMODE 4,1 and PMODE 4,5. To change the speed of the fast dance, change the value of 'T' in the two timing loops in Line 260. Variable S tells how many times the pages are flipped. Subroutine 270 (lines 270-280) makes a telephone ring sound effect.

Line 50 causes the dance sequence to start again (GOTO 30), so use BREAK to stop the program when you've seen enough dancing telephones. Don't forget to type POKE 65494,0 when you're done to slow the CoCo back to normal speed.

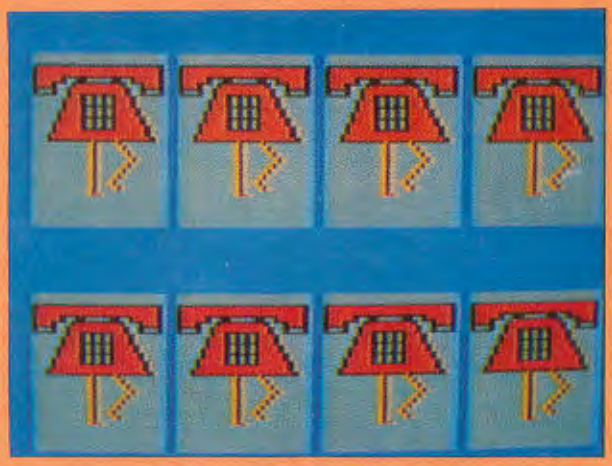
(Direct questions about this program to the author at 2415 Smith Springs Road, Nashville, TN 37217. Please enclose an SASE for a reply.) □

Becky Matthews and her husband, David, live in Nashville, Tennessee, and do free-lance work in electronics, computers and music.

The listing: ONHOLD

```
5 '***"ONHOLD" BY B. MATTHEWS -
SONG "DON'T PUT ME ON HOLD" COPY
RIGHT 1985 B. & D. MATTHEWS
1Ø POKE65495,Ø '*SPEED-UP POKE
15 DIMW(87)
2Ø GOSUB55 '*SONG CHORUS
25 GOSUB9Ø '*DRAW PHONES
3Ø GOSUB255 '*FAST DANCE
35 GOSUB27Ø '*PHONE RING
4Ø GOSUB195 '*SLOW DANCE
45 GOSUB55 '*CHORUS
5Ø GOTO3Ø '*START ROUTINE AGAIN
55 '***SONG CHORUS SUB
6Ø CLS4:PRINT @ 1Ø5,"DON'T";:SOU
```

```
ND 1Ø8,4:PRINT @ 3Ø5,"   ";:PRIN
T @ 175,"PUT";:SOUND 133,2:PRINT
 @ 235,"ME";
65 SOUND 133,2:PRINT @ 3Ø5,"ON";
:SOUND 147,4:PRINT @ 362,"HOLD!"
;:SOUND 32,4
7Ø CLS8:PRINT @ 1ØØ,"DON'T";:SOU
```



```
ND 147,4:PRINT @ 172,"PUT";:SOUN
D 147,2:PRINT @241,"ME";:SOUND 1
47,2:PRINT @ 3Ø8,"ON";:SOUND 133
,4:PRINT @ 375,"HOLD!";:SOUND 14
7,4
75 CLS3:PRINT @ 1Ø4,"AND";:SOUND
 1Ø8,4:PRINT @ 143,"DON'T";:SOUN
D 133,4:PRINT @ 235,"HANG";:SOUN
D 147,4:PRINT @ 3Ø5,"UP!";:SOUND
 32,4:FORT=1TO21Ø:NEXTT
8Ø CLS4:PRINT @ 1Ø6,"DON'T";:SOU
ND 147,4:FORT=1TO29Ø:NEXTT:PRINT
 @ 2Ø5,"HANG";:SOUND 133,4:PRINT
 @ 3Ø5,"UP!";:SOUND 1Ø8,4
85 RETURN
9Ø '***DRAW PHONES SUB
95 PMODE4,1:PCLS1:SCREEN1,1:PMOD
E3
1ØØ DRAW"BM2Ø,7ØC1S8NR2ØM+5,-1ØR
1U1R1D1R6U1R1D1R1NM+6,+1ØBU1R2D1
R2D2R4U1NL4U4L26D4NR4D1R4U2R2U1R
4NR6BD3NR6D2NR6D2NR6D2R2NU6R2NU6
R2NU6"
1Ø5 '*"STAMP" PHONES USING GET/P
UT
11Ø GET(15,4Ø)-(7Ø,7Ø),W,G
115 FORY=4ØTO125STEP85:FORX=15TO
195STEP6Ø:PUT(X,Y)-(X+55,Y+3Ø),W
,PSET:NEXTX:NEXTY
12Ø '*PAINT PHONES
125 FORY=47TO132STEP85
13Ø PAINT(3Ø,Y+18),2,1:PAINT(3Ø,
Y),2,1:PAINT(9Ø,Y+18),3,1:PAINT(
1ØØ,Y),3,1:PAINT(15Ø,Y+18),2,1:P
AINT(15Ø,Y),2,1:PAINT(21Ø,Y+18),
3,1:PAINT(21Ø,Y),3,1
135 NEXTY
14Ø '*COPY PHONES TO PMODE4,5
145 FORP=1TO4:PCOPYP TO P+4:NEXT
P
15Ø PMODE4,5:SCREEN1,1:PMODE3,5
155 '*DRAW STRAIGHT LEGS
16Ø DRAW"C2BM36,7ØD1ØL1BR8L1U1ØB
R23C3D1ØL1BR8L1U1ØBR25C2D1ØL1BR8
L1U1ØBR23C3D1ØL1BR8L1U1ØBD43D1ØR
1BL7NL1U1ØC2BL23D1ØNR1BL7R1U1ØBL
25C3D1ØNR1BL7R1U1ØBL23C2D1ØNR1BL
7R1U1Ø"
165 '*DRAW "CRAZY" LEGS
17Ø PMODE4,1:SCREEN1,1:PMODE3,1
175 DRAW"C2BM36,7ØG8H1BD3BR14R1N
U1ØC3BR24L1U1ØBR6F8E1C2BR8F1E8BR
4F8E1C3BR16BD3L1U1ØBR5F6L6D1"
18Ø DRAW"C2BM37,156G4F4G1BR4R1NU
1ØC3BR28L1U1ØBR4F4G4F1C2BR25E1H4
E4BR2F4G4F1BR24BU8C3G6R6D1BR5BD3
R1U1Ø"
185 C=2:Y=4Ø
19Ø RETURN
195 '***SLOW DANCE SUB
2ØØ FOR P=1TO4:PMODE4,1:R=RND(2)
-1:H=4Ø+(R*85):S=RND(3):X=13+(6Ø
*S)
2Ø5 GET(X,H)-(X+56,H+6Ø),W,G
21Ø Y=Y-2
215 IFY<33THENY=4Ø:PMODE4,5:SCRE
EN1,1:PMODE3,5:PCLSC:C=C+1:IFC>8
THENC=2
22Ø PMODE4,5:SCREEN1,1
225 FORX=13TO22ØSTEP6Ø:SOUND 226
,1:PUT(X,Y)-(X+56,Y+6Ø),W,PSET:N
EXTX
23Ø IFY<=4ØTHENY=Y+85:GOTO22Ø
235 Y=Y-85
24Ø NEXTP
245 FORT=1TO1ØØØ:NEXTT
25Ø RETURN
255 '***FAST DANCE SUB
26Ø FOR S=1TO18:PMODE4,1:SCREEN1
,1:SOUND 235,1:FORT=1TO15Ø:NEXTT
:PMODE4,5:SCREEN1,1:SOUND 237,1:
FORT=1TO15Ø:NEXTT:NEXT S
265 RETURN
27Ø '***PHONE RING SUB
275 FORR=1TO2:FORX=1TO4:PLAY"T25
5V31A1P1B1P1A1P1B1P1A1P1B1":FORT
=1TO7Ø:NEXTT:NEXTX:FORT=1TO25Ø:N
EXTT:NEXTR
28Ø RETURN
```

This program sets the songwriter's stage by providing blank sheet music — you just fill in the notes . . .

The Music Maker's Accompanist

By Barry McNeice

Music Paper uses the dot-addressable mode to print blank sheet music with the DMP-105 printer.

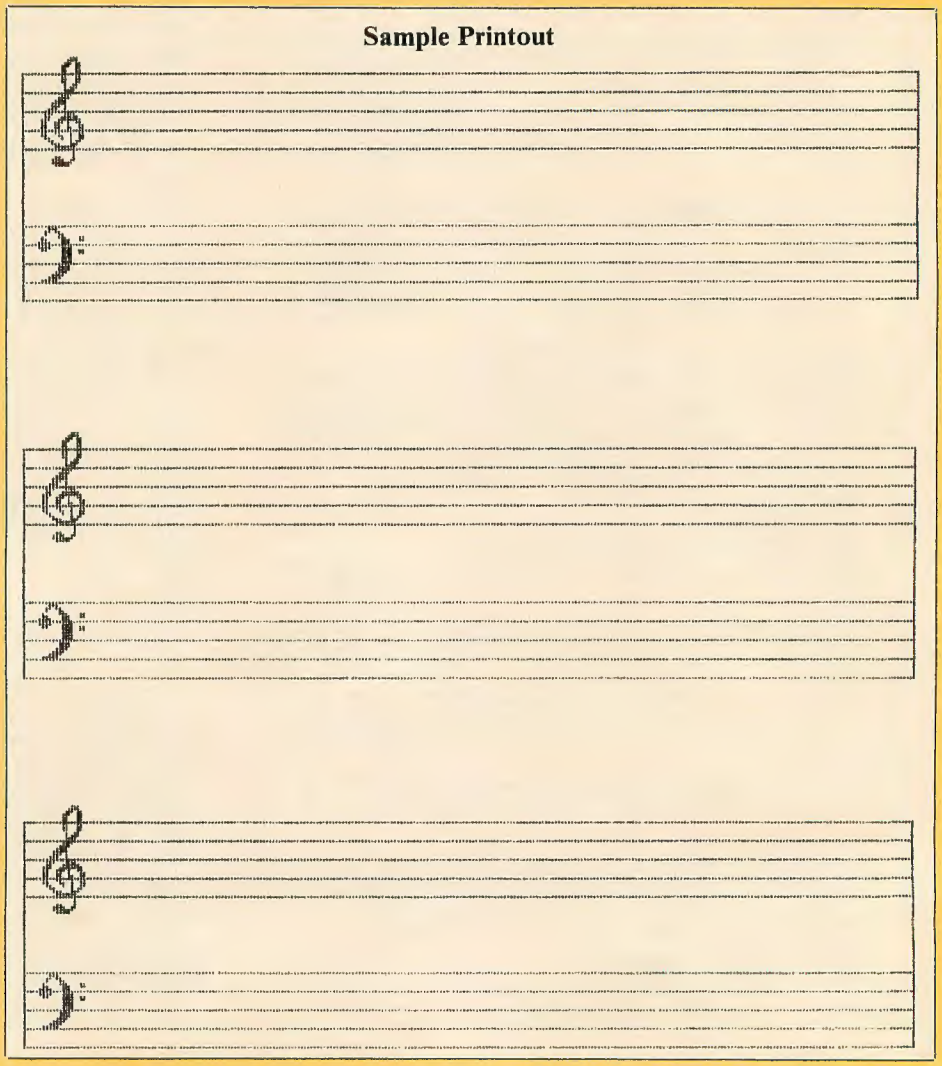
Data statements for poking the title screen are tucked away at the end of the program. Line 30 reads past the main body of data, so the title screen POKEs are read only once.

Line 70 checks to make sure the printer is ready. I got this helpful hint from Justin Snyder in the December 1984 RAINBOW letters section. The routine for "freehand drawing" in lines 150 through 230 was taken directly from the DMP-105 owner's manual.

Each page holds five lines of music with bass and treble clefs. There should be plenty of room between lines for lyrics to your song. I hope this program helps make song writing just a little easier.

(You may direct questions about this program to the author at P.O. Box 1248, Yakima, WA 98907, phone 509-457-8865 from 8 a.m. to 5 p.m. PST. Please enclose an SASE when writing.) □

Sample Printout



Barry McNeice lives in Yakima, Washington, and is employed as a rubber stamp maker. A novice programmer, his hobbies include music and the CoCo. He is involved with the Yakima CoCo Special Interest Group.

Introducing CoCo Max™ II

There is absolutely nothing else on the Color Computer that is comparable to CoCo Max's power and ease of use. The most enjoyable time with a computer I ever had.
- Computerware Review May 1985

I never expected to see anything like it on my CoCo screen. There isn't a single command to remember. Even a person who has no drawing ability like myself can create a presentable picture. I've spent hours just doodling enjoying all the things from silly to the serious. Fascinating experience. Buy it, you won't be sorry.
- 6809 Express May 1985

CoCo Max puts fun back into computing, offering a state of the art environment you find on much more expensive machines. Colorware has invested the kind of time and research that virtually secures its success, and that shows up on your screen.
- Hot CoCo July 1985

CoCo Max is the most incredible product ever marketed for the CC. No review can do it justice. I've never given any product a 10...I give Colorware's CoCo Max (Hardware, Software and Documentation) a 10!
- Color Chronicle Vol III #6

An outstanding program that almost turns your CoCo into a replica of the Macintosh. Terrific hi-res color, very easy to learn and use.
- Family Computing February 1986

The pack is well constructed, the user's manual is complete with illustrations and well organized. An outstanding buy for the performance. Colorware's advertisement accurately describes the product. Their delivery was timely as promised.
-Rainbow June 1985

These were reviews of CoCo Max I. CoCo Max II will blow your socks off with even more power!

- New bidirectional shrink and stretch
- New rotate function
- 9 new fonts (for over 200 typestyles)
- A new "Glyphic font" of small pictures
- A 68 page scrapbook
- Point and click to load files (no typing)
- Full error reporting, crash proof
- Custom patterns can be saved
- Printing in color (with CGP 115 or 220)
- Much more. (Note: CoCo Max II is available on disk only)

The reviews are nice, but see it for yourself* and draw your own conclusion.

*If you are not delighted with your CoCo Max II, we will immediately refund your purchase, including postage back.

COLORWARE Call Toll Free 800-221-0916.

For more information on CoCo Max, turn the page.

CoCo Max™ II

You'll use it all the time and love using it.

What is CoCo Max ?

Simply the most incredible graphic and text creation "system" you have ever seen. A Hi-Res Input Pack (more on the pack later) is combined with high speed machine language software. The result will dazzle you.

CoCo Max disk system, with Y-cable.

Is CoCo Max for you ?

Anyone who has ever held a pencil or a crayon for fun, school or business will love it. A 4 year-old will have fun doodling, a 15 year-old will do class projects and adults will play with it for hours before starting useful applications (illustrations, cards, artwork, business graphics, flyers, charts, memos, etc.) This is one of the rare packages that will be enjoyed by the whole family.

What made CoCo Max an instant success ?

First there's nothing to learn, no syntax to worry about. Even a child who can't read will enjoy CoCo Max. Its power can be unleashed by simply ***pointing*** and ***clicking*** with your mouse or joystick. With ***icons*** and ***pull down menus,*** you control CoCo Max intuitively; it works the same way you think.

Don't be misled by this apparent simplicity. CoCo Max has more power than you thought possible. Its blinding speed will astound you.

It lets you work on an area 3.5 times the size of the window on the screen. It's so friendly that you will easily recover from mistakes: The ***undo*** feature lets you revert to your image prior to the mistake. As usual, it only takes a single click.

Later, we will tell you about the "typesetting" capabilities of CoCo Max II, but first let's glance at a few of its graphic creation tools:

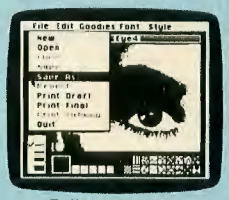
With the ***pencil*** you can draw free hand lines, then use the ***eraser*** to make corrections or changes. For straight lines, the convenient ***rubber-banding*** lets you preview your lines before they are fixed on your picture. It's fun and accurate. Lines can be of any width and made of any color or texture.

The ***paint brush,*** with its 32 selectable brush shapes, will adapt to any job, and make complicated graphics or calligraphy simple.

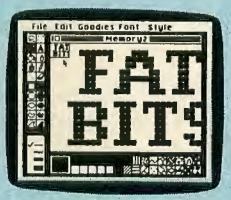
For special effects, the ***spray can*** is really fun: 86 standard colors and textures, all available at a click. It's like the real thing except the paint doesn't drip.

CoCo Max will instantly create many shapes: circles, squares, rectangles (with or without rounded corners), ellipses, etc. Shapes can be filled with any pattern. You can also add hundreds of custom patterns to the 86 which are included.

The ***Glyphics*** are 58 small drawings (symbols, faces, etc.) that can be used as rubber stamps. They're really great for enhancing your work without effort.



Pull down menus



Zoom in !

Control Over Your Work

CoCo Max's advanced "tools" let you take any part of the screen, (text or picture) and perform many feats:

• You can move it around • Copy it • Shrink or enlarge it in both directions • Save it on the electronic ***Clipbook*** • Flip it vertically or horizontally • Rotate it • Invert it • Clear it, etc. etc.

All this is done instantly, and you can always ***undo*** it if you don't like the results.

For detail work, the ***fat bits*** (zoom) feature is great, giving you easy control over each pixel.

To top it all, CoCo Max II works in color. Imagine the pictures in this ad in color. If you own a Radio Shack CGP-220 or CGP-115, you can even print your work in full color !

There is so much more to say, such as the capability to use CoCo Max images with your BASIC programs, the possibility to use CoCo Max's magic on any standard binary image file. There are also many advanced features such as the incredible ***lasso***.

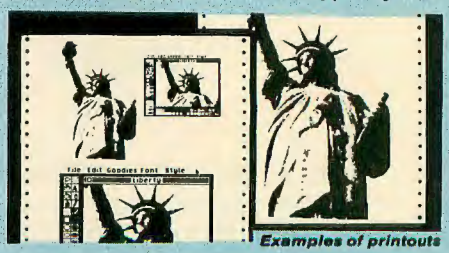
Inside the Hi-Res Input Pack

Why a Hi-Res Input Pack ?

Did you know that the CoCo joystick input port can only access 4096 positions (64x64)? That's less than 10% of the Hi-Res screen, which has 49152 points! (256x192). You lose 90% of the potential. The Hi-Res Input Pack distinguishes each of the 49152 distinct joystick or mouse positions. That's the key to CoCo Max's power. The pack plugs into the rom slot (like a rom cartridge). Inside the pack is a high speed multichannel analog to digital converter. Your existing joystick or mouse simply plugs into the back of the Hi-Res Pack.

Electronic Typesetting...

You'll be impressed with CoCo Max's capability. Text can be added and moved around anywhere on the picture. (You can also rotate, invert and flip it...) At a click, you can choose from 14 built in ***fonts*** each with 16 variations. That's over 200 typestyles !



Examples of printouts

Printing Your Creations

There are a dozen ways to print your work. All are available with a click of your joystick (or mouse) without exiting CoCo Max. Your CoCo Max disk includes drivers for over 30 printers !

All the CoCo Max pictures are **unretouched** screen shots or printouts (Epson RX-80).

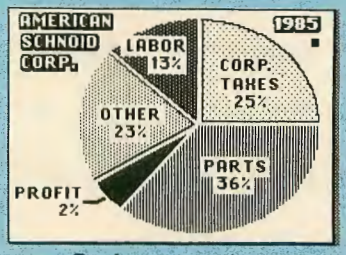
CoCo Max II™

The whole family will enjoy CoCo Max. Here are a few examples of the possibilities.

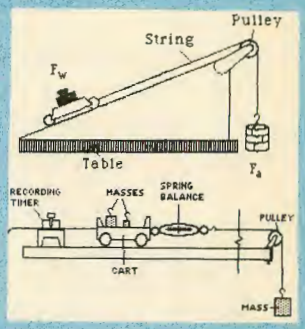
All these pictures are **unretouched** screen photos or printouts (on an Epson RX-80).

1 *Publish a newsletter or bulletin*

2 *Fun for children while stimulating creativity.*

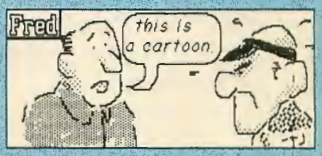


3 *Business graphs, charts, diagrams. Also memos*



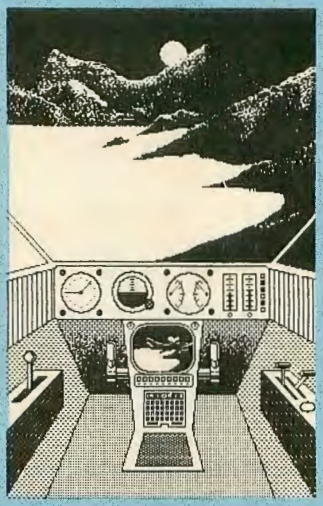
4 *Junior's homework and science projects. Term papers too!*

7 *Video portrait (with optional digitizer).*

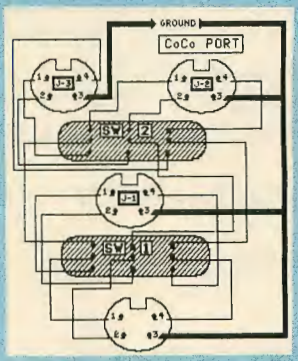


8 *This is a cartoon.*

5 *Over 200 typestyles to choose from! generate flyers.*



6 *A new way to express your imagination.*



9 *schematics and floor plans.*

10 *Logos and letterheads.*

System Requirements:

Any 64K CoCo and a standard joystick or mouse. (The koala pad and the track ball work, but are not recommended.)
Disk systems need a Multi-Pak or our Y-Cable.
CoCo Max is compatible with any Radio Shack DOS and ADOS.
Note: the tape version of CoCo Max includes almost all the features of CoCo Max II except *Shrink, Stretch, Rotate,* and *Glyphics.* Also, it has 5 fonts instead of 14.
CoCo Max is not compatible with JDOS, DoubleDOS, MDOS, OS-9, the X-pad, and Daisy Wheel Printers.

Printers Supported:

Epson MX, RX, FX and LX series, Gemini, Star, Micronix, Delta 10, 10X, 15, 15X, SG-10,Okidata 82A, 92, 93, C. Itoh Pro-writer, Apple Image-writer, Hewlett-Packard Thinkjet, Radio Shack DMP 100, 105, 110, 120, 200, 400, 500, Line Printer 7, Line Printer 8, TRP-100, CGP-220. (DMP-130 use Line Printer 8), PMC printers, Gorilla Banana.
Color printing: CGP-200, CGP-115

Pricing

CoCo Max on tape $69.95
with Hi-Res Pack and manual.
CoCo Max II (disk only) $79.95
with Hi-Res Pack and manual.
Upgrade: CoCo Max to CoCo Max II
New disk and manual. $19.95
New features of CoCo Max II: 14 fonts and glyphic font, dynamic shrink and stretch, rotate, multiple drive capability, 68 page scrapbook, point and click file load, color printer drivers, full error reporting.
Upgrade: CoCo Max tape to disk
manuals, disk and binder $24.95
Y-Cable: *Special Price* $19.95
Super Picture Disks #1, #2, and #3
each: $14.95
All three picture disks $29.95

Guaranteed Satisfaction
Use CoCo Max for a full month. If you are not delighted with it, we will refund every penny.

Font Editor Option

A font is a set of characters of a particular style. CoCo Max includes 15 fonts. You can create new fonts of letters, or even symbols or graphics with the font editor. Examples: set of symbols for electronics, foreign alphabets, etc. $19.95

Video Digitizer DS-69

This new Low Cost Digitizer is the next step in sophistication for your CoCo Max system. With the DS-69 you will be able to digitize and bring into CoCo Max a frame from any video source: VCR, tuner, or video camera. Comes complete with detailed manual and C-SEE software on disk. Multi-Pak is required.
New Low Price Save $50 ..... $99.95
New: faster DS-69A. $149.95

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Woodhaven, NY 11421

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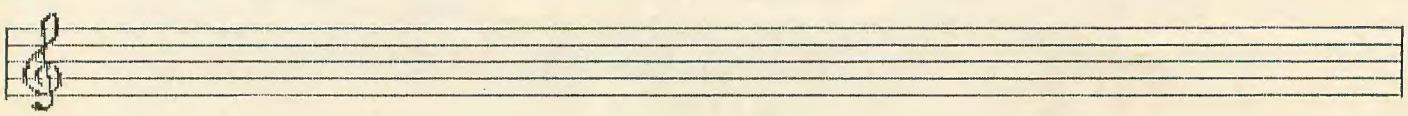
Hours: 9-5 Eastern time.

Add $3.00 per order for shipping.
We accept Visa, MC, checks, M.O.
C.O.D. add $3.00 extra.
NY and CT : add sales tax.
Shipping to Canada is $5.00
Overseas, FPO, APO add 10%

The listing: MUSPAPER

```
1 '*****************************
2 '*     MUSIC SHEET PAPER     *
3 '*      FOR THE DMP 1Ø5      *
4 '*     BY BARRY MCNEICE      *
5 '*        YAKIMA, WA         *
6 '*****************************
1Ø CLS:DIMA(51)
2Ø PRINT@87,"MUSIC":PRINT@119,"S
HEET":PRINT@151,"PAPER":PRINT@4Ø
7,"BY":PRINT@47Ø,"BARRY":PRINT@5
Ø1,"MCNEICE"
3Ø FORX=ØTO214:READA:NEXTX
4Ø FORX=ØTO5Ø:READB:A(X)=B:NEXTX
5Ø C=143:FORT=ØTO6:C=C+16
6Ø FORX=ØTO5Ø:POKE1Ø23+A(X),C:NE
XTX,T:RESTORE:CLS
7Ø IFPEEK(65314)/2<>INT(PEEK(653
14)/2) THENPRINT"PRINTER NOT REA
DY!":INPUT"WHEN READY,PRESS(ENTE
R)";PR$
8Ø IFPEEK(65314)/2<>INT(PEEK(653
14)/2) THEN 7Ø
9Ø CLS:PRINT"POSITION PAPER NEAR
 TOP OF PAGE":PRINT"PRESS p TO P
RINT":PRINT"PRESS q TO QUIT"
1ØØ IN$=INKEY$:IFIN$="" THEN1ØØ
11Ø IF IN$="Q" THEN PRINT#-2,CHR
$(3Ø):END
12Ø IF IN$="P" THENCLS:INPUT "NU
MBER OF PAGES";P
13Ø PRINT#-2,CHR$(18)
14Ø RE=Ø:PG=Ø
15Ø FORR=1TO2Ø
16Ø READ N:IF N=999 THEN 21Ø
17Ø IF N>=Ø THEN PRINT#-2, CHR$(
128+N);:GOTO 16Ø
18Ø READM
19Ø PRINT#-2,CHR$(28);CHR$(-N);C
HR$(128+M);
2ØØ GOTO16Ø
21Ø PRINT#-2:NEXTR
22Ø RESTORE:RE=RE+1:IF RE=5 THEN
GOSUB24Ø
23Ø GOTO 15Ø
24Ø REP=Ø:PG=PG+1
25Ø FOR SP=1TO13:PRINT#-2:NEXTSP
26Ø IF PG=P THEN PRINT#-2,CHR$(3
Ø):GOTO7Ø
27Ø RETURN
28Ø '***TREBLE CLEF***
29Ø DATA 999,-12,64,12Ø,124
3ØØ DATA 78,71,67,127,124
31Ø DATA -255,64,-2Ø6,64,999,127
32Ø DATA -11,64,71,127,96,112,12
Ø,95,71,-255,64,-2Ø5,64,127,999
33Ø DATA 127,-7,64,96,12Ø,124,94
34Ø DATA 79,127,67,65,64,64,-254
,64,-2Ø7,64
35Ø DATA 127,999,127,-5,64,124,1
27,71,65
36Ø DATA 12Ø,124,78,71,127
37Ø DATA 1Ø3,71,78,124,112
38Ø DATA -255,64,-2Ø4,64,127,999
39Ø DATA 127,-5,64,67,71,76,88
4ØØ DATA 113,115,1Ø2,96,96,127,1
12,88,79,71,-255,64,-2Ø4,64
41Ø DATA 127,999,127,-8,Ø,24,6Ø,
6Ø,56
42Ø DATA 48,48,24,15,-255,Ø,-2Ø7
,Ø,127
43Ø DATA 999,127,-255,Ø,-223,Ø,1
27
44Ø DATA 999,127,-255,Ø,-223,Ø,1
27
45Ø DATA 999,127,-255,Ø,-223,Ø,1
27,999
46Ø '***BASS CLEF***
47Ø DATA 127,-4,1,65,113,1Ø9,71,
3,7,29,121,113,97,-3,1,49,49
48Ø DATA -255,1,-2Ø4,1,127,999,1
27,-4,1,3,7,7,3,-3,1,-4,127,-2,1
49Ø DATA 13,13,-255,1,-2Ø4,1,127
5ØØ DATA 999,127,-5,1,65,65,97,1
13,121,63,31,15,7
51Ø DATA -255,1,-2Ø9,1,127,999
52Ø DATA 127,-255,1,-223,1,127
53Ø DATA 999,-255,1,-225,1
54Ø DATA 999,999,999,999
55Ø DATA 999,999,999,999
56Ø '****TITLE SCREEN POKES****
57Ø DATA 16,17,47,5Ø
58Ø DATA 79,82,111,113,142,143,1
44
59Ø DATA 172,173,175
6ØØ DATA 2Ø3,2Ø7,234,238,239,24Ø
,241,242
61Ø DATA 266,269,27Ø,272,275,276
62Ø DATA 298,3Ø1,3Ø4,3Ø8
63Ø DATA 33Ø,331,334,336,34Ø
64Ø DATA 364,368,371
65Ø DATA 397,398,399,4ØØ,4Ø1,4Ø2
66Ø DATA 433,463,465
67Ø DATA 495,496,497
```



Why do more CoCo owners choose 'REAL TALKER'?

Sure it's priced right, but there's more...

Thousands of 'Real Talker' owners know 'Real Talker' beats ALL other Coco voice synthesizers in ease of use and flexibility. And, NO other Coco talker has a clearer, more intelligible voice. That's quite a lot of advantage when you consider Real Talker's unbeatable price. Yet, Real Talker has some important features that you simply will not find in other Coco talkers:

'Real Talker' is compatible with any 16K, 32K, 64K Extended or non-extended Color Computer. It works with any cassette or disk system and comes complete and ready to talk through your T.V. or monitor speaker. Price includes the 'Real Talker' electronic voice synthesizer in a ROM pack, software on cassette (may be transferred to disk), and user manual.

'SAY' command - You'll have your computer talking brilliantly in just minutes thanks to this powerful new command. Type SAY "ANYTHING YOU WANT" and your words are instantly spoken. It's that simple. Think how easy this makes creating speaking Basic programs. Adding speech to your existing programs is a snap too.

'CONVERT' - This is a truly powerful command for the basic programer. CONVERT automatically transforms a machine language dependent speaking program into a stand-alone Basic program. In other words, you can effortlessly write speaking Basic programs that do not require a machine language translator in memory. This is a unique feature of 'Real Talker'. No other voice synthesizer gives you anything even remotely approaching this type of capability - even synthesizers costing considerably more.

'Real Talker' is a full-featured electronic voice synthesizer unit built into a compact cartridge case. You simply plug it into the side of your computer.

NOW INCLUDED WITH 'REAL TALKER'.....

1. 'DR. TALK'-This interactive "Eliza" type psychoanalyst program will discuss your innermost problems at length.

2. 'TALKING BATTLESHIP'-It's you vs. the computer in this speaking version of the classic game.

3. 'TALKING BLACKJACK'- Play for big stakes against a rather talkative casino dealer.

ONLY

$59.95

Other features include software controlled pitch, unlimited vocabulary text-to-speech, and even a program that will recite any ASCII file (such as from Telewriter-64 & other word processors). You also get Colorware's unique full-screen phoneme editor program that let's you experiment with and modify speech at it's most fundimental level.

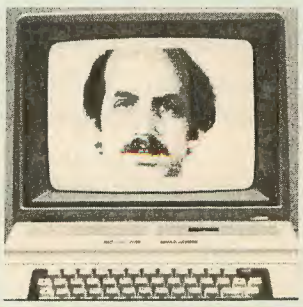
'REAL TALKER-1' (for the original Color Computer).....***$59.95***

'REAL TALKER-2' (for the Color Computer-2).....***$64.95***

'Y - BRANCHING CABLE' For disk systems. If you have a disk system but do not have a Radio Shack Multi-Slot unit, this economical cable will allow to connect and use your Real Talker and Disk system together.....***27.95***

TALKHEAD

If you have a 'Real Talker', do not deprive yourself of this absolutely incredible machine-language Talking Head simulation program. While other talking head simulations use a minimal cartoon-like face, TALKHEAD uses high resolution, full-screen, digitized images of an actual person's face to create a life-like animated effect.



SOFTWARE FOR THE 'REAL TALKER'

TALKHEAD can be easily commanded in Basic to appear on screen and say anything you want. Available on cassette or disk for only $19.95, TALKHEAD requires 64K and a Colorware 'Real Talker'.

ONLY $19.95

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Who Will Survive

By Scott Halfman

You are traveling in a land far away, seeking fortune. You gain loot by passing from castle to castle, each time picking up all the objects on the different levels (floors) of the castle. After cleaning out each castle, you move on to a new one, and the difficulty of the game increases accordingly.

Castle requires 32K Extended Color BASIC, however, it will run in 16K ECB with the disk controller unplugged. Now load in *Castle* and type RUN. The title screen appears. To continue, press the firebutton on the right joystick. The castle door opens and you enter the castle. A skill level prompt appears. Type a number between one and four (1-easy, 4-hard). There is a short pause, and then the computer reveals what objects are to be picked up on that level. Press the firebutton to play.

The game board appears. All the objects are laid on the castle floor, the bonus score and the number of men you have are displayed at the top of the screen. Your man is then lowered onto the game board.

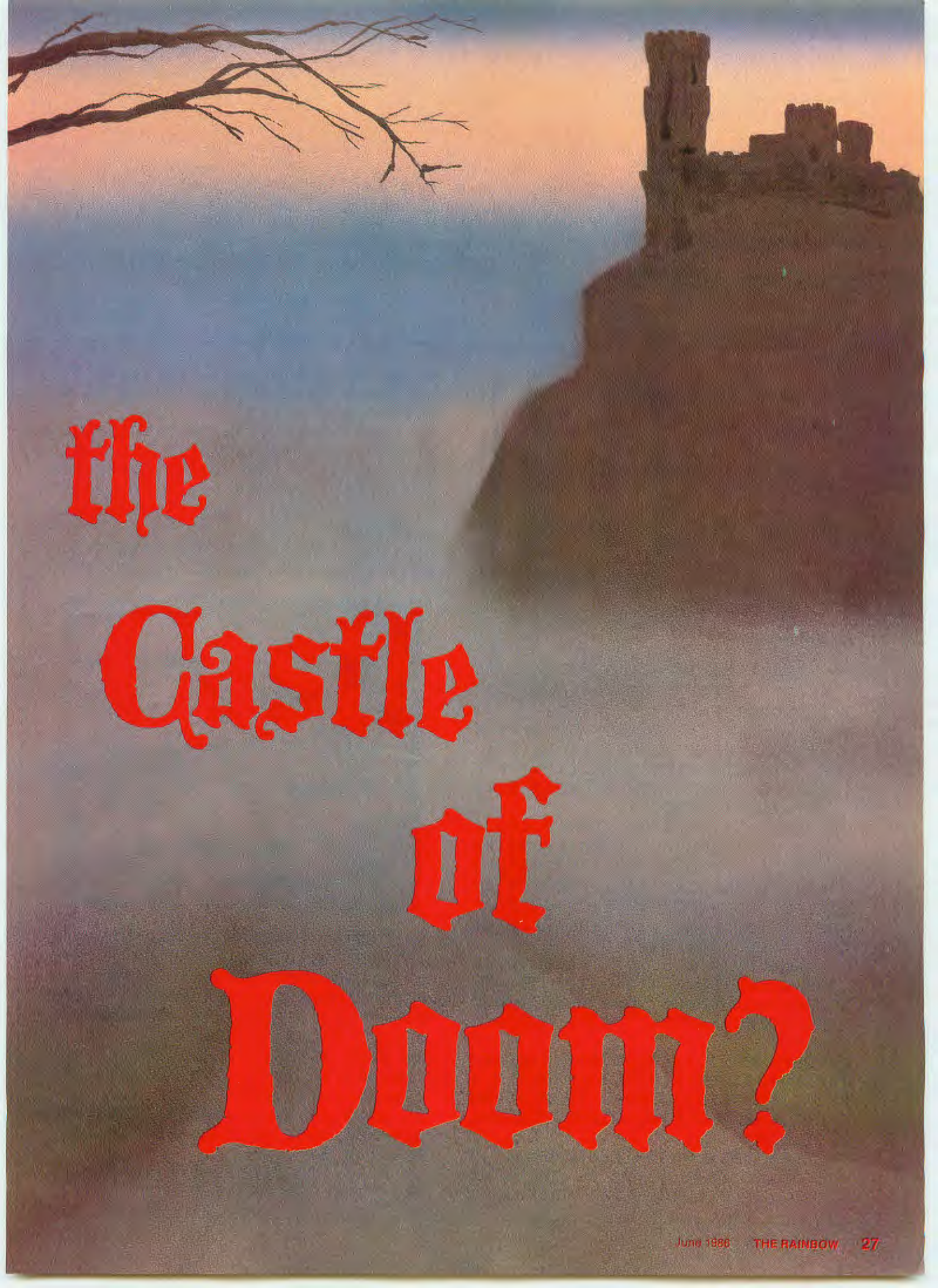
To clear the board, you must pick up all the keys (or other objects) before the bonus countdown runs out, without falling off the path.

When the board is cleared, move to the (white) elevator platform. You are then lifted off that castle level to the next.

After clearing level six, your man makes his way to the castle exit

---

Scott Halfman is a student at Hendrick Hudson High School in Peekskill, New York, where he has completed a BASIC programming course. His hobbies include skiing, football and the CoCo.


the
Castle
of
Doom?

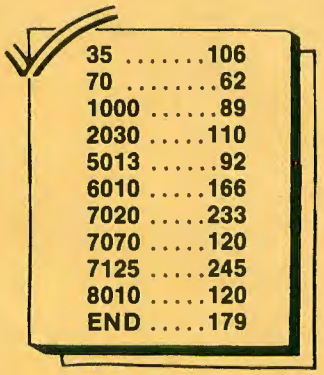
where you are prompted to either quit or go on. The number of castles finished, your score and the high score are displayed. Press 'Q' to quit or 'C' to continue.

If you dare to continue, your man leaves the castle and a new castle approaches.

(You may direct questions about this program to the author at 15 Lake Road, Peekskill, NY 10566, phone 914-739-4758. Please enclose an SASE when writing.) □

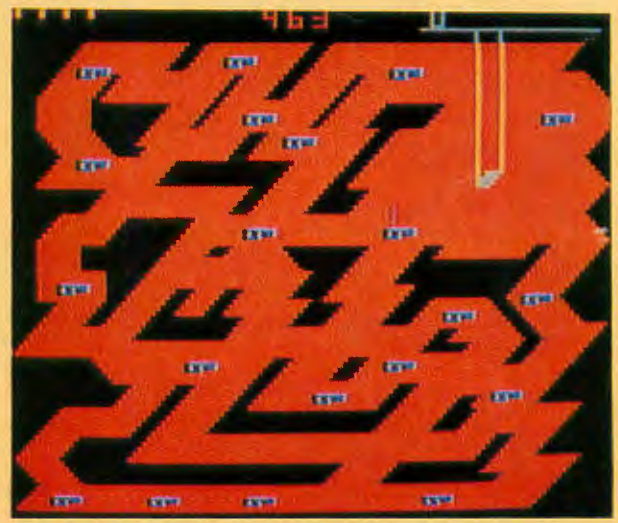
Main Variables

G	array value for man	SK	current skill level
A$(x)	horizontal location of objects	L	speed of movement of man
B$(x)	vertical location of objects	I	speed of bonus countdown
CR	number of objects left on board	BO	board level of castle (boards completed)
T1, T2, T3	bonus time digits	SC$	score
GU	number of men left	HS$	high score
A	horizontal location of man	L1	castle level (castles completed)
B	vertical location of man	L$	string value of L1



The listing: CASTLE

```
10 CLEAR1300:POKE65495,0:DIMG(3,1
),A$(21),B$(21):GOSUB8000:GOSUB7
1400:PMODE3,1
15 BO=0:T1=9:T2=9:T3=9:GU=4:A=200
0:RESTORE:PLAY"ABCDEFG":CLS:PRIN
T@6,;:INPUT"SKILL LEVEL(1-4)";SK
:I=SK*.2:IFSK<1ORSK>4THEN15 ELSE
 L=17-SK*3.5:GOTO45
20 PMODE3,1:PCLS:DRAW"BM14,185C3
R2005E200L200E200L200E300L101H10E
101H101E101U101H101L101E101L1000G200L10E2
00L400G101L10E101L400G200D10F10G10R300G
101L10G100D200R10G200R300F10R10G10L200
G200F10G10R10BM55,120R400E10L10E10
L10G10L10E10L10G200"
25 DRAW"BM34,175R1000E10L900E300L10
G200L200G10F10BM154,175E10R300E10R1
00G15R10G5L500BM84,155R700E200L10G10
L500E200L10G300BM134,135R10E10L10G1
00"
30 DRAW"BM34,115R10E400L300G10L10D
10R10D10G10BM64,65R400G10R10E200L2
00E10L10G10L200G10BM84,45E200L5G200R
5BM69,35L10L15E10L5G10D10F10R10E
5L5E15L5"
35 DRAW"BM89,85G5R10E5L10BM147,2
5R5G200L5E200BM114,85R400G200R10G10L
15E10L10E10L5H10BM124,75R200E10L1
00E200R10E10L25G10R5G300BM154,115E1
5L10E15R10G5R35E5R10G200F15G10L10
E10H15L200G10L15"
40 DRAW"BM180,115R10G5R10G5L200E1
00BM189,140R10G5R5G10L15E15":PAIN
T(38,22),3,3:DRAW"BM199,60C4R5U6
00D600G5L5U65D65E5":PAINT(201,61),
4,4:LINE(190,3)-(210,9),PRESET,B
F:RETURN
45 CR$(1)="C2R3D3L4U3R9D2L2U2":C
R$(2)="C2U4R4D6L4U4R3D4L1U6R2D2C
```



```
3U1":CR$(3)="C3R3U2C2R2U1D1R1D2R
1L1D1L2D1U1L1U2L1R1U1":CR$(4)="C
3R2U2C2D2F2E2U2L2D6R2L4":CR$(5)=
"C3R2U2C2R6L2D4R2L6R2U4R2D4":CR$
(6)="C3R2U4C2F4G4H4E4D2R2L4R2D1L
2R4L2D1R4L8R4D2L2R4L2"
50 DATA 36,96,162,224,36,104,120
,104,80,28,24,64,176,104,160,204
,216,184,132,160
55 DATA 24,20,24,40,56,40,48,80,
128,100,180,180,180,180,128,140,
104,110,140,80
60 FORX=1TO20:READA$(X):NEXTX:FO
RX=1TO20:READB$(X):NEXTX
```

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```
7Ø PR$(1)="PICK UP ALL KEYS":PR$
(2)="LOCK ALL DOORS":PR$(3)="PIC
K UP ALL RINGS":PR$(4)="PICK UP
ALL CUPS":PR$(5)="PICK UP ALL SC
ROLLS":PR$(6)="PICK UP ALL DIAMO
NDS"
8Ø N$(1)="C1R2C3G2E2D6R2L4":N$(2
)="R4D3L4D3R4":N$(3)="R4D3L3R3D3
L4":N$(4)="D3R4U3D6":N$(5)="R4L4
D3R4D3L4":N$(6)="D6R4U3L4":N$(7)
="R4D2G4":N$(8)="R4D3L4U3D6R4U3"
:N$(9)="D3R4U3L4R4D6":N$(Ø)="R4D
6L4U6":GOSUB5Ø1Ø
1ØØ PLAY";":A=A+(JOYSTK(Ø)-32)/L
:B=B+(JOYSTK(1)-32)/L:PUT(A-1,B-
3)-(A+1,B+3),G,NOT
1Ø5 T3=T3-I:ON T3+2 GOSUB2ØØ:LIN
E(13Ø,3)-(134,9),PRESET,BF:DRAW"
BM13Ø,3"+N$(T3)
11Ø PUT(A-1,B-3)-(A+1,B+3),G,NOT
:ONPPOINT(A,B+3)GOTO1ØØØ,2ØØØ,1Ø
Ø,3ØØØ
2ØØ T3=9:T2=T2-1:ONT2+2GOTO21Ø:L
INE(12Ø,3)-(124,9),PRESET,BF:DRA
W"BM12Ø,3"+N$(T2):RETURN
21Ø T2=9:T1=T1-1:LINE(11Ø,3)-(12
4,9),PRESET,BF:ONT1+2GOTO22Ø:DRA
W"C3BM11Ø,3"+N$(T1)+"BM12Ø,3"+N$
(T2):RETURN
22Ø T1=5:T2=9:T3=9:FORX=1TO3:PLA
Y"L1ØØ;1;2;3;4;5;6;7;8;9;1Ø;11;1
2":NEXTX:PUT(A-1,B-3)-(A+1,B+3),
G,NOT:GOTO1ØØØ
1ØØØ IN=3:FORX=B TO191STEP2:X=X+
IN:PUT(A-1,X-3)-(A+1,X+3),G,NOT:
IN=IN+.1
1Ø1Ø PLAY"AV"+STR$(INT(31-(X/8))
):PUT(A-1,X-3)-(A+1,X+3),G,NOT:N
EXT:ONGU GOTO 6ØØØ:GU=GU-1:PUT(G
U*1Ø-1,3)-(GU*1Ø+1,6),G,NOT
1Ø2Ø B=1Ø:PLAY"V31":IN=Ø:FORA=2T
O199STEP2:IFA>139THENB=B+1
1Ø25 PUT(A-1,B-3)-(A+1,B+3),G,NO
T:PLAYSTR$(INT(B/4)):PUT(A-1,B-3
)-(A+1,B+3),G,NOT:NEXTA
1Ø3Ø PUT(A-1,B-3)-(A+1,B+3),G,NO
T:PLAY"O3V15L255":FORX=1TO1Ø:PLA
YSTR$(RND(12)):PAINT(A,B),1,3:PA
INT(A,B),4,3:PAINT(A,B),2,3:NEXT
X:PAINT(A,B),3,3
1Ø4Ø DRAW"BM11Ø,3;"+N$(T1)+"BM12
Ø,3"+N$(T2)+"BM13Ø,3"+N$(T3):GOT
O1ØØ
2ØØØ CR=CR-1:PAINT(A,B+3),3,3:GO
TO2Ø1Ø
2ØØ5 Y=LEN(SC$):FORX=2 TO Y:LINE
(156+1Ø*X,3)-(166+1Ø*X,9),PRESET
,BF:DRAW"BM"+STR$(156+1Ø*X)+",3"
+N$(VAL(MID$(SC$,X,1))):NEXTX:RE
TURN
2Ø1Ø PLAY"L255ABC":SC$=STR$(VAL(
SC$)+1Ø):GOSUB2ØØ5:ONCR GOTO2Ø3Ø
2Ø2Ø GOTO 1ØØ
2Ø3Ø PUT(A-1,B-3)-(A+1,B+3),G,NO
T:FORV=1TO3ØSTEP6:PLAY"V"+STR$(V
):FORN=1TO12:PLAYSTR$(N):NEXTN,V
:PUT(A-1,B-3)-(A+1,B+3),G,NOT:GO
TO1ØØ
3ØØØ IFPPOINT(A-1,B+3)=3ORPPOINT
(A+1,B+3)=3THENGOTO1ØØELSEB=63:P
LAY"CDEFGAB":X=B'ELEVATOR ROUTIN
E
3Ø1Ø A=2ØØ:FORE1=1TO5:PLAY"O"+ST
R$(E1):FORE2=1TO12:X=X-1:PUT(A-1
,X-3)-(A+1,X+3),G,NOT:PLAYSTR$(E
2):PUT(A-1,X-3)-(A+1,X+3),G,NOT:
NEXTE2,E1
3Ø15 IF CR>1THENGOSUB5Ø3Ø
3Ø2Ø PLAY"O3":ON CR GOSUB5ØØØ:GO
TO1ØØ
5ØØØ IFBO=6THENBO=Ø:GOSUB7ØØØ'dr
aw board routine
5ØØ5 SC$=STR$(VAL(SC$)+T1*1ØØ+T2
*1Ø+T1):GOSUB2ØØ5:T1=1:T2=1:T3=1
:DRAW"C3":GOSUB2ØØ:LINE(11Ø,3)-(
134,9),PRESET,BF:FORX=1TO3Ø:PUT(
172,3)-(166+LEN(SC$)*1Ø,9),G,NOT
:PLAY"O1A":NEXTX
5Ø1Ø T1=9:T2=9:T3=9:PCLS:DRAW"BM
11Ø,3"+N$(9)+"BM12Ø,3"+N$(9)+"BM
13Ø,3"+N$(9):BO=BO+1:GU=GU+1:PCL
S:CLS:PRINT@268,"PHASE";BO:PRINT
@288+(32-LEN(PR$(BO)))/2,PR$(BO)
:GOSUB2Ø:IFGU>5THENGU=5
5Ø13 FORX=11ØTO13ØSTEP1Ø:DRAW"C3
BM"+STR$(X)+",3"+N$(9):NEXTX
```

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```
5Ø15 DRAW"C4":LINE(172,2)-(245,2
),PSET:LINE(172,1Ø)-(245,1Ø),PSE
T:GOSUB2ØØ5:PLAY"O1ABCDEFG"
5Ø2Ø PRINT@484,"PRESS FIRE BUTTO
N TO PLAY";:IFPEEK(6528Ø)=126 OR
PEEK(6528Ø)=254 THENSCREEN1,Ø:PO
KE65314,248:CR=21 ELSE GOTO5Ø2Ø
5Ø25 FORX=1TO2Ø:PLAY"O1CDEF":DRA
W"BM"+A$(X)+","+B$(X)+CR$(BO):NE
XTX:FORX=1ØTOGU*1Ø-1ØSTEP1Ø:PUT(
GU*1Ø-1-X,3)-(GU*1Ø-X+1,6),G,NOT
:PLAY"O3CDEFG":NEXTX:X=3
5Ø3Ø FORE1=5TO1STEP-1:PLAY"O"+ST
R$(E1):FORE2=12TO1STEP-1:X=X+1:P
UT(A-1,X-3)-(A+1,X+3),G,NOT:PLAY
STR$(E2):PUT(A-1,X-3)-(A+1,X+3),
G,NOT:NEXTE2,E1:B=X
5Ø4Ø PLAY"O3L255V15":FORA=199TO2
1Ø:PUT(A-1,X-3)-(A+1,X+3),G,NOT:
PLAY"12":PUT(A-1,X-3)-(A+1,X+3),
G,NOT:NEXTA:DRAW"C3":RETURN
55ØØ '?score and all that stuff
551Ø GOTO 551Ø
6ØØØ LINE(9Ø,88)-(178,12Ø),PRESE
T,BF
6Ø1Ø DRAW"BM1ØØ,9ØC4R4L4D6R4U3L2
BM1Ø9,9Ø;D6U3R4U3L4R4D6BM116,9Ø;
D6U6R3D3U3R3D6BM127,9ØR4L4D3R2L2
D3R4BM14Ø,9ØR4D6L4U6BM149,9Ø;D4F
2E2U4BM157,9ØR4L4D3R2L2D3R4BM165
,9Ø;D6U6R2F2G2L2R2F2"
6Ø2Ø DRAW"BM97,1ØØD6U3R4U3D6BM1Ø
4,1ØØR4L2D6L2R4BM113,1ØØR4L4D6R4
U3L2BM12Ø,1ØØD6U3R4U3D6BM137,1ØØ
R4L4D3R4D3L4BM144,1ØØR4L4D6R4BM1
53,1ØØR4D6L4U6BM16Ø,1ØØD6U6R2F2G
2L2R2F2BM169,1ØØR4L4D3R2L2D3R4"
6Ø3Ø IF VAL(SC$)>VAL(HS$)THEN HS
$=SC$:PLAY"V31CDEFGABBAGFEDCCCCC
V15"
6Ø4Ø Y=LEN(HS$)*1Ø:DE=117-Y/2:LI
NE(127-Y/2,1Ø8)-(127+Y/2,118),PR
ESET,BF:FORX=2TOY/1Ø:DRAW"C3BM"+
STR$(DE+X*1Ø)+",11Ø;"+N$(VAL(MID
$(HS$,X,1))):NEXTX
6Ø5Ø POKE178,RND(255):LINE(9Ø,88
)-(178,12Ø),PSET,B:IFPEEK(6528Ø)
=126ORPEEK(6528Ø)=254THEN6Ø6Ø EL
SE 6Ø5Ø
6Ø6Ø GOTO 15
7ØØØ CLS'intermission
7Ø1Ø PCLS:DRAW"C3BM19Ø,45F1ØL3ØG
1ØF5R1ØH1ØR4ØF3ØL4ØH1ØL13ØH15E
15R1ØE1ØR2ØF1Ø":PAINT(185,45),3
```

```
,3:DRAW"C4BM19Ø,16ØR6F6L6H6BM19Ø
,175D16U16F6D1ØU1ØR6D1ØBM175,45U
45D45R6F6U51D51L6U51D51H6"
7Ø15 L1=L1+1:L$=STR$(L1):IF L1>9
9THEN L1=1 ELSE IF L1<1ØTHENL$="
 "+L$
7Ø2Ø DRAW"C4S4ØBM1Ø,1Ø"+N$(VAL(M
ID$(L$,2,1)))+"BM6Ø,1Ø"+N$(VAL(M
ID$(L$,3,1)))+"S4":LINE(15Ø,2)-(
245,2),PSET:LINE(15Ø,1Ø)-(245,1Ø
),PSET:LINE(15Ø,3)-(245,9),PRESE
T,BF:GOSUB2ØØ5
7Ø25 SCREEN1,1:POKE65314,248:O=5
:P=8:FORX=5TO43:PUT(18Ø,X-3)-(18
2,X+3),G,NOT:P=P-1:IF P=Ø THEN P
=8:O=O-1
7Ø26 PLAY"L255O"+STR$(O)+";"+STR
$(P):PUT(18Ø,X-3)-(182,X+3),G,NO
T:NEXTX
7Ø3Ø PRINT"YOUR SCORE ";SC$:PRIN
T:PRINT"HIGH SCORE ";HS$:PRINT:P
RINT"YOU HAVE COMPLETED LEVEL";L
1:PRINT:PRINT"PRESS <<C>> TO CON
TINUE":PRINT"PRESS <<Q>> TO QUIT
"
7Ø4Ø A$=INKEY$:IFA$="Q"THENSCREE
N1,Ø:POKE65314,248:GOTO6ØØØ
7Ø45 PLAY"L255O"+STR$(RND(5))+";
"+STR$(RND(12))+"O3"
7Ø5Ø IF A$<>"C"THEN7Ø4Ø
7Ø6Ø SCREEN1,Ø:POKE65314,248:Y=4
5:FORX=181 TO 55STEP-1:PUT(X-1,Y
-3)-(X+1,Y+3),G,NOT:PLAY"A":PUT(
X-1,Y-3)-(X+1,Y+3),G,NOT:IFX<16Ø
THENY=Y+1
7Ø7Ø NEXTX:FORY=Y TO Y+1Ø:PUT(X-
1,Y-3)-(X+1,Y+3),G,NOT:PLAY"A":P
UT(X-1,Y-3)-(X+1,Y+3),G,NOT:NEXT
Y
7Ø8Ø FORX=55 TO195:PUT(X-1,Y-3)-
(X+1,Y+3),G,NOT:PLAY"AA":PUT(X-1
,Y-3)-(X+1,Y+3),G,NOT:NEXTX:FOR
Y=Y TO191:PUT(X-1,Y-3)-(X+1,Y+3)
,G,NOT:PLAY"A":PUT(X-1,Y-3)-(X+1
,Y+3),G,NOT:NEXTY
7Ø9Ø PMODEØ,2:PCLS:PMODEØ,1:PCLS
:SCREEN1,1:Y1=4Ø:Y2=151:X1=Ø:X=1
6Ø:UX=Ø:SCREEN1,1:IN=-3:DE=1:GOT
O7115
71ØØ X=X+IN:PLAY"O3V31L255B":PMO
DEØ,2:PCLS:LINE(97,191)-(97-X/2,
2Ø+X),PSET:LINE-(157+X/2,2Ø+X*.8
),PSET,B:LINE-(157,2Ø),PSET:LINE
-(97,2Ø+X*.8),PSET,B:LINE(97,2Ø)
-(97-X/2,2Ø+X*.8),PSET:LINE(157,
191)-(157+X/2,2Ø+X),PSET
711Ø PCOPY2TO1:PMODEØ,1:SCREEN1,
1:IFX=DE THEN 7111 ELSEGOTO71ØØ
7111 FORX=31TO1STEP-1:PLAY"O1AV"
+STR$(X):NEXTX:RETURN
7115 GOSUB71ØØ
712Ø IG=Ø:B=Ø:IN=Ø:PCLS:FORX=1TO
94:IG=IG+1:PMODEØ,2:PCLS:B=B+3+I
N:IFB>12ØTHENIN=IN-.4ELSEIN=IN+.
2
7125 IF IG>47THENIN=IN+.2
713Ø LINE(B-X/3,B-X)-(B+X/3,B+X)
,PSET,B:PCOPY2TO1:PMODEØ,1:SCREE
N1,1:NEXTX
714Ø PMODEØ,2:PCLS:SCREEN1,1:X=Ø
:IN=3:DE=192:GOSUB71ØØ
715Ø FORX=1TO2ØSTEP2:PMODEØ,2:PC
LS:LINE(97-X,2Ø-X)-(157+X,181+X/
5),PSET,B:LINE(Ø,181+X/5)-(255,1
81+X/5),PSET:LINE(Ø,181)-(97-X,2
Ø-X),PSET:LINE(157+X,2Ø-X)-(255,
181),PSET
716Ø PCOPY2TO1:PMODEØ,1:SCREEN1,
1:NEXTX
717Ø FORX=1TO76STEP4:PMODEØ,2:PC
LS::LINE(177+X,181+X/2)-(76-X,Ø)
,PSET,B:LINE-(Ø,181+X/2),PSET:LI
NE(177+X,Ø)-(255,181+X/2),PSET:L
INE(Ø,181+X/2)-(255,181+X/2),PSE
T
718Ø PCOPY2TO1:PMODEØ,1:SCREEN1,
1:NEXTX
719Ø PLAY"O3ACDDDEFAABV15":RETUR
N
8ØØØ PMODE3,1:POKE179,53:PCLS:SC
REEN1,1:POKE65314,248:POKE179,3:
PAINT(Ø,191),1,4
8Ø1Ø DRAW"BM36,7ØR32L32G3ØR32E5L
22E15R22E1ØR1C1R5;C4G3ØR6E2ØR1ØG
2ØR6E3ØL2ØR7G1C1G2C4R5G5L5E6C1E2
C4R15C1R5;C4R32G1ØL22G6R22G14L32
E6R22E4L22E2ØR33C1R3;C4R32G1ØL12
G2ØL6E2ØL12E1ØR32C1R7;C4R6G1ØL2G
14R24G6L32E3ØR1ØC1R28"
8Ø2Ø DRAW"C4R32G1ØL22G5R22G5L22G
5R22G5L32E3ØBM96,1Ø5R6G6L6E6R7C1
R3C4R6L6G3R3L3G3E6R7C1R12;C4R4D3
G3L9E6R5C1R8;C4R6G6L6E6R7C1R3;C4
R6G6L6E6R7C1R4;C4G6E6R3G3E3R4G6"
8Ø3Ø FORX=5ØTO23ØSTEP32:PAINT(X,
75),3,4:NEXTX:PAINT(7Ø,75),3,4
8Ø35 POKE65494,Ø:PLAY"V15O1L9CP3
ØCP3CP3ØCP3":PLAY"L2CL9DP2L2CL9D
P2L2CL4DL3E-L2CL2Ø":FORX=15TO1ST
EP-1:PLAY"GL3ØG-V"+STR$(X)+"L2Ø"
:NEXTX:POKE65495,Ø
8Ø4Ø FORX=1TO255:POKE178,X:LINE(
3,65)-(25Ø,12Ø),PSET,B
8Ø5Ø IFPEEK(6528Ø)=127ORPEEK(652
8Ø)=255THENNEXTX:GOTO8Ø4ØELSELIN
E(5,65)-(25Ø,12Ø),PRESET,B:POKE1
78,53:PAINT(Ø,Ø),,2:POKE178,3:RE
TURN
```

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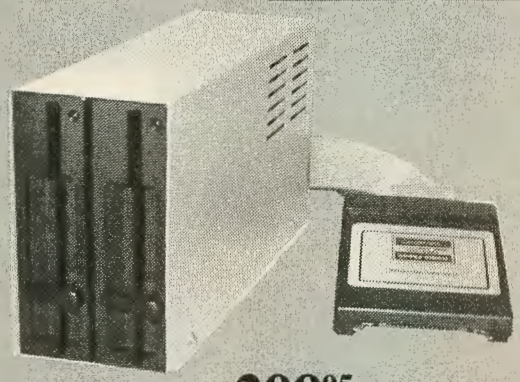

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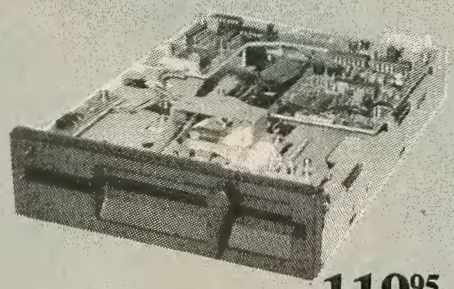

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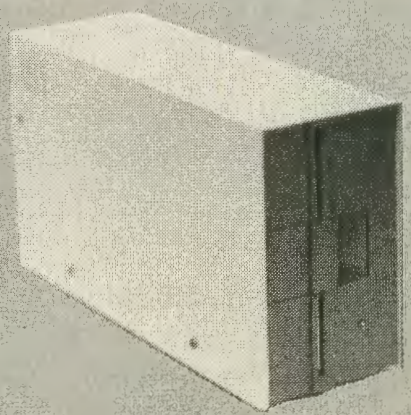

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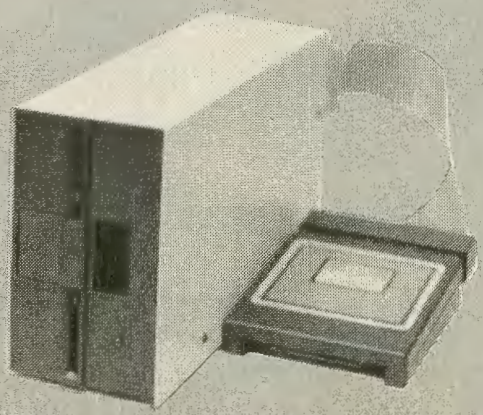

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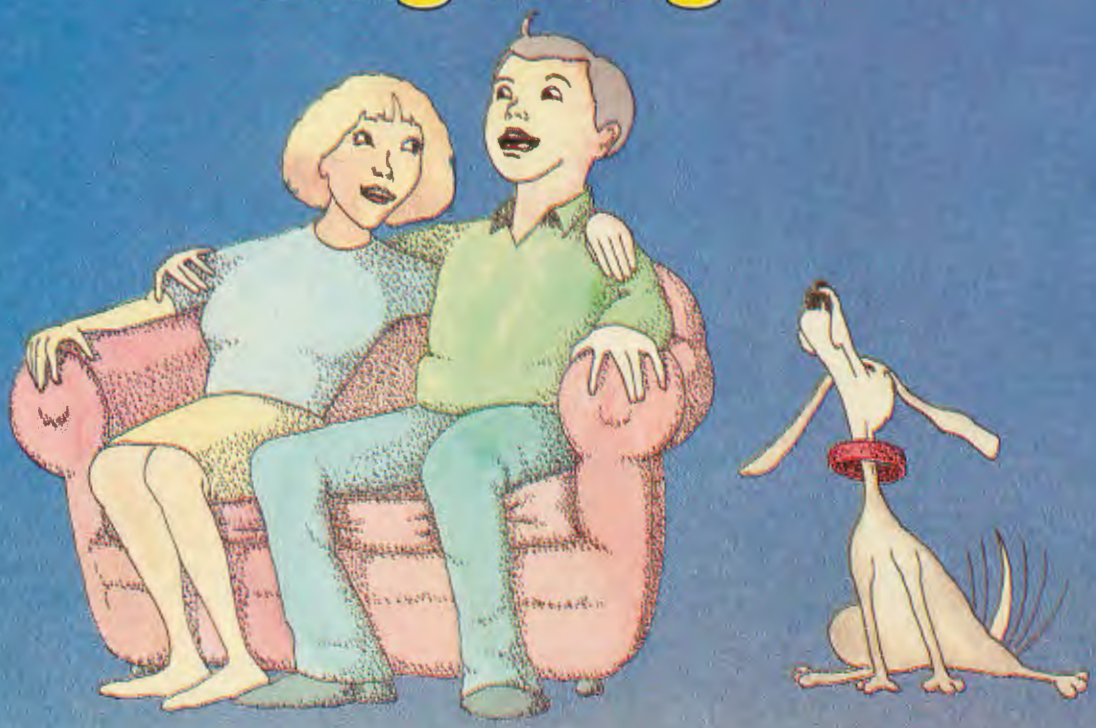
Saturday at the Bijou — Remembering Intermission Sing-alongs



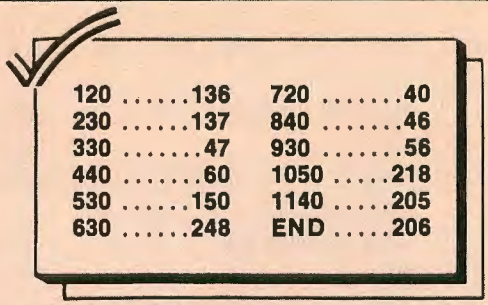
By Ruth E. Golias

When I was a little girl, a cherished amusement was a trip to the movies. During intermission, there was often a sing-along. The organist would play while the words to the song flashed on the screen. Everyone joined in as the master of ceremonies led the singing.

With *Sing-Along* I have tried to evoke that long-ago era when the audience was so much a part of the entertainment. I used the PRINT @ statements rather than graphics because I find them very interesting. Enjoy!

(Questions about this program may be directed to the author at 2826 Pacific Coast Highway, Torrance, CA 90505, phone 213-325-1384. Please enclose an SASE when writing.) □

Ruth Golias has retired from the Torrance Police Department wnere she did microfilming. She is learning to program her CoCo and it has become her hobby.



120	136	720	40
230	137	840	46
330	47	930	56
440	60	1050	218
530	150	1140	205
630	248	END	206

The listing: SINGLONG

```
1Ø 'SING-ALONG-BY RUTH E. GOLIAS
2 '----TORRANCE, CALIFORNIA----
2Ø '
3Ø CLS4:FORB=32TO448STEP21:PRINT
@B,"SING-ALONG";:NEXT:SCREENØ,1
4Ø GOSUB122Ø
5Ø CLS6: PRINT@136,"NOW, LET'S B
EGIN,";:PRINT@295,"SING ALONG WI
TH ME.";:SCREENØ,1
6Ø GOSUB122Ø
7Ø CLS:PRINT@134,"I DON'T WANT T
O PLAY";:PRINT@17Ø,"IN YOUR YARD
";:PRINT@236,"********";:PRINT@2
92,"WORDS BY PHILIP WINGATE";:PR
INT@326,"MUSIC BY H.W.PETRIE";:P
RINT@365,"1894";:SCREENØ,1
8Ø GOSUB122Ø
9Ø CLS3:FORB=35 TO 45ØSTEP2Ø:PRI
NT@B,"I"CHR$(175)"DON'T";:NEXT:S
CREENØ,1:PLAY"O2L8FA"
1ØØ CLS3:FORB=34 TO 45ØSTEP21:PR
INT@B,"WANT"CHR$(175)"TO";:NEXT:
SCREENØ,1:PLAY"O3CO2A"
11Ø CLS3:FORB=34 TO 45ØSTEP21:PR
INT@B,"PLAY"CHR$(175)"IN";:NEXT:
SCREENØ,1:PLAY"FD"
12Ø CLS3:FORB=33 TO 45ØSTEP21:PR
INT@B,"YOUR"CHR$(175)"YARD";:NEX
T:SCREENØ,1:PLAY"L4EL4.E"
13Ø GOSUB122Ø
14Ø GOSUB124Ø
15Ø PRINT@23Ø,"I DON'T WANT TO P
LAY                IN YOUR YARD,
":PLAY"T2L8FAO3CO2AFDL4.EEP4"
16Ø PRINT@224,"        I DON'T L
IKE YOU                  ANY M
ORE,":PLAY"L8GB-O3L8DO2B-GEO3L2.
C"
17Ø PRINT@224,"      YOU'LL BE S
ORRY WHEN                YOU SEE
 ME,":PLAY"O2L8FAO3CO2AFDL4.EE"
18Ø PRINT@224,"        SLIDING D
OWN OUR                  CELLAR
DOOR,":PLAY"L8AGBAFDL2.G"
19Ø PRINT@23Ø,"YOU CAN'T HOLLER
DOWN              OUR RAIN BARRE
L,":PLAY"L8FAO3CO2AFDL4.EEP4"
2ØØ PRINT@224,"        YOU CAN'T
 CLIMB                   OUR APPLE
 TREE,":PLAY"L8GB-O3DO2B-GEO3L2.
CL4C#"
21Ø PRINT@23Ø,"I DON'T WANT TO P
LAY                IN YOUR YARD"
:PLAY"L8DE-DO2DF#AO3L4.CO2B-P4"
22Ø PRINT@23Ø,"  IF YOU WON'T BE
                   GOOD TO ME.":
SCREENØ,1:PLAY"L8AGB-GL8..ECL4L2
..F"
```

One-Liner Contest Winner . . .

Here's one to frighten even the toughest of you. Type it in and RUN it. You might even want to bring it back out for Halloween.

The listing:

```
1Ø PMODE 2,1:SCREEN 1,1:PCLS(1):
PMODE4,1:SCREEN1,1:PCLS:N=RND(4)
:FOR T=1 TO N:Z=RND(11):X=RND(23
Ø):Y=RND(1ØØ):LINE(X,Ø)-(X+1Ø,Y)
,PSET:LINE-(X,Y+Z),PSET:LINE-(X+
2Ø,Y+8Ø),PSET:NEXT T:PCLS:FOR W=
1 TO X*9:NEXT W:GOTO 1Ø
```

John Collicott
Inman, Kansas

(For this winning one-liner contest entry, the author has been sent copies of both *The Second Rainbow Book of Simulations* and its companion *The Second Rainbow Simulations Tape.*)

One-Liner Contest Winner . . .

Try using this program to encode secret messages to your friends. You might try to use this routine in a larger program that would encode and decode the messages for you.

The listing:

```
1Ø INPUT"MESSAGE";M$:INPUT"SHIFT
(1-25)";S:PRINT:FORN=1TOLEN(M$):
P$=MID$(M$,N,1):IF ASC(P$)<65 OR
 ASC(P$)>9Ø THEN PRINTP$;:NEXTN
ELSE K=ASC(P$)+S:IF K>9Ø THEN K=
K-26:PRINTCHR$(K);:NEXTN ELSE PR
INTCHR$(K);:NEXTN:PRINT
```

Richard Delval
Cardiff, California

(For this winning one-liner contest entry, the author has been sent copies of both *The Second Rainbow Book of Simulations* and its companion *The Second Rainbow Simulations Tape.*)

```
23Ø GOSUB122Ø
24Ø CLS:PRINT@134,"MEET ME IN ST
. LOUIS":PRINT@226,"WORDS BY AND
REW B. STERLING":PRINT@262,"MUSI
C BY KERRY MILLS":PRINT@333,"19Ø
4":SCREENØ,1
25Ø GOSUB122Ø
26Ø CLS6:FOR B=35 TO 45ØSTEP2Ø:P
RINT@B,"MEET"CHR$(223)"ME";:NEXT
:SCREENØ,1:PLAY"T4O2L2CL4D"
27Ø CLS6:FORB=33 TO 448 STEP51:P
RINT@B,"IN"CHR$(223)"ST."CHR$(22
3)"LOUIS";:NEXT:SCREENØ,1:PLAY"T
4L2EL4FL2GO3L4E"
28Ø CLS6:FOR B=32 TO 448 STEP45:
PRINT@B,"LOUIS";:NEXT:SCREENØ,1:
PLAY"CO2L4G"
29Ø GOSUB122Ø
3ØØ GOSUB124Ø
31Ø PRINT@228,"MEET ME IN ST.LOU
IS, LOUIS,        MEET ME AT THE
 FAIR.":PLAY"T4O2L2CL4DL2EL4FL2G
O3L4EL4CO2L2GL2AO3L4CO2L2BL4AL2.
GL2GP4"
32Ø PRINT@227,"DON'T TELL ME THE
 LIGHTS ARE    SHINING ANY PLACE
 BUT THERE.":PLAY"T4O2L2CL4DL2EL
4FL2GO3L4EL4CO2L2GO2L2AO3L4DL2DL
4EL2.DL4D"
33Ø PRINT@224,"        WE WILL D
ANCE THE              'HOOCH-EE
KOOCH-IE,'":PLAY"L4DL4D#L2EL4DL2
CL4O2BO3L4EO2L2AL4A"
34Ø PRINT@224,"         I WILL B
E YOUR                TOOTSIE W
OOTSIE.":PLAY"L4G#L4AO3L2DL4CO2L
2BL4AO3L4DO2L2GL4GL4EL4D"
35Ø PRINT@224,"   MEET ME IN ST.
LOUIS, LOUIS,       MEET ME AT
THE FAIR.":SCREENØ,1:PLAY"T4O2L2
CL4DL2EL4FL2GO3L4EL4.CO2L2.GL2AO
3L4CO3L2DO2L4GO3L2.CL2C
36Ø GOSUB122Ø
37Ø CLS:PRINT@164,"A BICYCLE BUI
LT FOR TWO":PRINT@2Ø6,"BY":PRINT
@234,"HARRY DACRE":SCREENØ,1
38Ø GOSUB122Ø
39Ø CLS7:FORB=33 TO 448 STEP21:P
RINT@B,"A"CHR$(239)"BICYCLE";:NE
XT:SCREENØ,1:PLAY"O2L4B-O3L2CAF"
4ØØ CLS7:FORB=33 TO 448 STEP21:P
RINT@B,"BUILT"CHR$(239)"FOR";:NE
XT:SCREENØ,1:PLAY"L2GL4C"
41Ø CLS7:FORB=34 TO 45Ø STEP49:P
```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- programming articles for users

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```
RINT@B,"TWO";:NEXT:SCREENØ,1:PLA
Y"L2..F"
42Ø GOSUB122Ø
43Ø GOSUB124Ø
44Ø PRINT@233,"DAISY, DAISY,
        GIVE ME YOUR ANSWER, D
O":PLAY"T5O3L2.CO2AFCL4DEFL2DL4F
L2...C"
45Ø PRINT@233,"I'M HALF CRAZY,
         ALL FOR THE LOVE OF Y
OU!":PLAY"L2.GO3L2.CO2L2.AFL4DEF
L2GL4AL2...G"
46Ø PRINT@225,"IT WON'T BE A STY
LISH MARRIAGE.    I CAN'T AFFORD
 A CARRIAGE.":PLAY"L4AB-AGO3L2CO
2L4AGL2...FL4GL2AL4FL2DL4FDL2...
C"
47Ø PRINT@224,"      BUT YOU'LL
LOOK SWEET,                ON THE
 SEAT,":PLAY"L4CL2FL4AL4...GP8P8
L2FL4AGP4P8"
48Ø PRINT@224,"       OF A BICYC
LE BUILT,                  OF A BICYC
LE BUILT,":PLAY"L8AB-O3L4CO2AFGP
4P8L8AB-O3L4CO2AFGP4P8"
49Ø PRINT@224,"
                  OF A BICYCLE B
UILT FOR TWO!":SCREENØ,1:PLAY"L8
AB-O3L4CO2AFL2GL4CL2..FL4F"
5ØØ GOSUB122Ø
51Ø CLS:PRINT@168,"AFTER THE BAL
L":PRINT@2Ø6,"BY":PRINT@231,"CHA
RLES K. HARRIS":SCREENØ,1
52Ø GOSUB122Ø
53Ø CLS6:FORB=33 TO 479 STEP 48:
PRINT@B,"AFTER"CHR$(223)"THE"CHR
$(223)"BALL";:NEXT:SCREENØ,1:PLA
Y"T4O2L2.ABL4GO3L2.CC"
54Ø GOSUB122Ø
55Ø GOSUB124Ø
56Ø PRINT@228,"AFTER THE BALL IS
 OVER,          AFTER THE BREAK O
F DAWN.":PLAY"T4O3L4EGEL2CO2L4AO
3L2.CO2L2.GO3L4EGEL2CO2L4AL2...B
"
57Ø PRINT@227,"AFTER THE DANCER'
S LEAVING,     AFTER THE STARS A
RE GONE.":PLAY"O3L4FAFL2EL4DL2.C
#DL4DEDO2L2BL4GO3L2..G"
58Ø PRINT@224,"     MANY A HEART
 IS ACHING;        IF YOU COULD R
EAD THEM ALL,":PLAY"L4EGEL2CO2L4
AO3L2.CO2L2.GL4AO3C#EL2AL4GL2...
F
59Ø PRINT@224,"          MANY THE
 HOPES                   THAT HAVE
VANISHED":PLAY"L4GDDDEFL2.EO2G"
6ØØ PRINT@224,"":PRINT@255,"
     AFTER THE BALL.":SCREENØ,1:
PLAY"ABL4GO3L2...C"
61Ø GOSUB122Ø
62Ø CLS:PRINT@133,"IN MY MERRY O
LDSMOBILE":PRINT@2Ø4,"********":
PRINT@261,"WORDS BY VINCENT BRYA
N":PRINT@294,"MUSIC BY GUS EDWAR
DS":SCREENØ,1
63Ø GOSUB122Ø
64Ø CLS1:FORB=32 TO 448 STEP21:P
RINT@B,"IN"CHR$(143)"MY"CHR$(143
)"MERRY";:NEXT:SCREENØ,1:PLAY"T4
O3L4CO2BL2AL4E"
65Ø CLS1:FORB=33 TO 448 STEP21:P
RINT@B,"OLDSMOBILE";:NEXT:SCREEN
Ø,1:PLAY"L2AL4EL2.AL4A"
66Ø GOSUB122Ø
67Ø GOSUB 124Ø
68Ø PRINT@228,"COME AWAY WITH ME
 LUCILLE,          IN MY MERRY OLD
SMOBILE,":PLAY"T5L2O3DL4CO2L2BL4
DL2BL4DL2.BL4BO3CO2L4BL2AL4EL2AL
4EL2.AL4A"
69Ø PRINT@224,"DOWN THE ROAD OF
LIFE WE'LL FLY      AUTOMOBUBLING
 YOU AND I.":PLAY"L4AGL2F#O3L4DL
2DL4DL2.DO2L4DEF#GO3L2DDL4DL2.D"
7ØØ PRINT@224,"            TO THE
CHURCH                  WE'LL SWIF
TLY STEAL,":PLAY"L2DL4CO2L2BL4DL
2BL4DL2.BL4B"
71Ø PRINT@224,"       THEN OUR WE
DDING BELLS                 WILL
PEAL,":PLAY"O3CO2BL2AL4EL2AL4EL2
.AL4A"
72Ø PRINT@23Ø,"  YOU CAN GO AS F
AR,              AS YOU LIKE WITH
 ME":PLAY"AGL2F#O3L4DDC#DL2EL4DO
2L4B"
73Ø PRINT@224,"": PRINT@256,"
   IN MY MERRY OLDSMOBILE.":SCRE
ENØ,1:PLAY"AGL2AL4G#L2AL4BL2.GO3
L2G"
74Ø GOSUB122Ø
75Ø CLS:PRINT@194,"GIVE MY REGAR
DS TO BROADWAY":PRINT@265,"BY":P
RINT@334,"GEORGE M. COHAN":SCREE
NO,1
76Ø GOSUB122Ø
77Ø CLS7:FORB=34 TO 448 STEP21:P
RINT@B,"GIVE"CHR$(239)"MY";:NEXT
:SCREENØ,1:PLAY"L4CL2D"
78Ø CLS7:FORB=33 TO 448 STEP21:P
RINT@B,"REGARDS"CHR$(239)"TO";:N
EXT:SCREENØ,1:PLAY"L4EL2FG"
79Ø CLS7:FORB=34 TO 448 STEP21:P
RINT@B,"BROADWAY";:NEXT:SCREENØ,
1:PLAY"L1FL2.E"
8ØØ GOSUB122Ø
81Ø GOSUB124Ø
```

```
82Ø PRINT@224,"  GIVE MY REGARDS
 TO BROADWAY,    REMEMBER ME TO
HERALD SQUARE.":PLAY"T4O2L4CL2DL
4EL2FGL1FL2.EL4CDDDDL2EEL1C"
83Ø PRINT@224,"       TELL ALL T
HE GANG,              AT FORTY SEC
OND STREET":PLAY"L4CL2DL4EL2FDEF
L4GED"
84Ø PRINT@224,"
                  THAT I WILL SO
ON BE THERE.":PLAY"CL2FDEFL1GL2.
G"
85Ø PRINT@224,"          WHISPER
OF HOW,                   I'M YEA
RNING":PLAY"L4CL2DL4EL2FGL1FL2.E
"
86Ø PRINT@224,"          TO MINGL
E WITH                  THE OLD TIM
E THRONG.":PLAY"L4CDDDDL2EEL1CC"
87Ø PRINT@224,"          GIVE MY
REGARDS                   TO OLD B
ROADWAY":PLAY"L4AL2F#L4DL2B-AGF#
L4G"
88Ø PRINT@224,"   AND SAY THAT I
'LL BE THERE              E'ER L
ONG.":SCREENO,1:PLAY"FGFL2AFFGL1
FL2F"
89Ø GOSUB122Ø
9ØØ CLS:PRINT@167,"I'VE BEEN WOR
KING":PRINT@2ØØ,"ON THE RAILROAD
":PRINT@271,"A":PRINT@331,"FOLK
SONG":SCREENØ,1
91Ø GOSUB122Ø
92Ø CLS4:FORB=32 TO 448 STEP22:P
RINT@B,"I'VE"CHR$(191)"BEEN";:NE
XT:SCREENØ,1:PLAY"T4O2L2FL4C"
93Ø CLS4:FORB=32 TO 479 STEP25:P
RINT@B,"WORKING"CHR$(191)"ON";:N
EXT:SCREENØ,1:PLAY"FCF
94Ø CLS4:FORB=33 TO 479 STEP23:P
RINT@B,"THE"CHR$(191)"RAILROAD";
:NEXT:SCREENØ,1:PLAY"GL1AF"
95Ø GOSUB122Ø
96Ø GOSUB124Ø
97Ø PRINT@232,"I'VE BEEN WORKING
":PRINT@265,"ON THE RAILROAD":PL
AY"T5L2.FL4CFCFGL1AF"
98Ø PRINT@224,"":PRINT@262,"ALL
THE LIVE LONG DAY,":PLAY"L2.B-L4
B-L2FGL1AA"
99Ø PRINT@232,"I'VE BEEN WORKING
":PRINT@262,"   ON THE RAILROAD"
:PLAY"L2.FL4CFCFGL1AL2F"
1ØØØ PRINT@231,"   JUST TO PASS"
:PRINT@264," THE TIME AWAY.":PLA
Y"L4AAL2AGGAL1GG"
1Ø1Ø PRINT@232," CAN'T YOU HEAR"
:PRINT@262,"THE WHISTLE BLOWING,
":PLAY"L2.GL4GF#GAGL1FC"
1Ø2Ø PRINT@233,"RISE UP SO EARLY
":PRINT@261,"      IN THE MORN,"
:PLAY"L2B-L4B-B-FFGGL1AA"
1Ø3Ø PRINT@233,"CAN'T YOU HEAR":
PRINT@262,"THE CAPTAIN SHOUTING"
:PLAY"L2.DL4EFEFDL1CL2F"
1Ø4Ø PRINT@23Ø,"     'OH, DINAH"
:PRINT@262,"   BLOW YOUR HORN.'"
:SCREENØ,1:PLAY"GAB-AGL1FL2F"
1Ø5Ø GOSUB122Ø
1Ø6Ø CLS:PRINT@165,"AMERICA, THE
 BEAUTIFUL":PRINT@258,"WORDS BY
KATHARINE LEE BATES":PRINT@293,"
MUSIC BY SAMUEL A. WARD":SCREENØ
,1
1Ø7Ø GOSUB122Ø
1Ø8Ø CLS3:FORB=34 TO 45Ø STEP2Ø:
PRINT@B,"AMERICA!";:NEXT:SCREENØ
,1:PLAY"L2GO3L2.EL4EL2DCL2.CO2L4
BL2B"
1Ø9Ø GOSUB122Ø
11ØØ GOSUB124Ø
111Ø PRINT@224," O BEAUTIFUL FOR
 SPACIOUS SKIES     FOR AMBER WA
VES OF GRAIN,":PLAY"T4O2L2GL2.GL
4EL2EGL2.GL4DL2DEFGABL1GL2G"
112Ø PRINT@224,"  FOR PURPLE MOU
NTAIN MAJESTIES      ABOVE THE F
RUITED PLAIN!":PLAY"L2GL2.GL4EL2
EGL2.GL4DL2DO3DC#DEO2AO3L1DL2D"
113Ø PRINT@224,"        AMERICA!
 AMERICA!          GOD SHED HIS
GRACE ON THEE,":PLAY"O2L2GO3L2.E
L4EL2DCL2.CO2L4BL2BO3CDO2BAGO3L1
CL2C"
114Ø PRINT@224,"       AND CROWN
 THY GOOD                WITH BRO
THERHOOD":PLAY"CL2.CO2L4AL2AO3L2
CL2.CO2L4GL2G"
115Ø PRINT@224,"":PRINT@261,"FRO
M SEA TO SHINING SEA.":SCREENØ,1
:PLAY"GAO3CO2GO3DL1CL2C"
116Ø GOSUB122Ø
117Ø CLS6:FOR B=65 TO 74:PRINT@B
,"THAT'S";:NEXT B
118Ø FOR B=166TO169:PRINT@B,"ALL
";:NEXT B
119Ø FOR B=269TO278:PRINT@B,"FOL
KS"CHR$(33);:NEXT:SCREENØ,1:PLAY
"T255ABCDEFGABCDEFGABCDEFGABC"
12ØØ FOR B=396 TO 4Ø4:PRINT@B,CH
R$(33)"THE"CHR$(223)"END"CHR$(33
);:NEXT:SCREENØ,1
121Ø GOTO121Ø
122Ø FOR X=1 TO 3ØØØ:NEXT
123Ø RETURN
124Ø CLSRND(8):PRINT@224,STRING$
(34," ")
125Ø RETURN
```

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I Want My CoCo TV

By Becky and David Matthews

CoCoTV is no longer a distant dream. CoCoTV is here today! Watch the graphics video generated by the program while you listen to the original song recording of "Shadow of the Rings" on this month's RAINBOW ON TAPE. Your usually mild-mannered computer turns into CoCoTV with a music video of its very own. Follow the loading instructions and you'll want your CoCoTV, too.

The speed-up POKE is used in Line 40. This program uses many timing loops and can work without the speed-up POKE, but it will not be synchronized with the music.

Before loading the program, type PCLEAR 8 to free two Hi-Res graphics screens, then CLOAD "SHADOW" and run. The program first prompts for a color test (lines 50 through 80). Follow the instructions on the screen. Next is the cassette test (lines 90 through 110).

The Play button on the recorder should be pressed and the TV volume should be up (if it is, you hear sound effects during the two tests). When ENTER is pressed (for "yes" to the cassette test), the cassette is started (Line 170) and the countdown begins. Line 190 displays the countdown from eight to one. Welcome to CoCoTV!

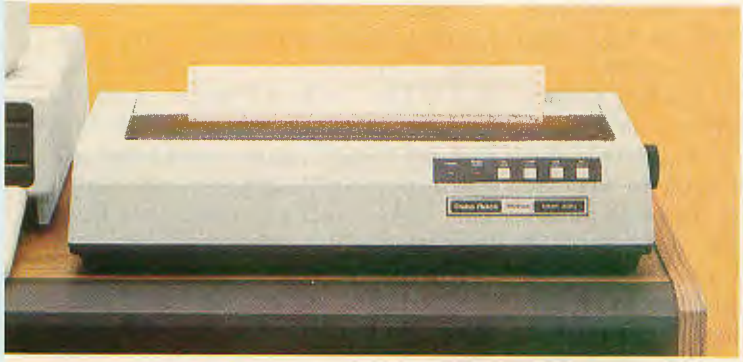
Becky and David Matthews freelance in electronics, computers and music. When they perform live music (with their robot face sidekick), they are known as Adobe Pagoda.

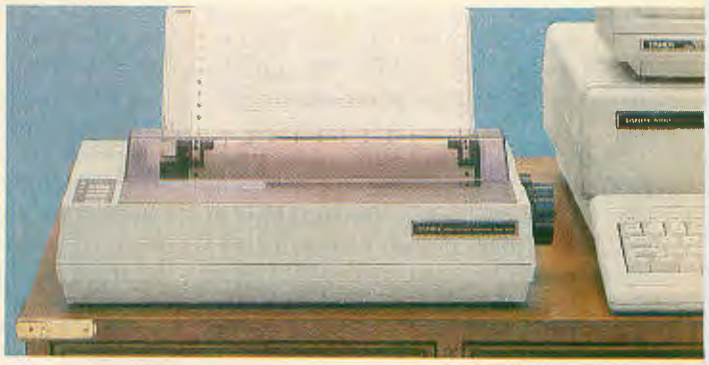
Shadow uses its own built-in alphabet to display words on Hi-Res graphics screens. In Line 150 the array for 26 letters is dimensioned — DIML$(26). Subroutine 2230 has the DRAW substrings to draw each letter. The letters are used in lines 2590 through 2770 of the title page subroutine to write "Shadow of the Rings" on the title page screen and in lines 620 through 1970 to display the lyrics of the song bridge.

Note in Line 2590 and Line 620, S4 has been specified to define the size of the DRAW commands. Changing S4 to S2 makes the letters half their original size. Similarly, S6 makes them twice as large. The only other information needed to use this alphabet is the X,Y coordinates (where to start drawing the letter) and which letter to draw. L$(1) is the letter 'A', L$(2) is 'B', L$(3) is 'C', and so on. Using Line 2600 as an example, 54 is the 'X' position, 66 is the 'Y' position and L$(8) is the letter 'H'. See the letters subroutine (lines 2230 through 2460) for easy reference to which letter is which element of the L$ array. Letters 'L', 'Q', 'X' and 'Z' are not defined in the letters subroutine. Every letter except 'I' is 20 steps across and 28 steps up and down.

Knowing this, you can finish the alphabet. Starting with an easy letter, write your own 'L' DRAW substring, which is L$(12). Add it to the program as Line 2345. Now try adding the letter 'Q', L$(17) at Line 2385. For hints, look at Line 2370, which draws the letter 'O'. Continue and add 'X', L$(24), Line 2445 and 'Z', L$(26), Line 2455, and you have

Next to your computer,





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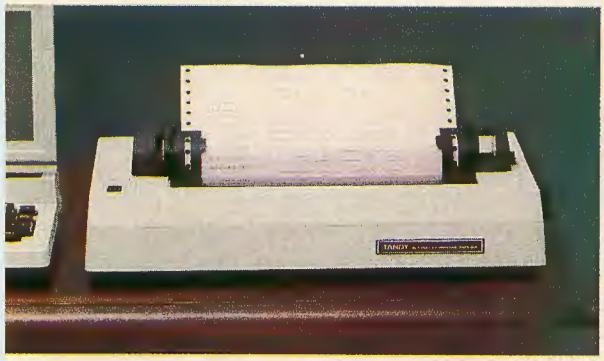

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a complete alphabet — a new font of letters to use on the graphics screens.

The asteroids subroutine (starting at Line 2530) is called several times in the program. At Line 240 it is used as an asteroids background for the Saturn man drawing, but at lines 350 and 460 the asteroids represent moons of Saturn.

In the Saturn man subroutine (lines 1990 through 2220), there is a variety of uses for the CIRCLE command. Part of the face outline, the ear covers, helmet front, eyebrows, eyes and mouth were all drawn with CIRCLE. Line 2210 draws the word TITAN on the screen in simple block letters.

All drawings of Saturn are done with CIRCLE. The routines that shimmer the rings also use CIRCLE, but vary the color (variable C) and the step (variable V). See the Medium Saturn, Large Saturn and Big Rings subroutines.

About the Musical Group

"Adobe Pagoda" is a live musical show performed by Becky and David Matthews using three CoCos to provide multimedia excitement. The show includes CoCo graphics displayed on a large-screen TV, a 12-channel synchronized light show, a talking and singing robot face, fog machine and computer-controlled audio effects.

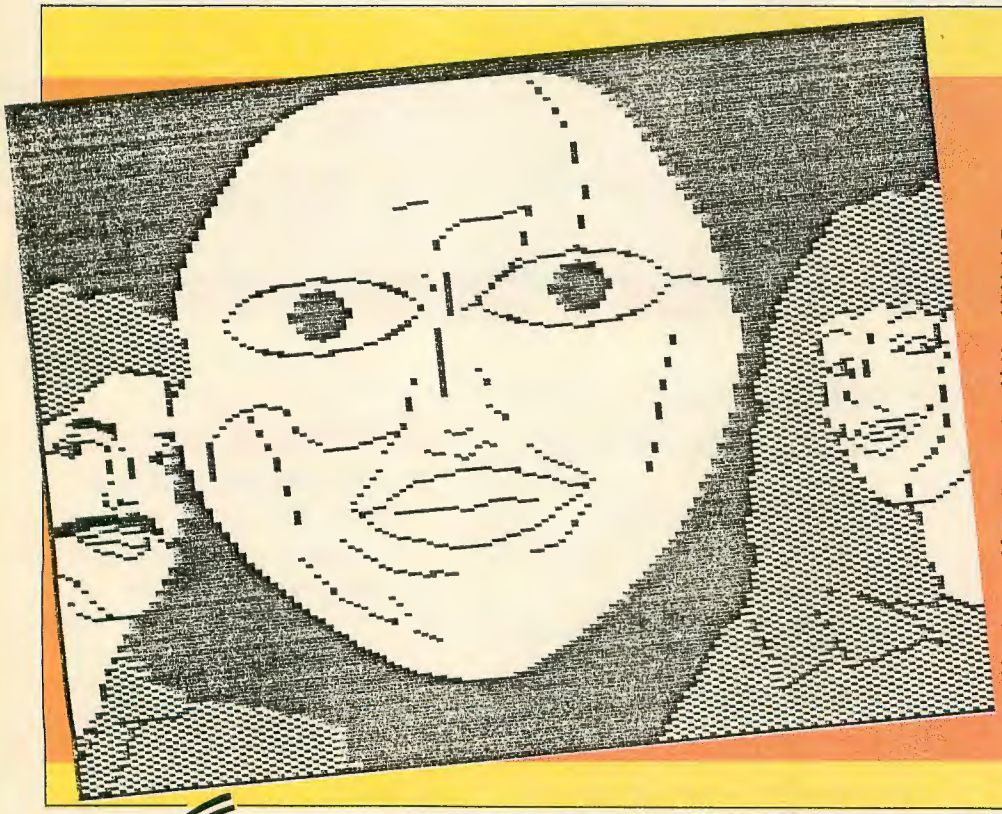
A gray model CoCo running *Colorforth* from The MicroWorks is the main controller for the system. It tells the drum machine what song to play at what tempo and reads the clock pulses from the drum machine to synchronize the show. The gray CoCo controls the fog, light show and audio effects delay line to follow pre-programmed actions unique to each song. This CoCo also sends synchronizing triggers to the CoCo used for graphics, and control signals to the CoCo used for the robot face and voice. The gray CoCo uses five PIAs for I/O.

A CoCo 2 running *Colorforth* from Armadillo International Software controls the robot face with lights for the eyes and mouth synchronized to the voice. The voice is generated by an SSI 263 voice chip. This CoCo receives numerical data that tells it what speech/sound effect routine to perform via the RS-232 port from the gray CoCo.

Finally, another CoCo 2 running BASIC provides the graphics for each song. Some pictures are generated by *CoCo Max*, most by BASIC. *Autorun* from Sugar Software is used to load and run new graphics screens and programs automatically throughout the show. This CoCo receives instructions from the gray CoCo via a joystick port.

"Shadow of the Rings," written and performed by Becky and David Matthews, was recorded at Sound Vortex studio in Nashville with the help of Tom Steinman and Rob Earls. For a cassette of two additional original song recordings with an accompanying graphics program, send $10 to 2415 Smith Springs Road, Nashville, TN 37217. □

Editor's Note: The musical recording of "Shadow of the Rings" will immediately follow the *Shadow* program listing on this month's RAINBOW ON TAPE.



SHADOW OF THE RINGS

By David and Becky Matthews

Once ran a gold mine in the asteroids
I ran a crew of fifty androids
I loved you son of a Saturn man
I spent my leaves with you on Titan

Living in the shadow
I'm living in the shadow of the rings
Living in the shadow
I'm living in the shade of Saturn's rings

Can't kiss you now my blue-skin beauty
Your father felt it was his duty
He sent me here to mine the ice rings
He keeps me busy with so many things

Ammonia gas seeps into my ship
As I suit up for the day
I shoot my shipments out into your orbit
But I know I can never come that way.

*Song Copyright 1985 D. and B. Matthews

190	12	2180	158
440	11	2330	196
640	239	2470	158
950	80	2660	49
1230	173	2820	237
1550	0	2910	92
1830	218	END	19
2060	116		

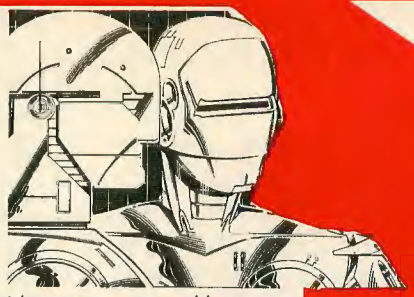
The listing: SHADOW

```
1Ø '****"SHADOW" BY B. MATTHEWS
2Ø '**SONG "SHADOW OF THE RINGS"
 COPYRIGHT 1983 D. & B. MATTHEWS
3Ø 'SPEED-UP POKE
4Ø POKE65495,Ø
```

```
5Ø 'COLOR TEST
6Ø A$=INKEY$:CLSØ:PRINT"RED?
   PRESS ENTER.";:PRINT@64,"BLUE
?      STOP CASSETTE, BREAK, RES
ET AND RUN.";:FORT=1TO15Ø:NEXTT
7Ø PMODE4:PCLS:SCREEN1,1:PMODE3:
PCLS6:PLAY"O2T255CDEFGABC"
8Ø IFA$<>CHR$(13)THEN6Ø
9Ø 'CASSETTE TEST
1ØØ CLS7:PRINT"CASSETTE ON PLAY?
  VOLUME UP?    (ENTER FOR YES)"
;
11Ø PLAY"O1T255BAGFEDC":A$=INKEY
$:IFA$<>CHR$(13)THEN11Ø
12Ø 'SET COLORS
13Ø M=2:W=3:Q=2:U=1:E=Ø
14Ø 'LETTERS
15Ø DIML$(26):GOSUB223Ø
16Ø 'START CASSETTE
17Ø MOTOR ON:AUDIO ON
18Ø 'COUNT-OFF
19Ø C=3:FORN=8TO1STEP-1:CLSC:PRI
NT@238,N;:FORT=1TO6ØØ:NEXTT:C=C+
1:IFC>8THENC=3
2ØØ NEXTN
21Ø 'GOSUB TITLE PAGE
22Ø GOSUB257Ø
23Ø 'GOSUB ASTEROIDS
24Ø PMODE4,5:PCLSØ:SCREEN1,1:GOS
UB253Ø:FORT=1TO3ØØØ:NEXTT
25Ø 'GOSUB SATURN MAN
26Ø FORP=1TO4:PCOPYP+4TOP:NEXTP:
GOSUB199Ø
27Ø FORT=1TO23ØØ:NEXTT
28Ø 'GOSUB MEDIUM SATURN
29Ø GOSUB282Ø
3ØØ 'GOSUB BIG RINGS
31Ø GOSUB247Ø
32Ø 'GOSUB AMMONIA
33Ø PMODE4,1:PCLS1:SCREEN1,1:COL
ORØ,1:GOSUB61Ø
34Ø 'GOSUB ASTEROIDS(MOONS)
35Ø PMODE4,5:PCLS:SCREEN1,1:GOSU
B253Ø
36Ø 'GOSUB LARGE SATURN
37Ø GOSUB29ØØ
38Ø FORT=1TO1ØØØ:NEXTT
39Ø 'GOSUB SATURN MAN
4ØØ PMODE4,1:PCLS:E=1:GOSUB199Ø
41Ø 'FLICKER
42Ø FORT=1TO99Ø:PMODE4,5:SCREEN1
,Ø:PMODE4,1:SCREEN1,1:NEXTT
43Ø 'GOSUB AMMONIA
44Ø PMODE4,1:PCLS1:SCREEN1,1:COL
ORØ,1:GOSUB61Ø
45Ø 'GOSUB ASTEROIDS (MOONS)
46Ø PMODE4,5:PCLS:SCREEN1,1:PCLS
Ø:GOSUB253Ø
47Ø 'GOSUB STARS
48Ø GOSUB298Ø
49Ø 'GOSUB MEDIUM SATURN
5ØØ GOSUB282Ø
51Ø FORT=1TO1ØØØ:NEXTT
52Ø 'GOSUB TITLE PAGE
53Ø GOSUB257Ø
54Ø 'FLICKER
55Ø FORP=1TO5ØØ:PMODE3,1:SCREEN1
,1:SCREEN1,Ø:PMODE4,1:SCREEN1,1:
NEXTP
56Ø 'STOP CASSETTE
57Ø MOTOR OFF:AUDIO OFF:POKE6549
4,Ø
58Ø 'CREDITS
59Ø CLS3:PRINT@1Ø3,"SHADOW OF TH
E RINGS";:PRINT@233,"BY B. MATTH
EWS";:PRINT@457,"SONG COPYRIGHT"
;:PRINT@485,"1983 D. AND B. MATT
HEWS";:FORT=1TO7ØØØ:NEXTT:CLSØ
6ØØ END
61Ø '*AMMONIA SUB- WRITE AMMONIA
62Ø DRAW"BM44,3ØS4"+L$(1)
63Ø DRAW"BM64,3Ø"+L$(13)
64Ø DRAW"BM94,3Ø"+L$(13)
65Ø DRAW"BM124,3Ø"+L$(15)
66Ø DRAW"BM15Ø,3Ø"+L$(14)
67Ø DRAW"BM176,3Ø"+L$(9)
68Ø DRAW"BM2ØØ,3Ø"+L$(1)
69Ø 'GAS
7ØØ DRAW"BM12,7Ø"+L$(7)
71Ø DRAW"BM44,7Ø"+L$(1)
72Ø DRAW"BM64,7Ø"+L$(19)
73Ø 'SEEPS
74Ø DRAW"BM114,7Ø"+L$(19)
75Ø DRAW"BM14Ø,7Ø"+L$(5)
76Ø DRAW"BM166,7Ø"+L$(5)
77Ø DRAW"BM192,7Ø"+L$(16)
78Ø DRAW"BM218,7Ø"+L$(19)
79Ø 'INTO
8ØØ DRAW"BM76,11Ø"+L$(9)
81Ø DRAW"BM94,11Ø"+L$(14)
82Ø DRAW"BM12Ø,11Ø"+L$(2Ø)
83Ø DRAW"BM146,11Ø"+L$(15)
84Ø 'MY
85Ø DRAW"BM36,15Ø"+L$(13)
86Ø DRAW"BM66,15Ø"+L$(25)
87Ø 'SHIP
88Ø DRAW"BM114,15Ø"+L$(19)
89Ø DRAW"BM14Ø,15Ø"+L$(8)
```

```
9ØØ DRAW"BM166,15Ø"+L$(9)
91Ø DRAW"BM184,15Ø"+L$(16)
92Ø FORT=1TO38ØØ:NEXTT:PCLS1
93Ø 'AS
94Ø DRAW"BM76,3Ø"+L$(1)
95Ø DRAW"BM96,3Ø"+L$(19)
96Ø 'I
97Ø DRAW"BM152,3Ø"+L$(9)
98Ø 'SUIT
99Ø DRAW"BM4Ø,7Ø"+L$(19)
1ØØØ DRAW"BM66,7Ø"+L$(21)
1Ø1Ø DRAW"BM92,7Ø"+L$(9)
1Ø2Ø DRAW"BM11Ø,7Ø"+L$(2Ø)
1Ø3Ø 'UP
1Ø4Ø DRAW"BM162,7Ø"+L$(21)
1Ø5Ø DRAW"BM188,7Ø"+L$(16)
1Ø6Ø 'FOR
1Ø7Ø DRAW"BM36,11Ø"+L$(6)
1Ø8Ø DRAW"BM62,11Ø"+L$(15)
1Ø9Ø DRAW"BM88,11Ø"+L$(18)
11ØØ 'THE
111Ø DRAW"BM142,11Ø"+L$(2Ø)
112Ø DRAW"BM168,11Ø"+L$(8)
113Ø DRAW"BM194,11Ø"+L$(5)
114Ø 'DAY
115Ø DRAW"BM84,15Ø"+L$(4)
116Ø DRAW"BM116,15Ø"+L$(1)
117Ø DRAW"BM136,15Ø"+L$(25)
118Ø FORT=1TO37ØØ:NEXTT:PCLS1
119Ø 'I
12ØØ DRAW"BM11Ø,Ø"+L$(9)
121Ø 'SHOOT
122Ø DRAW"BM22,32"+L$(19)
123Ø DRAW"BM48,32"+L$(8)
124Ø DRAW"BM74,32"+L$(15)
125Ø DRAW"BM1ØØ,32"+L$(15)
126Ø DRAW"BM126,32"+L$(2Ø)
127Ø 'MY
128Ø DRAW"BM174,32"+L$(13)
129Ø DRAW"BM2Ø4,32"+L$(25)
13ØØ 'SHIPMENTS
131Ø DRAW"BM8,64"+L$(19)
132Ø DRAW"BM34,64"+L$(8)
133Ø DRAW"BM6Ø,64"+L$(9)
134Ø DRAW"BM78,64"+L$(16)
135Ø DRAW"BM1Ø4,64"+L$(13)
136Ø DRAW"BM134,64"+L$(5)
137Ø DRAW"BM16Ø,64"+L$(14)
138Ø DRAW"BM186,64"+L$(2Ø)
139Ø DRAW"BM212,64"+L$(19)
14ØØ 'OUT
141Ø DRAW"BM2Ø,96"+L$(15)
142Ø DRAW"BM46,96"+L$(21)
143Ø DRAW"BM72,96"+L$(2Ø)
144Ø 'INTO
145Ø DRAW"BM12Ø,96"+L$(9)
146Ø DRAW"BM138,96"+L$(14)
147Ø DRAW"BM164,96"+L$(2Ø)
148Ø DRAW"BM19Ø,96"+L$(15)
149Ø 'YOUR
15ØØ DRAW"BM6Ø,128"+L$(25)
151Ø DRAW"BM86,128"+L$(15)
152Ø DRAW"BM112,128"+L$(21)
153Ø DRAW"BM138,128"+L$(18)
154Ø 'ORBIT
155Ø DRAW"BM52,16Ø"+L$(15)
156Ø DRAW"BM78,16Ø"+L$(18)
157Ø DRAW"BM1Ø4,16Ø"+L$(2)
158Ø DRAW"BM13Ø,16Ø"+L$(9)
159Ø DRAW"BM148,16Ø"+L$(2Ø)
16ØØ FORT=1TO34ØØ:NEXTT:PCLS1
161Ø 'BUT
162Ø DRAW"BM86,1Ø"+L$(2)
163Ø DRAW"BM112,1Ø"+L$(21)
164Ø DRAW"BM138,1Ø"+L$(2Ø)
165Ø 'I
166Ø DRAW"BM24,44"+L$(9)
167Ø 'KNOW
168Ø DRAW"BM66,44"+L$(11)
169Ø DRAW"BM92,44"+L$(14)
17ØØ DRAW"BM118,44"+L$(15)
171Ø DRAW"BM144,44"+L$(23)
172Ø 'I
173Ø DRAW"BM196,44"+L$(9)
174Ø 'CAN
175Ø DRAW"BM4,78"+L$(3)
176Ø DRAW"BM36,78"+L$(1)
177Ø DRAW"BM56,78"+L$(14)
178Ø 'NEVER
179Ø DRAW"BM11Ø,78"+L$(14)
18ØØ DRAW"BM136,78"+L$(5)
181Ø DRAW"BM162,78"+L$(22)
182Ø DRAW"BM188,78"+L$(5)
183Ø DRAW"BM214,78"+L$(18)
184Ø 'COME
185Ø DRAW"BM4,112"+L$(3)
186Ø DRAW"BM3Ø,112"+L$(15)
187Ø DRAW"BM56,112"+L$(13)
188Ø DRAW"BM86,112"+L$(5)
189Ø 'THAT
19ØØ DRAW"BM136,112"+L$(2Ø)
191Ø DRAW"BM162,112"+L$(8)
192Ø DRAW"BM194,112"+L$(1)
193Ø DRAW"BM214,112"+L$(2Ø)
194Ø 'WAY
195Ø DRAW"BM86,146"+L$(23)
196Ø DRAW"BM118,146"+L$(1)
197Ø DRAW"BM138,146"+L$(25)
198Ø FORT=1TO4ØØØ:NEXTT:RETURN
199Ø '*SATURN MAN SUB- DRAW FACE
2ØØØ 'OUTLINE FACE
2Ø1Ø PMODE4,1:SCREEN1,1:COLOR1,Ø
:DRAW"BM18Ø,97C1S6M164,138G15L2Ø
H15M78,97BM125,154R4"
2Ø2Ø CIRCLE(129,7Ø),7Ø,1,.92,.37
,.99:CIRCLE(129,7Ø),7Ø,1,.92,Ø,.
15
2Ø3Ø 'EAR COVERS
```

Robot Odyssey I



Adventure game or advanced education? You decide! **Robot Odyssey I** is divided into 3 parts: a **tutorial** that teaches the basics of robot anatomy and circuit design; the **lab**, where you practice building robots to perform specific tasks; and the **game**, an adventure that challenges you to escape from Robotropolis.

Robotropolis is an underground city inhabited by both friendly and bothersome robots. It is built in five levels, so your escape must be achieved in five increasingly more difficult stages. First is the sewer where friendly robots aid your escape. In the next level, the subway, you must rewire a robot. At the fourth level you get to the master control center. Finally, you reach the skyways. Less than 5% ever solve the last level!

Each robot has one eye, a grabber, an antenna to send and receive signals, four thrusters for guidance, four bumpers that detect walls, and a rechargable battery. You must learn to operate these robots, including modifying and designing their inner circuitry, to escape from Robotropolis.

In addition to having great fun and adventure, you will learn a great deal about the inside of robots, integrated circuitry, and logic. **Robot Odyssey I** is the ultimate puzzle, requiring much time and effort while providing big rewards in return!

Requires 64K, Disk $34.95

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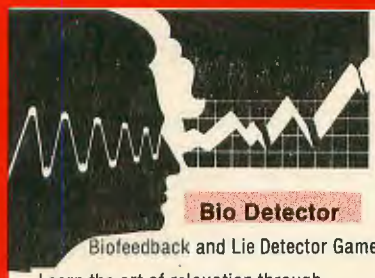

Bio Detector

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Learn the art of relaxation through biofeedback - or use the same device for party fun as a lie detector game. Software for both is included. The Bio Detector works through silver finger sensors attached to the Bio Detector unit which plugs into the joystick port. Your galvanic skin response is plotted in hires color graphics and sound. Learn stress reduction easily by watching your responses on the screen. The Anxiety Attack Game will provide hours of embarrassing and truthful fun as well. All hardware, software, and instructions are included.

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Advanced OS-9 Utilities

by Brian Lantz

KSHELL allows wildcard with any utility! Includes PATH for multiple path directories, UNLOAD for repetitive unlinks, FLINK for alternative boot files, ARCHIVE to backup large media to small media, & CPY.

Serious OS-9 users cannot do without this set of utilities!

Requires 64K, OS-9 $29.95

Disk Fix & OS-9 Utilities

by Harry Hardy

Unleash the real power of OS-9! **DISK FIX** supports true double-sided, double-density, 40 or 80 tracks, and step rates up to 6 ms - and each drive is configured separately! (CCDISK included)

DMODE allows super easy modification of drive descriptors. DIRCOPY is a powerful copy utility. PATCH lets you inspect & modify a disk file. FILELOOK displays file modules without loading. COMPARE compares a file to memory.

Includes modules for **1.X and 2.X** OS-9!

Requires 64K, OS-9 $34.95

The Last Word

by Michael Bailey

Computerware is proud to represent The Last Word by Michael Bailey of United Software. We chose The Last Word because it is truly the ultimate OS-9 word processor!

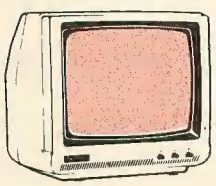
The Last Word offers fast, on-screen formatting using your choice of mouse, joystick or keyboard. The popdown menu is accessible at all times while inputting text so it is very easy to use. The Last Word provides the capability to move, insert or delete blocks of text, paragraphs, lines, or characters with just a click of the mouse or joystick or the touch of a key.

The Last Word is compatible with Word-Pak or you can use its own hires 51x24 display. You open files just by pointing to names on a directory menu. Once the file is open, you can move freely within the file from top to bottom and back again. If using it with Word-Pak, you have a 22,000 word dictionary on-line at your fingertips!

You can easily imbed your printer's special codes in your files. With more than 30 screen editing commands available, it's simple to format or reformat as necessary. Change the margins, double or single space, etc. using the pop-down menus. The Last Word is very easy to use and learn. It will be a staple in your OS-9 library!

Requires 64K, OS-9 $49.95

Monitors



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```
2Ø4Ø FOR R=1TO11STEP2:CIRCLE(71,
95),R,1,2:CIRCLE(185,95),R,1,2:N
EXTR
2Ø5Ø 'HELMET FRONT
2Ø6Ø H=.6Ø:FORY=94TO1Ø4STEP2:CIR
CLE(129,Y),8Ø,1,H,.625,.88:H=H+.
Ø5:NEXTY:LINE(72,6Ø)-(73,75),PSE
T,B:LINE(184,6Ø)-(185,75),PSET,B
2Ø7Ø 'PAINT HELMET,DRAW EYEBROWS
2Ø8Ø DRAW"BM199,66S4C1D4":POKE17
8,145:PAINT(14Ø,3Ø),,1
2Ø9Ø FORY=73TO77STEP2:CIRCLE(152
,Y),15,1,.6,.62,.95:CIRCLE(1Ø4,Y
),15,1,.6,.55,.9:NEXTY
21ØØ 'EYES
211Ø CIRCLE(152,88),15,1,.8,.62,
.9:CIRCLE(1Ø4,88),15,1,.8,.6,.9:
CIRCLE(152,76),15,1,.8,.1,.41:CI
RCLE(1Ø4,76),15,1,.8,.1,.4
212Ø PAINT(146,82),1,1:PAINT(1ØØ
,82),1,1:FOR R=1TO4STEP2:CIRCLE(
152,82),R,Ø:CIRCLE(1Ø4,82),R,Ø:N
EXT R
213Ø 'NOSE AND MUSTACHE
214Ø DRAW"BM125,86C1S8D2M12Ø,116
F1R2BR2R1BD1L2G1H1L2G1L2G1L2G3R3
E1R1M125,126M135,128R2E1R1E4L3G2
L2H1L2BM157,114C1S4F2D2"
215Ø 'MOUTH AND PAINT FACE
216Ø CIRCLE(126,122),2Ø,1,.5,1,.
4:POKE178,U:PAINT(128,128),,1:PA
INT(128,13Ø),,1:POKE178,Q:PAINT(
14Ø,8Ø),,1
217Ø 'OUTLINE EYES
218Ø CIRCLE(152,88),15,Ø,.8,.62,
.9:CIRCLE(1Ø4,88),15,Ø,.8,.6,.9:
CIRCLE(152,76),15,Ø,.8,.1,.41:CI
RCLE(1Ø4,76),15,Ø,.8,.1,.4:IFE=1
THENRETURN
219Ø FORT=1TO2ØØØ:NEXTT
22ØØ 'WRITE "TITAN"
221Ø DRAW"BM12,148C1S2R8ND16R8BR
8D16BR16U16NL8R8BR8G8NR14D8BR16U
8H8BR16ND16F12ND4U12BF8BR4R18NG6
H6"
222Ø RETURN
223Ø '*LETTERS SUBROUTINE
224Ø L$(1)="R1ØF4D24L4U12L12D12L
4U24E4BD4BR4R4F4D4L12U4E4":'A
225Ø L$(2)="R16F4D6G4F4D6G4L16U2
8BF4R1ØF2D3G3L4D4R4F3D3G2L1ØU2Ø"
:'B
226Ø L$(3)="R2ØD4L16D2ØR16D4L2ØU
28":'C
227Ø L$(4)="R16F4D2ØG4L16U28BF4R
1ØF2D16G2L1ØU2Ø":'D
228Ø L$(5)="R2ØD4L16D8R12D4L12D8
R16D4L2ØU28":'E
229Ø L$(6)="R2ØD4L16D8R12D4L12D1
2L4U28":'F
23ØØ L$(7)="R2ØD8L4U4L12D2ØR12U6
L4U4R8D14L2ØU28":'G
231Ø L$(8)="R4D12R12U12R4D28L4U1
2L12D12L4U28":'H
232Ø L$(9)="R12D4L4D2ØR4D4L12U4R
4U2ØL4U4":'I
233Ø L$(1Ø)="R12D4L4D24L16U8R4D4
R8U2ØL4U4":'J
234Ø L$(11)="R4D12E1ØU2R6D2G12F1
2D2L6U2H1ØD12L4U28":'K
235Ø L$(13)="R4F8E8R4D28L4U22G8H
8D22L4U28":'M
236Ø L$(14)="R4F12U12R4D28L4U1ØH
12D22L4U28":'N
237Ø L$(15)="R2ØD28L2ØU28BF4R12D
2ØL12U2Ø":'O
238Ø L$(16)="R16F4D8G4L12D12L4U2
8BF4R1ØF2D4G2L1ØU8":'P
239Ø L$(18)="R2ØD16L1ØF1ØD2L6U2H
1ØD12L4U28BF4R12D8L12U8":'R
24ØØ L$(19)="R2ØD8L4U4L12D8R16D1
6L2ØU8R4D4R12U8L16U16":'S
241Ø L$(2Ø)="R2ØD4L8D24L4U24L8U4
":'T
242Ø L$(21)="R4D24R12U24R4D28L2Ø
U28":'U
243Ø L$(22)="R4D16F6E6U16R4D18G1
```


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REVIEWED IN MAY, 1986 RAINBOW

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```
ØH1ØU18":'V
244Ø L$(23)="R4D22E6F6U22R4D28L4
H6G6L4U28":'W
245Ø L$(25)="R4D6F6E6U6R4D8G8D12
L4U12H8U8":'Y
246Ø RETURN
247Ø '*BIG RINGS SUBROUTINE
248Ø PMODE4,1:PCLSØ:SCREEN1,1:CO
LOR7,6:FORS=1TO9Ø:X=12+RND(233):
Y=12+RND(167):PSET(X,Y,7):NEXTS:
PMODE3,1:FORR=1TO3Ø:CIRCLE(128,9
5),R,M,.9:NEXTR
249Ø PMODE3,1:V=3:C=2:FORT=1TO21
:FORR=9ØTO55STEP-V:CIRCLE(128,95
),R,C,.95:NEXT R:C=C+1:IFC=>9THE
NC=1
```

```
25ØØ V=V+1
251Ø NEXTT
252Ø RETURN
253Ø '*ASTEROIDS (MOONS) SUB
254Ø PMODE4,5:PCLS:GOSUB298Ø:FOR
X=ØTO6STEP2:LINE(X,Ø)-(X,192),PS
ET:LINE(X+248,Ø)-(X+248,192),PSE
T:NEXTX
255Ø FORR=1TO3STEP2:CIRCLE(67,55
),R,1:CIRCLE(145,4Ø),R,1:CIRCLE(
8Ø,35),R,1:CIRCLE(18Ø,13Ø),R,1:C
IRCLE(35,9Ø),R,1:NEXTR
256Ø FORR=1TO6STEP2:CIRCLE(82,15
2),R,1:NEXTR:RETURN
257Ø '*TITLE PAGE SUBROUTINE
258Ø 'SHADOW
259Ø PMODE4,1:PCLS:SCREEN1,1:COL
OR1,Ø:DRAW"BM28,66S4"+L$(19)
26ØØ DRAW"BM54,66"+L$(8)
261Ø DRAW"BM86,66"+L$(1)
262Ø DRAW"BM1Ø6,66"+L$(4)
263Ø DRAW"BM132,66"+L$(15)
264Ø DRAW"BM158,66"+L$(23)
265Ø 'OF
266Ø DRAW"BM48,1Ø2"+L$(15)
```

```
267Ø DRAW"BM74,1Ø2"+L$(6)
268Ø 'THE
269Ø DRAW"BM118,1Ø2"+L$(2Ø)
27ØØ DRAW"BM144,1Ø2"+L$(8)
271Ø DRAW"BM17Ø,1Ø2"+L$(5)
272Ø 'RINGS
273Ø DRAW"BM8Ø,138"+L$(18)
274Ø DRAW"BM1Ø6,138"+L$(9)
275Ø DRAW"BM124,138"+L$(14)
276Ø DRAW"BM15Ø,138"+L$(7)
277Ø DRAW"BM178,138"+L$(19)
278Ø 'DRAW SMALL SATURN
279Ø COLOR1,Ø:FORX=1TO1ØSTEP2:LI
NE(X,X)-(256-X,191-X),PSET,B:NEX
TX:X=198:Y=4Ø
28ØØ FOR R=ØTO19:CIRCLE(X,Y),R:N
EXTR:FORR=23TO35STEP3:CIRCLE(X,Y
),R,1,.27:NEXTR:GOSUB298Ø:IFE=1T
HENRETURN
281Ø FORT=1TO75:PMODE3,1:SCREEN1
,Ø:FORR=1TO5Ø:NEXTR:PMODE4,1:SCR
EEN1,1:FORR=1TO5Ø:NEXTR:NEXTT:RE
TURN
282Ø '*MEDIUM SATURN SUBROUTINE
283Ø PMODE4,5:SCREEN1,1:X=126:Y=
9Ø:FORR=ØTO3Ø:CIRCLE(X,Y),R:NEXT
```

The Crossword Creator Contest

Can you create a totally symmetrical crossword puzzle using the *Word+* program and the specifications outlined in the accompanying article on Page 38 of the May 1986 issue of THE RAINBOW? If so, you may wish to enter The Crossword Creator Contest. And, if we choose to print your crossword puzzle, you will be awarded a special prize.

Send us a disk or cassette copy of the data file of your puzzle created by *Word+* along with a printed copy of the crossword puzzle — including the clues and answers. Be sure to put a title on the puzzle and if possible, follow a general interest theme.

Entries will be judged on the following criteria:

Puzzle symmetry
Number of words
Spelling
Creativity
Thematic originality
Understandability
Ease of loading data
Neatness
Packaging

Enter as often as you like! Please note: We consider your act of entering the contest as consent to publish your creation.

The Crossword Creator Contest is open to all RAINBOW readers, advertisers and employees of Falsoft, Inc.

Send entries to:
Crossword Creator Contest
c/o THE RAINBOW
The Falsoft Building
P.O. Box 385
Prospect, KY 40059

```
R
284Ø FORR=4ØTO5ØSTEP4:CIRCLE(X,Y
),R,1,Ø.25,Ø,.65:CIRCLE(X,Y),R,1
,Ø.25,.85,.99:NEXTR
285Ø FORR=56TO62STEP4:CIRCLE(X,Y
),R,1,Ø.25,Ø,.69:CIRCLE(X,Y),R,1
,Ø.25,.81,.99:NEXTR
286Ø V=2:C=1:FORT=1TO19:FORR=4ØT
O52STEPV:CIRCLE(X,Y),R,C,.25,Ø,.
624:CIRCLE(X,Y),R,C,.25,.875,.99
:NEXTR
287Ø FOR R=56TO62STEPV:CIRCLE(X,
Y),R,C,.25,Ø,.67:CIRCLE(X,Y),R,C
,.25,.844,.99:NEXTR:V=V+1:C=C-1:
IFC=-1THENC=1
288Ø IFV>5THENV=2
289Ø NEXTT:RETURN
29ØØ '*LARGE SATURN SUBROUTINE
291Ø PMODE4,5:COLOR1,Ø:SCREEN1,1
```

```
:X=127:Y=96:FORR=1TO11STEP2:CIRC
LE(2ØØ,17Ø),R,1:NEXTR:FORR=1TO4Ø
:CIRCLE(X,Y),R,1:NEXTR
292Ø FORR=6ØTO7ØSTEP3:CIRCLE(X,Y
),R,1,.3,Ø,.67:CIRCLE(X,Y),R,1,.
3,.845,.99:NEXTR:FORR=74TO9ØSTEP
3:CIRCLE(X,Y),R,1,.3,Ø,.689:CIRC
LE(X,Y),R,1,.3,.815,.99:NEXTR
293Ø V=2:C=1:FORT=1TO7:FOR R=6ØT
O7ØSTEPV:CIRCLE(X,Y),R,C,.3,Ø,.6
4:CIRCLE(X,Y),R,C,Ø.3,.86,.99:NE
XTR
294Ø FOR R=74TO9ØSTEPV:CIRCLE(X,
Y),R,C,.3,Ø,.68Ø:CIRCLE(X,Y),R,C
,.3,.831,.99:NEXTR:V=V+1:C=C-1:I
FC=-1THENC=1
295Ø IFV>7THENV=2
296Ø NEXTT:RETURN
297Ø '*STARS SUBROUTINE
298Ø FORS=1TO8Ø:X=12+RND(233):Y=
12+RND(167):PSET(X,Y,5):NEXTS:RE
TURN
```

Music+: New Commands, No Bugs

By Bob Ludlum

Since *Music+* appeared in RAINBOW ("Making Four-Part Harmony Easier," June 1984, Page 74) I've received a large response from *Music+* users with questions and requests for additional features. As a result, I've fixed a minor bug and added two new commands to the program.

If you're not familiar with *Music+*, it's an enhanced version of Larry Konecky's *CoCo Composing* (RAINBOW, December 1983). It is a BASIC program that loads a machine language music synthesis program. A screen editor facilitates the entry, editing and playing of four-part music. It requires a 32K Color Computer with Extended BASIC and runs without modification on both tape and disk systems.

I want to answer some questions I received repeatedly. First, is it possible to add more voices and octaves? Yes, relatively simple modifications to the editor and synthesis programs are all that is required, but a tradeoff exists between the added complexity and the quality of the sounds produced.

Music+ synthesizes the music wave form by summing the contributions from the four voices at equally spaced time intervals. The result is a sampled approximation of the desired wave form. The accuracy of the approximation depends on how often the samples are calculated (the sampling rate). The theoretical minimum rate required is two samples per cycle of the highest frequency component in the wave form. In practice, much higher rates are needed.

If the sampling rate is too low, unwanted frequency components appear in the wave form, a phenomenon known as "aliasing." *Music+* calculates a new wave form sample every 145 microseconds (6,896 samples per second), which is already marginal.

The second question frequently asked was, "Why do I get a 'C' note when I enter a 'B' sharp and why do the notes jump from 'B' in one octave to 'C' in the next?"

The note table in *Music+* implements the equally tempered chromatic scale with a standard pitch of 440 Hertz (cycles per second) for 'A' in the fourth octave. Each octave begins with the note 'C' and is made up of 12 pitch intervals (half-steps). There is one half-step between 'B' and 'C', and between 'E' and 'F'. There are two half-steps between the rest of the notes with the sharps falling on the half-steps between.

For example, beginning with the third octave, the notes are C3, C3#, D3, D3#, E3, F3, F3#, G3, G3#, A3, A3#, B3, C4, C4#, etc. To raise a note one half-step, its pitch is multiplied by the twelfth root of two (approximately 1.0595).

The original *Music+* program had a bug that showed up when the music was saved following use of the (M)ove command. The (M)ove command changes the pointer (actually a branch instruction offset) to the start of the music data allowing a portion of a song to be played. Moving and then saving caused the wrong start location to be saved and the entire song would not play when executed. Playing before saving prevents the problem. Adding `POKE A9,0:POKE A9+1,128:` to the beginning of Line 625 of the original program fixes the bug.

The first of the new commands is (H)dcopy, which is used to dump the music data between specified note columns to a printer. The command simply lists each column number followed by the note length and the four note names for that column. The `POKE 150,18` in Line 9600 sets the Baud rate to 2400. Change it to match your printer, if necessary.

Turn the printer off when playing music. The synthesis program generates a byte (eight bits) to the output port that drives the CoCo's six-bit digital-to-analog converter. One of the lower-order bits appears on the serial port while music is playing and will cause your printer to do strange things!

The other new command is (W)form.

Bob Ludlum is an electronics design engineer and holds a master's degree in electrical engineering. Bob lives in Panama City, Florida, and his hobbies include electronics, personal computers, classical and flamenco guitar, and flying.

It allows changing the wave form table to produce sounds with different timbres. The program prompts for the percentages of the fundamental and the first four overtones of the music wave form. The 256 values for the new wave form table are calculated (in BASIC) by summing the scaled sinusoidal fundamental and the second through the fifth harmonics.

The new wave form table is in effect for played and saved music until *Music+* restores the table after RUN. The original *Music+* organ wave form has 50 percent fundamental, and 25 percent each for the second and third harmonics. The sum of the percentages should equal 100.

The machine language program is located immediately above the BASIC screen editor in order to maximize the amount of memory available for holding music data. Adding the new commands required either relocating the machine language program (which would have destroyed compatibility with existing *Music+* music files) or shrinking the BASIC program.

I decided on the latter and removed the unnecessary spaces and packed the lines. Unfortunately, doing so makes describing the necessary steps to update the original *Music+* program very difficult. I'll be happy to make a copy of the latest version of the program if you send me a tape or (preferably) a disk in a self-addressed, stamped return mailer. My mailing address is 226 Pine Ridge Drive, Panama City, FL 32405.

I've been very pleased with the positive responses to *Music+* and hope the new commands will be useful. I'm especially grateful to all who were kind enough to send me some outstanding samples of their music. I encourage you to share your efforts with the readers of RAINBOW.

Editor's Note: Due to the length of the new and improved *Music+* program, we are unable to print the listing in THE RAINBOW. We will, however, include the modified *Music+* program on this month's RAINBOW ON TAPE. □

Place these values into the Music+ program or simply load and execute each song file from this month's RAINBOW ON TAPE. Either way, you'll be musically entertained.

The following contributors have sent us their compositions using the original *Music+* program. We have dumped the first portion of the music data from each song using *Music+*'s (H)dcopy command and have printed it for your enjoyment. Both songs will be provided in their entirety on this month's RAINBOW ON TAPE, immediately following the *Music+* program listing. Simply CLOADM and EXEC to play each song.

Scott Joplin's "The Entertainer"
By Bill Kast

The listing: ENTRTAIN

```
COL: LEN ,V1  ,V2  ,V3  ,V4
  1: 16  ,D6  ,D5  ,Ø   ,Ø
  2: 16  ,E6  ,E5  ,Ø   ,Ø
  3: 16  ,C6  ,C5  ,Ø   ,Ø
  4: 8   ,A5  ,A4  ,Ø   ,Ø
  5: 16  ,B5  ,B4  ,Ø   ,Ø
  6: 8   ,G5  ,G4  ,Ø   ,Ø
  7: 16  ,D5  ,D4  ,Ø   ,Ø
  8: 16  ,E5  ,E4  ,Ø   ,Ø
  9: 16  ,C5  ,C4  ,Ø   ,Ø
 1Ø: 8   ,A4  ,A3  ,Ø   ,Ø
 11: 16  ,B4  ,B3  ,Ø   ,Ø
 12: 8   ,G4  ,G3  ,Ø   ,Ø
 13: 16  ,D4  ,D3  ,Ø   ,Ø
 14: 16  ,E4  ,E3  ,Ø   ,Ø
 15: 16  ,C4  ,C3  ,Ø   ,Ø
 16: 8   ,A3  ,A2  ,Ø   ,Ø
 17: 16  ,B3  ,B2  ,Ø   ,Ø
 18: 16  ,A3  ,A2  ,Ø   ,Ø
 19: 16  ,G3# ,G2# ,Ø   ,Ø
 2Ø: 8   ,G3  ,G2  ,Ø   ,Ø
 21: 8   ,Ø   ,Ø   ,Ø   ,Ø
 22: 8   ,G5  ,D5  ,B4  ,G2
 23: 16  ,D4  ,B3  ,G3  ,Ø
 24: 16  ,D4# ,B3  ,G3  ,Ø
 25: 16  ,E4  ,C3  ,Ø   ,Ø
 26: 16  ,C5  ,C3  ,Ø   ,Ø
 27: 16  ,C5  ,C4  ,G3  ,E3
 28: 16  ,E4  ,C4  ,G3  ,E3
 29: 16  ,C5  ,G3  ,G2  ,Ø
 3Ø: 16  ,C5  ,G3  ,G2  ,Ø
 31: 16  ,E4  ,C4  ,A3# ,G3
 32: 16  ,C5  ,C4  ,A3# ,G3
 33: 8   ,C5  ,F3  ,F2  ,Ø
 34: 8   ,C5  ,C4  ,A3  ,Ø
 35: 16  ,C5  ,Ø   ,Ø   ,E3
 36: 16  ,C6  ,E5  ,C5  ,E3
 37: 16  ,D6  ,F5  ,C4  ,G3
 38: 16  ,D6# ,F5# ,C4  ,G3
 39: 16  ,E6  ,G5  ,E5  ,G2
 4Ø: 16  ,C6  ,E5  ,C5  ,G2
 41: 16  ,D6  ,F5  ,C4  ,G3
 42: 16  ,E6  ,G5  ,C4  ,G3
 43: 16  ,E6  ,G5  ,E5  ,G2
 44: 16  ,B5  ,D5  ,B4  ,G2
 45: 8   ,D6  ,F5  ,B3  ,G3
 46: 8   ,C6  ,E5  ,C5  ,C3
 47: 8   ,C6  ,E5  ,C4  ,G3
 48: 8   ,C6  ,E5  ,C4  ,G3
```

Handel's "Hallelujah Chorus"
By Dave Greenfield

The listing: HALELUJA

```
COL: LEN ,V1  ,V2  ,V3  ,V4
  1: 8   ,D5  ,A4  ,F4# ,D3
  2: 8   ,D5  ,G4  ,Ø   ,E3
  3: 8   ,D5  ,A4  ,Ø   ,F3#
  4: 8   ,A5  ,F5# ,Ø   ,D3
  5: 8   ,B5  ,G5  ,D5  ,G3
```

```
 6:  8    ,A5   ,F5#  ,D5   ,D3
 7:  8    ,Ø    ,Ø    ,Ø    ,F3#
 8:  8    ,Ø    ,Ø    ,Ø    ,A3
 9:  8    ,D6   ,A5   ,F5#  ,D3
1Ø:  8    ,D6   ,A5   ,F5#  ,E3
11:  8    ,D6   ,A5   ,F5#  ,F3#
12:  8    ,F5#  ,D5   ,A4   ,D3
13:  8    ,G5   ,C5#  ,G4   ,E3
14:  8    ,F5#  ,D5   ,A4   ,D3
15:  8    ,Ø    ,Ø    ,Ø    ,Ø
16:  8    ,A5   ,D5   ,A4   ,F3#
17:  8    ,G5   ,C5#  ,A4   ,E3
18:  8    ,F5#  ,D5   ,A4   ,D3
19:  8    ,E5   ,D5   ,A4   ,A3
2Ø:  8    ,E5   ,C5#  ,G4   ,A2
21:  8    ,D5   ,A4   ,F4#  ,D3
22:  8    ,A4   ,Ø    ,F4#  ,D3
23:  8    ,B4   ,Ø    ,G4   ,Ø
24:  8    ,C5#  ,Ø    ,E4   ,Ø
25:  4.   ,D5   ,A4   ,F4#  ,D3
26:  8    ,A4   ,A4   ,D4   ,F3#
27:  8    ,B4   ,G4   ,D4   ,G3
28:  8    ,A4   ,F4#  ,D4   ,D3
29:  8    ,Ø    ,Ø    ,Ø    ,F3#
3Ø:  8    ,Ø    ,Ø    ,Ø    ,A3
31:  4.   ,D5   ,A4   ,F4#  ,D3
32:  8    ,A4   ,A4   ,D4   ,F3#
33:  8    ,B4   ,G4   ,D4   ,G3
34:  8    ,A4   ,F4#  ,D4   ,D3
35:  8    ,Ø    ,Ø    ,Ø    ,Ø
36:  16   ,D5   ,A4   ,D4   ,F3#
37:  16   ,D5   ,A4   ,D4   ,F3#
38:  8    ,D5   ,B4   ,G4   ,G3
39:  16   ,D5   ,A4   ,F4#  ,D3
4Ø:  16   ,D5   ,A4   ,F4#  ,Ø
41:  8    ,D5   ,B4   ,G4   ,Ø
42:  16   ,D5   ,A4   ,D4   ,F3#
43:  16   ,D5   ,A4   ,D4   ,F3#
44:  8    ,D5   ,B4   ,G4   ,G3
45:  16   ,D5   ,A4   ,F4#  ,D3
46:  16   ,D5   ,A4   ,F4#  ,Ø
47:  8    ,D5   ,B4   ,G4   ,D4
48:  8    ,D5   ,A4   ,D4   ,F3#
49:  8    ,C5#  ,G4   ,E4   ,E3
5Ø:  8    ,D5   ,F4#  ,A3   ,D3
51:  8    ,D5   ,E4   ,A3   ,A3
52:  8    ,C5#  ,E4   ,A3   ,A2
53:  8    ,D5   ,F4#  ,A3   ,D3
54:  8    ,A5   ,D5   ,A4   ,F3#
55:  8    ,G5   ,C5#  ,A4   ,E3
56:  8    ,F5#  ,D5   ,A4   ,D3
57:  4.   ,E5   ,A4   ,C4#  ,A3
58:  8    ,A4   ,A4   ,E4   ,C4#
59:  8    ,F5#  ,A4   ,D4   ,D4
6Ø:  8    ,E5   ,A4   ,C4#  ,A3
61:  8    ,Ø    ,Ø    ,Ø    ,C4#
62:  8    ,Ø    ,Ø    ,Ø    ,E4
63:  4.   ,E5   ,A4   ,C4#  ,A3
```

```
COL: LEN  ,V1   ,V2   ,V3   ,V4
 64:  8    ,A4   ,A4   ,E4   ,C4#
 65:  8    ,F5#  ,A4   ,D4   ,D4
 66:  8    ,E5   ,A4   ,C4#  ,A3
 67:  8    ,Ø    ,Ø    ,Ø    ,Ø
 68:  16   ,E5   ,A4   ,E4   ,C4#
 69:  16   ,E5   ,A4   ,E4   ,C4#
 7Ø:  8    ,F5#  ,A4   ,D4   ,D4
 71:  16   ,E5   ,A4   ,C4#  ,A3
 72:  16   ,E5   ,A4   ,C4#  ,A3
 73:  8    ,Ø    ,F4#  ,D4   ,A3
 74:  16   ,E5   ,A4   ,E4   ,C4#
 75:  16   ,E5   ,A4   ,E4   ,C4#
 76:  8    ,F5#  ,A4   ,D4   ,D4
 77:  16   ,E5   ,A4   ,C4#  ,A3
 78:  16   ,E5   ,A4   ,C4#  ,A3
 79:  8    ,Ø    ,F4#  ,D4   ,A3
 8Ø:  8    ,E5   ,A4   ,E4   ,C4#
 81:  8    ,F5#  ,A4   ,D4   ,D4
 82:  8    ,E5   ,A4   ,E4   ,C4#
 83:  8    ,D5   ,A4   ,F4#  ,B3
 84:  8    ,D5   ,G4#  ,D4   ,B3
 85:  8    ,C5#  ,A4   ,E4   ,A3
 86:  16   ,Ø    ,A4   ,C4#  ,E3
 87:  16   ,Ø    ,A4   ,C4#  ,E3
 88:  8    ,Ø    ,A4   ,D4   ,F3#
 89:  8    ,Ø    ,A4   ,C4#  ,E3
```


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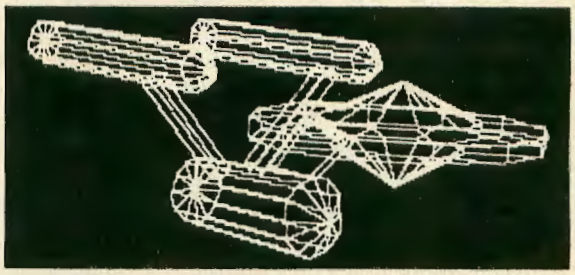

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Rejuvenate Father Time with a Chic Quartz-Locked Clock

By Henry C. Gernhardt, Jr.

Many years ago when I purchased my first computer I sorely felt the need for some sort of clock everytime DOS asked for the time and date. I solved the date problem with a calendar, but the cost of a quartz-locked board with battery backup was prohibitive. And all the clock circuits shown in computer and electronic magazines were very difficult to build.

Today, with computers that just a few years ago sold for several thousand dollars now selling for several hundred, it is possible to find quartz clock modules in many hobby shops. These black box modules are pre-wired, require no external circuitry and generally make use of widely available penlight cells that last for several years. They are even available with electronic gongs and chimes.

Construction begins with the hunt for parts. Locate either a five and one-quarter inch or eight-inch diskette. A magnetic tape reel could be substituted, but you will have to use some ingenuity since nine-track computer tape is incompatible with most diskette machines (unless you have a tape transport mechanism).

Next, you need a piece of mat board, cardboard, or a thin piece of plywood or hardboard. Cut this piece into a square slightly smaller than the diskette. (See Figure 1.) Cut, punch or drill a three-eighths-inch hole in the exact center. This dimension is not critical, and a bit of play may even be beneficial.

Use some double-sided tape, contact cement or any kind of adhesive to affix the mat board to the backside of the diskette. I used double-sided tape to hold everything together while the silicon rubber glue (RTV) set up. This allows for quick assembly, yet provides a secure joining of the two pieces.

Make sure the hold in the mat board is centered in the middle of the diskette jacket hub hole. Then center the diskette itself, making sure all three holes are concentric. A dab of RTV will ensure they remain centered.

For the diskette clock assemblies, quartz clock modules with one-quarter inch or shorter mounting collars should be used, but longer collars are acceptable if you use appropriate spacers or are making a computer tapereel-based unit. These marvelous little black boxes make use of both electronic and mechanical linkages and offer quartz-locked accuracy at an affordable price.

Mount the black box through the center hole from the back of the diskette assembly. Make sure the rubber gasket has been placed over the mounting collar. Put a brass washer and mounting nut over the collar from the front of the diskette and tighten. Mount the time indicators according to the directions that come with the module. Secure them with a cap nut, or an open nut if you plan to use a second indicator.

Viola! A handsome wall clock in the shape of a computer diskette. Various LCD and LED modules are also available. One of these can be mounted in the hub hole of a diskette or even in the head slot. For movements using electronic chimes, a thin box can be constructed in which to mount the chime, using the diskette as a lid.

I painted the second hands fluorescent orange, the hour hand red and the minute hand yellow to provide easily deciphered time. Dots, numerals and other kinds of markers for dial indicators are available from clock movement suppliers. I did not use dial indicators because I like the starkness of an unmodified and unmarked diskette with the orange second hand sweeping an

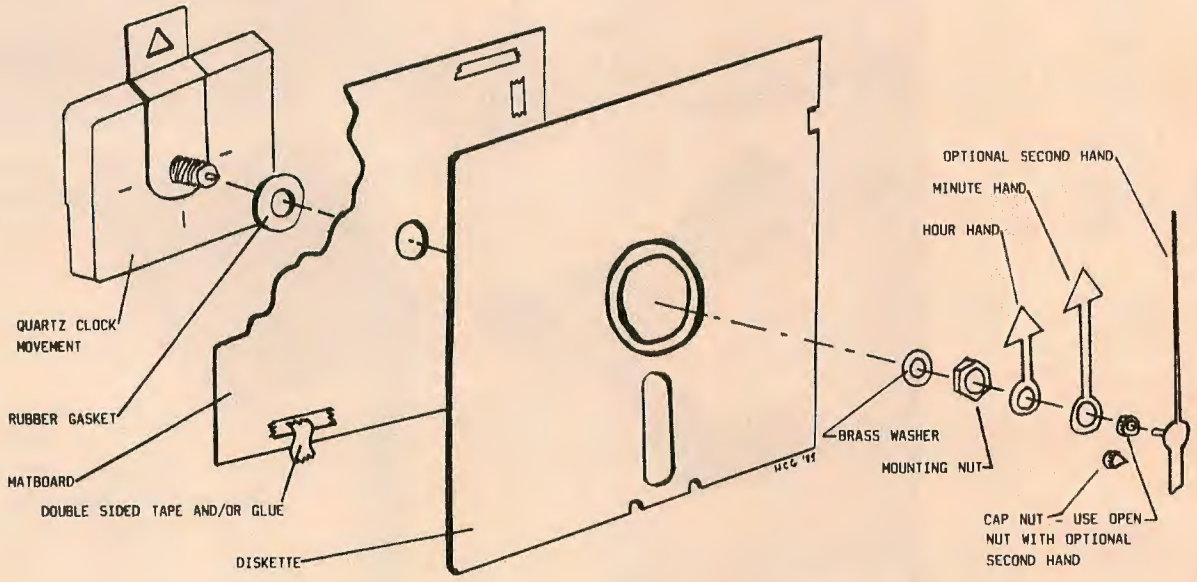
Henry Gernhardt lives in Huntington, West Virginia, and is the owner and operator of H and F Data Service. His company provides word processing, business graphics and data services to authors, students and local businesses.

eternal path around a black background. My diskette clock draws many compliments.

One supplier of quartz movements is Klockit, P.O. Box 629, Highway H North, Lake Geneva, WI 53147.

(You may contact Mr. Gernhardt with questions about the quartz clock construction at 926 Ninth St., Huntington, WV 25701, phone 304-697-4642. Please enclose an SASE when writing.) □

Figure 1



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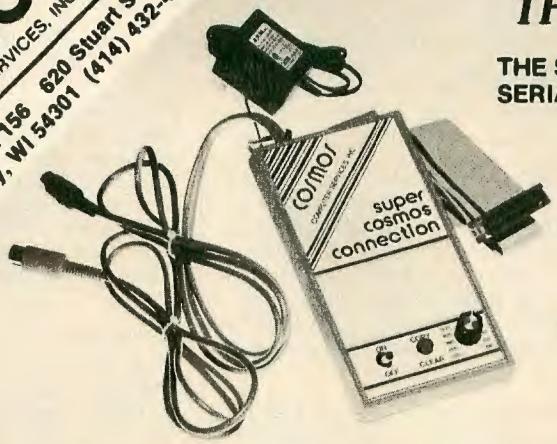

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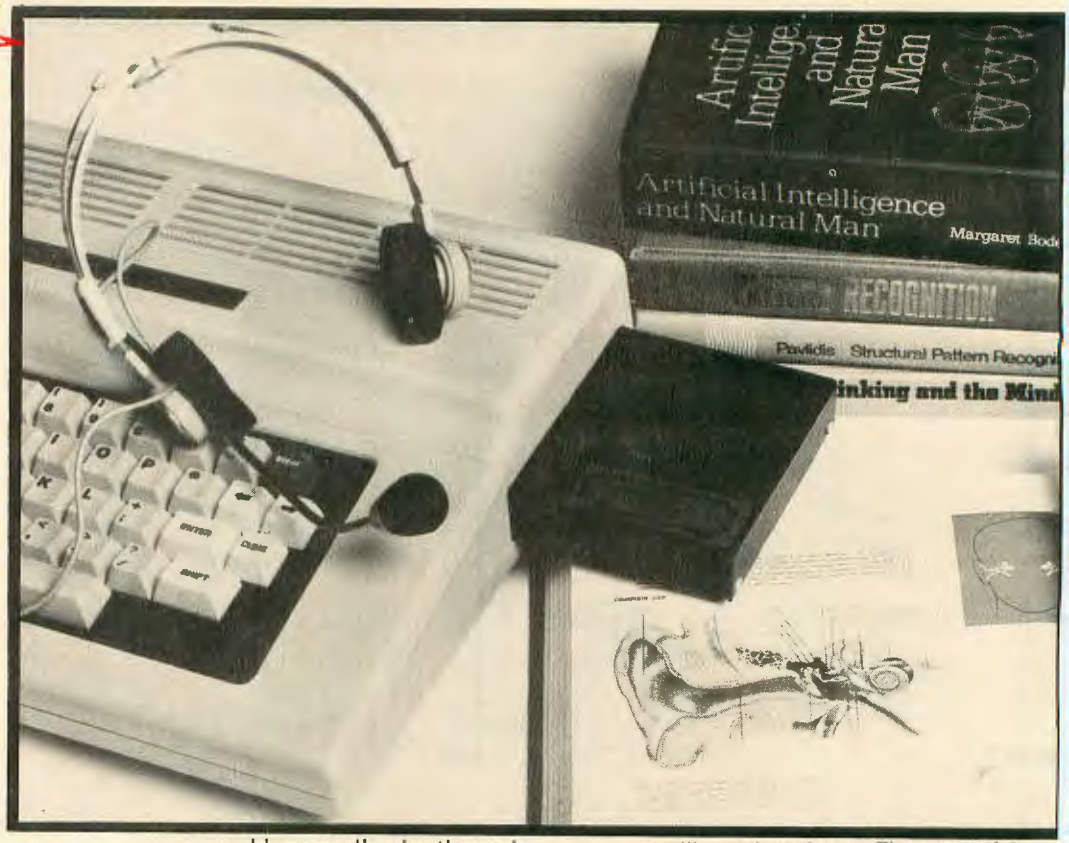

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THE LIBRARY. Each group of the library contains words designed for a particular application. The SCIENTIFIC LIBRARY contains phrases designed for process or home control. The EDUCATIONAL LIBRARY has those words to help ensure keeping a child's attention. Words may be put together to form sentences and easily produced from BASIC, so you can write your own programs with incredible speech quality.

GENERAL 1
EARS SPEECH LIBRARY

AGAIN	GET	OUT
ALL	GO	PASS
AND	HALF	PENNY
AT	HAVE	PLEASE
BUY	HOUR	QUARTER
CALL	IN	READY
CASE	IS	REACH
CENT	IT	RIGHT
CLEAR	LEAVE	SECOND
CLOSE	LEFT	SELECT
COMPUTER	LEVEL	SEND
CONNECT	LOVE	SET
DAY	MORE	START
DIAL	MULTIPLY	STOP
DOLLAR	NEAR	SOUTH
DOWN	NEED	THAN
DOOR	NEXT	THE
EAST	NICKEL	THIRD
END	NO	TIME
ENTER	NORTH	UP
FAST	NUMBER	WAIT
FASTER	OF	WEST
FIFTH	OFF	YES
FIRST	ON	YOU

2 disks $19.95

GENERAL 2
EARS SPEECH LIBRARY

ADD	HELLO	PRESS
ASK	HELP	PLACE
ASSISTANCE	HERE	PLAY
AUTO	HOLD	POINT
BUT	INCORRECT	QUICK
COCO	INCREASE	RADIO
COMPLETE	JUST	RECEIVE
CONTINUE	KEY	RECORD
COPY	LESS	REPLACE
CORRECT	LESSER	REVERSE
COST	LIGHT	ROOM
DATE	LOWER	SERVICE
DECREASE	LOWEST	SIDE
DEPOSIT	MONEY	SLOW
DIME	MOVE	SLOWER
DIVIDE	NEAR	SPACE
DRIVE	NEED	STATION
ENTRY	NEXT	THANK YOU
EXIT	NOT	THIS
FLOOR	NOTICE	TOTAL
FORWARD	ONWARD	TRY
FROM	OPEN	TURN
GOING	OR	USE
GREAT	OVER	YOUR

2 disks $19.95

Alphabet/Numbers
EARS SPEECH LIBRARY

ONE	A	ALPHA
TWO	B	BRAVO
THREE	C	CHARLIE
FOUR	D	DELTA
FIVE	E	ECHO
SIX	F	FOXTROT
SEVEN	G	GOLF
EIGHT	H	HOTEL
NINE	I	INDIA
TEN	J	JULIETT
ELEVEN	K	KILO
TWELVE	L	LIMA
THIRTEEN	M	MIKE
FOURTEEN	N	NOVEMBER
FIFTEEN	O	OSCAR
SIXTEEN	P	PAPA
SEVENTEEN	Q	QUEBEC
EIGHTEEN	R	ROMEO
NINETEEN	S	SIERRA
TWENTY	T	TANGO
THIRTY	U	UNIFORM
FORTY	V	VICTOR
FIFTY	W	WHISKEY
SIXTY	X	X-RAY
SEVENTY	Y	YANKEE
EIGHTY	Z	ZULU
NINETY	THOUSAND	MILLION
HUNDRED	ZERO	

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SCIENTIFIC
EARS SPEECH LIBRARY

ABORT	FIRE	MICRO
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ALARM	FEET	MILLI
AMPERE	FLOW	MINUS
ATTENTION	FORCE	MINUTE
BRAKE	FUEL	NORMAL
BUTTON	GALLON	OPERATOR
CANCEL	GAS	PER
CAUTION	GRAM	PERCENT
CENTIGRADE	HERTZ	PHASE
CHANGE	HIGH	POUND
CHECK	HIGHER	PRESSURE
CONTROL	INCHES	PULSE
CURRENT	INTRUDER	RANGE
DANGER	KILO	SAFE
DEGREE	LIMIT	SMOKE
DISK	LOAD	SPEED
EMERGENCY	LOCK	SWITCH
EQUAL	LOW	SYSTEM
ERROR	MEASURE	TEMPERATURE
EVACUATE	MARK	TEST
FAHRENHEIT	MEG	VOLT
FAIL	MEGA	WARNING
FAILURE	METER	WEIGHT

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AMIE	GIRL	QUESTION
ANSWER	GIVE	RACHAEL
AROUND	GOOD	RICHARD
AREA	HILL	SAY
AWAY	HORSE	SENTENCE
BEFORE	HOW	SINK
BOB	JOHN	SIT
BOX	LAURA	SIGN
BOY	LIKE	SOLVE
CAN	LINDA	SPELL
CAT	LISA	SQUARE
CHAIR	MAKE	SPRING
CHRIS	MEAGAN	SUBTRACT
CLASS	MEASURE	SUMMER
DAY	MISSING	TABLE
DECIMAL	MODIFY	TAKE
DESK	NAME	TEACHER
DIFFERENCE	NIGHT	TIM
DO	NOUN	TOM
DOG	PEOPLE	UNDER
DRINK	PERIOD	VERB
FALL	PHRASE	WOULD
FIND	PRODUCT	WINTER

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CUSTOM
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For those needing a custom vocabulary, Speech Systems offers customized speech libraries at the rate of $15 per phrase (5 seconds max.), 10 phrases minimum order. Provide an audio cassette tape with phrases or use our announcer. . . . . Minimum $150.00

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*EARS and Disk system required.
†Custom Library not part of introductory offer.

SYMPHONY 12™

A 12 VOICE POLYPHONIC STEREO MUSIC SYNTHESIZER

NEW! 61 NOTE KEYBOARD

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- 4 NOISE GENERATORS
- SOUND EFFECTS
- PLAYS AND MAKES MUSICA 2 FILES

SUPER POLYPHONIC. Speech Systems is proud to bring you SYMPHONY 12, a polyphonic 12 voice hardware stereo music synthesizer for the Color Computer. SYMPHONY 12 also gives you 4 noise generators for percussion synthesis and sound effects. The PIANO KEYBOARD and MUSICA 2 (sold separately) turns your COCO into a real music machine with incredible flexibility.

STEREO and MONO. By connecting SYMPHONY 12 to your home stereo system, music is produced in stereo, 6 voices from each channel. However, you don't need to have a stereo system, all 12 voices also come out of your TV or monitor.

PICK AN INSTRUMENT. SYMPHONY 12 lets you choose from 10 preset instruments to synthesize chimes, violin, oboe, banjo, harpsichord, piano and more. You can even change instruments as the music plays.

SOUND EFFECTS. SYMPHONY 12 is a sophisticated sound generator. 12 voices and 4 noise generators give you incredible sound effect capability. We have included gun shot, explosion, racing car and more.

WATCH IT PLAY. As SYMPHONY 12 plays, a graphics display of a piano keyboard shows the notes playing. The display is entertaining as well as very educational.

PLAY MUSICA 2 FILES. Thousands of MUSICA 2 users will be excited to know SYMPHONY 12 plays all music developed using MUSICA 2 like you have never Seen or Heard it. In fact we highly recommend the use of MUSICA 2 as a composition development tool for SYMPHONY 12. Use MUSICA 2's superior graphics input capability and then play it through SYMPHONY 12. You can also take advantage of our MUSIC LIBRARY series (sold separately) to give you access to over 500 music pieces representing 20 hours of music.

ULTIMATE MUSIC DEVELOPMENT SYSTEM. SYMPHONY 12, MUSICA 2, and the PIANO KEYBOARD give you incredible flexibility. Imagine sitting down at the PIANO KEYBOARD, playing a piece and recording it as you play just as you would to a tape recorder. Save your masterpiece and then using MUSICA 2 edit it if you like and print it. If you have a MIDI synthesizer, you can take the music and play it using COCO MIDI (sold separately). Try that on an IBM, APPLE, or COMMODORE (good luck).

PIANO KEYBOARD. For those wishing to turn SYMPHONY 12 into a real polyphonic synthesizer we offer the extremely powerful and versatile PIANO KEYBOARD. The PIANO KEYBOARD was deisgned to be used in our entire music product line. You can use it with SYMPHONEY 12, MUSICA 2, SYNTHER 77 PLUS, and even our advanced speech synthesizer, SUPER VOICE.

When using MUSICA 2, you will be using 4 of the 12 voices available from SYMPHONY 12. To take advantage of the full 12 voice capability of SYMPHONY 12 you may use either the Color Computer's keyboard or the PIANO KEYBOARD.

Y-CABLE or MULTI-PAK. Tape users using both SYMPHONY 12 and the PIANO KEYBOARD will require a Y-CABLE. Disk users will require the Triple Y-Cable or MULTI-PAK.

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SYMPHONY 12 (with Keyboard order)	$59.95
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- Metronome available.
- Real time recording.
- Save your masterpiece to disk.
- Tempo may be modified.
- Quantizing to 32nd or 64th.

- Playback any or all tracks at any tempo.
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- Simple music editing.
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- Transposition.

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Now under development, voicing patch libraries for the Casio CZ series of synthesizers.

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We offer the CZ-101 CONNECTION and the 61 NOTE PIANO KEYBOARD to turn the 101 into a professional full size synthesizer.

CZ-101 CONNNECTION . $29.95
61 NOTE KEYBOARD . $129.95

MUSICA MIDI™

COCO MIDI takes any MUSICA 2 music file and plays it through your music synthesizer. We offer you over 800 tunes from our MUSIC LIBRARY series (sold separately) or create your own music using the best music composition program available, MUSICA 2 (sold separately).

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MUSIC LIBRARY™

The MUSIC LIBRARY series consists of 8 volumes: 100 through 800 each sold separately. Each contains over 100 four voice music selections with a playing time of over 3 hours each. The disk version is shipped on 5 full disks. When coupled with the STEREO PAK, the music is reproduced with unsurpassed realism.

A JUKEBOX program is included to allow you to select specific songs or automatically play each. These songs are ready to go, you don't need MUSICA 2 or a knowledge of music. MUSICA 2 users may customize each song. Each volume sold separately, specify tape or disk. . . . . **$29.95** Tape or Disk

MUSIC LIBRARY 100

Stage, Screen, & TV	Classical
Music of the 70's	Christmas (popular)
Music of the 60's	Christmas (traditional)
Music of the 50's	Patriotic
Old Time Favorites	Polka Party

MUSIC LIBRARY 200 (another 100 selections)
MUSIC LIBRARY 300 (another 100 selections)
MUSIC LIBRARY 400 (another 100 selections)
MUSIC LIBRARY 500 (another 100 selections)
MUSIC LIBRARY 600 (another 100 selections)
MUSIC LIBRARY 700 (another 100 selections)
MUSIC LIBRARY 800 (another 100 selections)

Entire Library
30 Hours of Music!
40 disks or 25 tapes

SYNTHER 77 PLUS

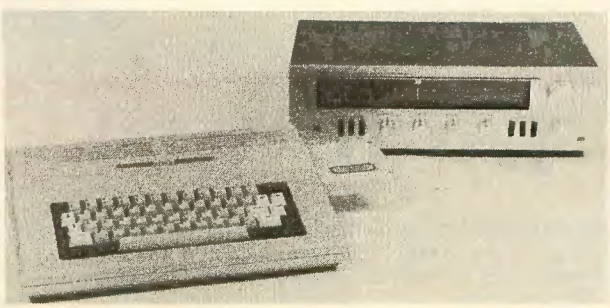
You control vibrato pattern, Bender rate, Volume level as well as Attack, Decay, Sustain, and Release (ADSR envelope). As you play you can record, then edit and save it to disk or tape. You can even fine tune it to match other instruments.

The PIANO KEYBOARD is not necessary, you can use your COCO keyboard but the PIANO KEYBOARD makes your COCO a real music instrument. . . . . **$29.95** Disk only

STEREO PAK™

Plug this gem into your computer, connect to your home stereo system and sit back and enjoy music realism. The STEREO PAK is a hardware music synthesizer that plays our MUSIC LIBRARY series and MUSICA 2 music in stereo. Because it was designed specifically with music reproduction in mind, the sound is superb. The highs are crisp and clear while the bass notes will rattle your walls. Internally we use two high performance 8 bit digital to analog converters to assure fidelity.

The STEREO PAK is all hardware. It is intended as an enhancement for MUSICA 2 and our MUSIC LIBRARY series. Disk users will require our Y-CABLE or a MULTI-PAK. **$39.95**



NEW! 61 NOTE PIANO KEYBOARD

ATTENTION CZ-101 OWNERS

Our new 61 note (5 octave) full size keyboard is perfect for the beginner or professional. To give the PIANO KEYBOARD the most flexibility, we give you a choice of 5 different products to use: SYMPHONY 12, MUSICA 2, SYNTHER 77 PLUS, SUPER VOICE, and the CZ-101 CONNECTION.

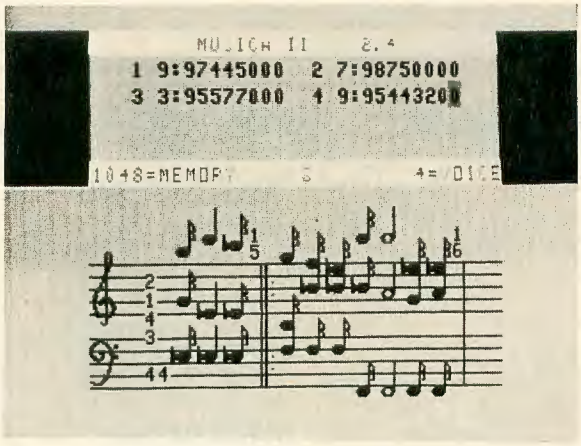
The PIANO KEYBOARD and SYMPHONY 12 turns the COCO into a 12 voice music synthesizer. When used with MUSICA 2, the PIANO KEYBOARD provides a user-friendly means of inputting music. For those wishing control over Vibrato, Volume, Bender, as well as Attach, Decay, Sustain, and Release (ADSR), we offer SYNTHER 77 PLUS, a monophonic synthesizer. SUPER VOICE, COCO's most advanced speech synthesizer, doubles as a music synthesizer when used with the PIANO KEYBOARD. For those with the Casio CZ-101 music synthesizer, the CZ-101 CONNECTION allows you to connect the "full size" PIANO KEYBOARD to give you standard keyboard.

61 NOTE PIANO KEYBOARD **$129.95**
CZ-101 CONNECTION . . . . . **$ 29.95**

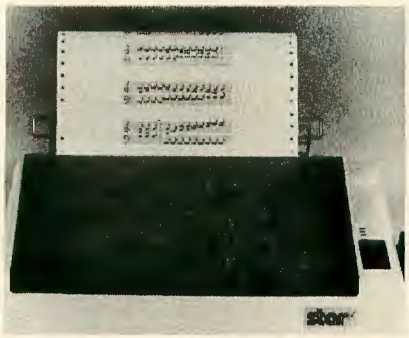
MUSICA 2 $29.95

Tape or Disk

- When in stereo mode, music is played through our STEREO PAK (purchased separately).
- Loudness of each voice may be individually specified.
- Memory available is constantly displayed.
- Voice waveshapes may be exchanged between voices at any point.
- Tempo may be specified and may even be altered as the music plays.
- Flats and sharps supported.
- Billions of timbre combinations.
- High resolution graphic display, looks just like sheet music.
- MUSICA 2 is 100% software, no need for hardware unless you want music produced in STEREO. In that case, the STEREO PAK may be purchased separately. It's a must for the audiophile!
- Repeat bars allow repeating of music without re-inserting music a second or third time.
- 30 page manual describes all.
- Requires 64K.



- Output music to your printer (Gemini 10X, Epson, R.S. printers).



- Allows you to specify key signature.
- Voice timbre (waveshape) may be altered by specifying harmonic content just like stops on an organ.
- During editing, voice being inserted is displayed.
- Each measure is numbered for easy reading of music.
- Measure bars aid in reading and developing music.
- Each voice may be visually highlighted for easy identification.
- 4 Voices produced simultaneously.
- Input notes from Coco keyboard, joystick, or Piano Keyboard.
- Play music from your own BASIC program.
- Block copy music for easy music development.
- 100% machine language so it is lightning fast.
- Vibrato effect easily produced.
- With STEREO PAK, voices may be switched between left and right speakers as music plays.
- Durations include: whole, half, quarter, eighth, sixteenth, thirty-second, sixty-fourth, and triplet.

MUSIC THEORY

COURSE 1

This course covers all the basics from music notation & duration, key signatures, tempo, to an introduction of the keyboard. This is an entry level course recommended as a prerequisite for Course 2. 32K Disk only **$49.95**

COURSE 2

A more advanced course that deals with: Major and Harmonic Minor scales, interval spelling, Triad (Chord) theory, Inversions, Dominant 7th chords, and ear training of the intervals. 32K Disk only . **$49.95**

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COCO'S MOST ADVANCED SPEECH SYNTHESIZER.

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SUPER VOICE is no ordinary speech synthesizer. It uses Silicon Systems, Inc. SSI-263, the most advanced speech/sound chip available. SUPER VOICE is not only capable of highly intelligible speech, sound effects, and singing over a 6 octave range, but now we have turned SUPER VOICE into a monophonic Super Music Synthesizer with our PIANO KEYBOARD.

IT TALKS. A free TRANSLATOR text-to-speech program makes writing your own talking program as easy as SAYING "HELLO."

SUPER VOICE works in any 32K or 64K computer. A disk system requires a Y-Cable or Multi-Pak.

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Volume Levels	[redacted]	1	1	1
Articulation Rates	[redacted]	1	1	1
Vocal Tract Filter Settings	[redacted]	1	1	1
Basic unit of Speech	[redacted]	64 phonemes	64 allophones 5 pause lengths	64 phonemes
Pitch Variations	[redacted]	4	1	4

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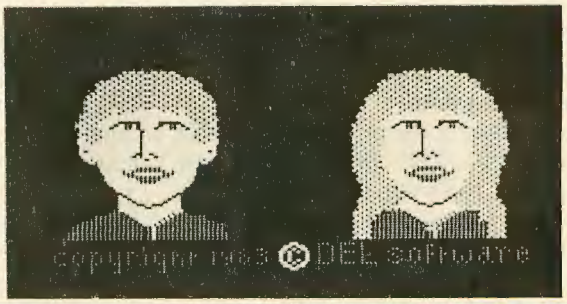
SUPER TALKING HEADS

Paul and Pauline, our talking heads program is normally $24.95. Until May 15 we will include them with each SUPER VOICE order.



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Mix the PLAY command with Sound Processor and you'll have . . .

CoCo Instant Music

By Dan Tandberg, M.D.

The PLAY command in Extended Color BASIC is a useful and powerful command for creating sound effects and music on the CoCo, but has always seemed difficult to use in actual practice. The string arguments for this command must be written in BASIC and then laboriously altered using the EDIT command. This trial-and-error procedure can be cumbersome. To overcome this and other problems, I have written a specialized text editor, *Sound Processor*, to facilitate creating and using strings for the PLAY command.

Using the Program

When running the program shown in Listing 1, the screen briefly clears and then shows the main display and the first of four help screens. Pressing 'H' at any time brings up the next help screen. These screens contain all the symbols and commands in the *Sound Processor* program.

The display area on the top half of the screen contains the page number and the length of the string on that page. To create a sound, type in the symbols wanted and they are displayed. For example, try:

```
T200;O4;L40;V22;1;2;3;4;5;6;
```

To see how this sounds, press the space bar and this string will be executed using the PLAY command. (Review the section on the PLAY command in the Extended BASIC manual if this seems confusing.)

Small changes can easily be made in this string using the various features of *Sound Processor*. You can hear the changes quickly and conveniently before going on. In this way, sounds and music can be created and edited as quickly and easily as text can be manipulated on a word processor.

Program Features

All of the features and functions of *Sound Processor* are displayed on the four help screens for easy reference during use. Press 'H' until the first help screen labeled SYMBOLS appears. This is a list of all the characters that can be entered into a string argument for the PLAY command.

Note that the program allows the use of either letters (A through G) or numbers (1 through 12) for notes. In addition, the plus (or '#') and minus signs are used for sharps and flats. The length, tempo, pause, octave and volume parameters are listed with their allowable ranges. The other symbols, ';' '<', '>' and '.', are also used in the standard fashion. Anytime you press one of these valid characters, it is added to the string at the cursor position.

Press 'H' again to see the second help screen labeled CURSOR. This shows all of the possible ways the cursor can be manipulated. The right- and left-arrow keys move the cursor one space forward or backward and, if shifted, move it 10 spaces in the appropriate direction. The up-arrow key moves the cursor to the very beginning of the string (home) while the down-arrow key moves it to the end of the page. The CLEAR key deletes the character just in front of the cursor.

Sound Processor can edit and test up to eight different strings at once, with each string displayed on a separate "page." The shifted up- and down-arrow keys are used to move forward and backward. (When first running the program, all eight pages are, of course, empty.)

The third help screen, labeled PLAY ROUTINES, shows the different ways the strings can be executed. The space bar, as mentioned, plays one repetition of the string on the page displayed. Pressing ENTER plays the displayed

Dan Tandberg lives in Albuquerque where he teaches emergency medicine at the University of New Mexico.

string several times in a row. Initially, the sound is played three times, but the repeat counter can be set to any number desired using the '$' function. Finally, pressing the '@' key plays all the pages in rapid succession, beginning with page one and ending with page eight. These commands are especially helpful when writing music. Small sections can be developed separately and each tested using the space bar. The whole piece can then be played with '@'.

The last help screen contains the TRANSFER ROUTINES. These may seem a bit complicated, but are useful for moving strings or parts of strings around between pages. The '!' key extends a string by taking all the characters from the cursor to the end of the string and adding this substring onto the end of the string. This is especially helpful when you need to write a string with many repeated elements.

To see how this works, go to page two (use SHIFT-down arrow) and type in:

```
T4;L2;O4;V25;EEFGGFEDCCDE;
L2.;E;L8.;D;L2;D;P2;
```

Now play it using the space bar. Move the cursor to the beginning of the page (up arrow). Press the '!' key and watch what happens. To complete the phrase, change the last three notes to 'D', 'C' and 'C'. You can use this extend function repeatedly until the string becomes too long. (Each page is limited to 240 characters).

The insert command (close parenthesis) actually inserts a blank page and moves each page above it up by one. Any data in page eight is lost, so be careful. The delete command (open parenthesis) simply deletes a page and moves everything above it downward.

Pressing the '%' key allows you to exchange pages. For example, pages one and two can be swapped. The '&' key adds the page specified to the displayed page. The '=' key copies the displayed page to the page specified. You can also replicate a page with the apostrophe (') key. This makes a copy of the displayed page, inserts it into the next higher page and moves everything above upward. As with the insert command, the highest page is lost. Finally, pressing SHIFT and CLEAR together erases the entire displayed page, leaving all others intact.

Notice the message at the bottom of each help screen, IF ERROR OR BREAK USE GOTO 10. Whenever you make a syntax mistake in a string and try to play it, you'll get an error message (SN). If the program is run again, it erases all the strings already created. To avoid this, simply enter GOTO 10 and the program returns to where you were. Fix the error in the string and go on.

Input/Output Routines

Press 'I' at any time to bring up the I/O menu. This is used for saving or loading strings created to or from tape. Strings can be sent to the line printer as well by using option seven.

Perhaps the most useful I/O routines are three and four. These save either the displayed page or all eight pages to tape, but as DATA statements with line numbers. These files can be reloaded at a later time and used in your own BASIC programs without retyping any of the data.

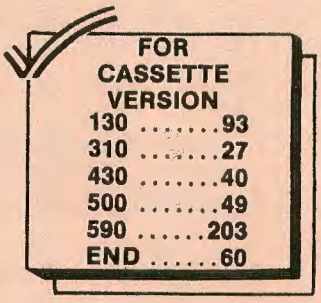
Modifications

Sound Processor can easily be modified to hold more pages of strings. Simply increase the value of 'Z' in Line 560 to suit your own needs. Also increase the amount of string space cleared in Line 20. Lines 650 and 660 may also be altered to produce DATA statements with different line numbers, if needed.

The *Sound Processor* can also be modified for disk operation by simply changing the device number in Line 670 and making minor changes in a few other lines. Substituting the lines shown in Listing 2 demonstrates one method of doing this.

I've found that using the *Sound Processor* markedly improves the utility of the PLAY command. Having all the information continuously available from the help screens is a real plus. Sound effects or music can be developed in a matter of minutes rather than hours. When a set of strings is finished, saving them as DATA lines using option four from the I/O menu produces a file that can be incorporated into one of your own BASIC programs. I would enjoy hearing about any modifications or unique applications.

(Questions about this program can be directed to Dr. Tandberg at 4130 Coe Drive NE, Albuquerque, NM 87110, phone 505-256-9457. Please enclose an SASE when writing.) □



Listing 1: SOUNDCAS

```
1Ø 'SOUND PROCESSOR
    DAN TANDBERG, M.D.
    ALBUQUERQUE, NEW MEXICO
2Ø IFF=ØTHENCLEAR4ØØØ:GOSUB55Ø
3Ø CLS:GOSUB24Ø
4Ø L=LEN(N$(I)):PRINT@Ø,"PAGE";I
;"OF";Z:PRINT@2Ø,"LENGTH=";
5Ø PRINT@27,L,LEFT$(N$(I),C);CHR
$(2Ø7);RIGHT$(N$(I),L-C):GOSUB1Ø
Ø
6Ø N=INSTR(Q$,K$):IFN>23THENIF L
<X THENN$(I)=LEFT$(N$(I),C)+K$+R
IGHT$(N$(I),L-C):C=C+1:L=L+1:GOT
O5ØELSEGOTO5Ø
7Ø IFN>12THENPRINT@32,C$:PRINT@3
2,"";:ON N-12 GOSUB25Ø,27Ø,29Ø,3
ØØ,31Ø,33Ø,36Ø,37Ø,39Ø,41Ø,43Ø:P
RINT@32,C$:PRINT@32,"";ELSE ON N
 GOSUB12Ø,13Ø,14Ø,15Ø,16Ø,17Ø,18
Ø,19Ø,2ØØ,21Ø,22Ø,23Ø
8Ø GOTO4Ø
9Ø 'WAIT SUBROUTINE
1ØØ K$=INKEY$:IFK$=""THEN1ØØELSE
RETURN
11Ø 'MAIN SUBROUTINES
12Ø C=C-(C<L):RETURN
13Ø C=C+(C>Ø):RETURN
14Ø IFC<(L-9)THENC=C+1Ø:RETURNEL
SEC=L:RETURN
```

```
15Ø IFC>9THENC=C-1Ø:RETURNELSEC=
Ø:RETURN
16Ø C=Ø:RETURN
17Ø C=L:RETURN
18Ø PLAYN$(I):RETURN
19Ø IFC>ØTHENN$(I)=LEFT$(N$(I),C
-1)+RIGHT$(N$(I),L-C):C=C-1:RETU
RNELSERETURN
2ØØ FORK=1TOR:PLAYN$(I):NEXTK:RE
TURN
21Ø FORK=1TOZ:PLAYN$(K):NEXTK:RE
TURN
22Ø IFL+LEN(RIGHT$(N$(I),L-C))<=
X THENN$(I)=N$(I)+RIGHT$(N$(I),L
-C):C=C+LEN(RIGHT$(N$(I),L-C)):R
ETURNELSERETURN
23Ø H=H+1:IFH>3THENH=Ø
24Ø PRINT@288,H$(H);:RETURN
25Ø IFI<Z THENI=I+1ELSEI=1
26Ø C=Ø:RETURN
27Ø IFI>1THENI=I-1ELSEI=Z
28Ø C=Ø:RETURN
29Ø PRINT"ERASE THIS PAGE?  (Y/N
)";:GOSUB1ØØ:IFK$<>"Y"THENRETURN
ELSEN$(I)="":C=Ø:RETURN
3ØØ PRINT"REPEAT COUNTER IS SET
TO";R:INPUT"ENTER NEW VALUE";R:I
FR<1THENR=1:RETURNELSERETURN
31Ø INPUT"PAGE TO APPEND";K:IFK>
Z OR K<1THENRETURN
32Ø IFLEN(N$(I)+N$(K))<X THENN$(
I)=N$(I)+N$(K):C=L:RETURNELSERET
URN
33Ø PRINT"REPLICATE THIS PAGE?
(Y/N)";:GOSUB1ØØ
34Ø IFK$<>"Y"ORI=Z THENRETURN
35Ø FORK=Z-1TOI STEP-1:N$(K+1)=N
$(K):NEXTK:RETURN
36Ø PRINT"EXCHANGE THIS PAGE WIT
H PAGE #";:INPUTK:IFK<1ORK>Z THE
NRETURNELSEN$(Ø)=N$(I):N$(I)=N$(
K):N$(K)=N$(Ø):C=Ø:RETURN
37Ø PRINT"INSERT A BLANK PAGE?
(Y/N)":GOSUB1ØØ
38Ø IFK$<>"Y"ORI=Z THENRETURNELS
EFORK=Z-1TOI STEP-1:N$(K+1)=N$(K
):NEXTK:N$(I)="":C=Ø:RETURN
39Ø PRINT"DELETE THIS PAGE?  (Y/
N)":GOSUB1ØØ
4ØØ IFK$<>"Y"THENRETURNELSEIFI=Z
 THENN$(I)="":C=Ø:RETURNELSEFORK
=I TO Z-1:N$(K)=N$(K+1):NEXTK:N$
(Z)="":C=Ø:RETURN
41Ø PRINT"COPY PAGE";I;"TO PAGE
#";:INPUTK:IFK<1ORK>Z THENRETURN
ELSEN$(K)=N$(I):C=Ø:RETURN
42Ø 'I/O ROUTINES
43Ø CLS:PRINT"   I/O ROUTINES:",
STRING$(32,2Ø8);"Ø  EXIT I/O MEN
U","1  SAVE PAGE",,"2  SAVE ALL
PAGES","3  SAVE PAGE (DATA)"
44Ø PRINT"4  SAVE ALL PAGES (DAT
A)","5  LOAD PAGE",,"6  LOAD ALL
 PAGES","7  LPRINT ALL PAGES","8
  SAVE MAIN PROGRAM":GOSUB1ØØ
45Ø CLS:N=INSTR(M$,K$):IFN=ØTHEN
GOSUB24Ø:RETURN
46Ø ON N GOSUB47Ø,48Ø,49Ø,5ØØ,51
Ø,52Ø,53Ø,54Ø:GOTO43Ø
47Ø PRINT"SAVE PAGE";I:INPUT"CAS
SETTE READY TO RECORD?       FIL
ENAME";K$:PRINT "SAVING PAGE";I:
OPEN"O",#D,K$:PRINT#D,N$(I):PRIN
TN$(I):CLOSE#D:RETURN
48Ø PRINT"SAVE ALL PAGES:":INPUT
"CASSETTE READY TO RECORD?
 FILENAME";K$:PRINT "SAVING PAGE
S";1;"TO";Z:OPEN"O",#D,K$:FORK=1
TOZ:PRINT#D,N$(K):PRINTN$(K):NEX
TK:CLOSE#D:RETURN
49Ø PRINT"SAVE PAGE (DATA)";I:IN
PUT"CASSETTE READY TO RECORD?
    FILENAME";K$:PRINT"SAVING PA
GE";I;"(DATA)":OPEN"O",#D,K$:K$=
STR$(Q)+" DATA "+N$(I):PRINT#D,K
$:PRINTK$:CLOSE#D:RETURN
5ØØ PRINT"SAVE PAGES (DATA):":QQ
=Q:INPUT"CASSETTE READY TO RECOR
D?       FILENAME";K$:PRINT"SAVI
NG ALL PAGES (DATA)";I:OPEN"O",#
D,K$:FORK=1TOZ:K$=STR$(QQ)+" DAT
A "+N$(K):PRINT#D,K$:PRINTK$:QQ=
QQ+A:NEXTK:CLOSE#D:RETURN
```

Two-Liner Contest Winner . . .

This little routine is great as a stand-alone or it could be incorporated into most any home written education program. Alter it to suit your needs.

The listing:

```
1Ø CLS:PRINT@16Ø,"I WILL TEACH Y
OU YOUR           MULTIPLICATION
 TABLES.":INPUT"WHICH TABLE(1-12
)";M:CLS:Y=RND(12):PRINT@2ØØ,"WH
AT IS"M"*"Y"":INPUT A:IF A=M*Y T
HENPRINT"CORRECT":FOR P=1TO46Ø*5
:NEXT:GOTO1Ø
2Ø CLS:PRINT@2Ø5,"WRONG":FOR P=1
TO46Ø*5:NEXT:GOTO1Ø
```

Mary Hooper
Waterford, Ontario

(For this winning two-liner contest entry, the author has been sent copies of both *The Second Rainbow Book of Simulations* and its companion *The Second Rainbow Simulations Tape.*)

```
51Ø PRINT"LOAD PAGE:";I:INPUT"CA
SSETTE READY TO PLAYBACK?     FI
LENAME";K$:PRINT"LOADING PAGE";I
:OPEN"I",#D,K$:INPUT#D,N$(I):PRI
NTN$(I):CLOSE#D:RETURN
52Ø PRINT"LOAD ALL PAGES:":INPUT
"CASSETTE READY TO PLAYBACK?
 FILENAME";K$:PRINT"LOADING PAGE
S";1;"TO";Z:OPEN "I",#D,K$:FORK=
1TOZ:INPUT#D,N$(K):PRINTN$(I):NE
XTK:CLOSE#D:RETURN
53Ø PRINT"LINEPRINTING ALL PAGES
":INPUT"PRINTER ON";K$:IFK$<>"Y"
THENRETURNELSEFORK=1TOZ:PRINTN$(
K):PRINT#-2,N$(K):PRINT#-2:NEXTK
:RETURN
54Ø PRINT"SAVING MAIN PROGRAM:":
CSAVE"SP":RETURN
55Ø 'INITIALIZATION
56Ø Z=8:DIMN$(Z):'# OF PAGES
57Ø X=24Ø:'MAX PAGE LENGTH
58Ø C$=STRING$(X,32):'BLANK
59Ø DIMH$(3):FORH=ØTO3:READH$(H)
:H$(H)=H$(H)+LEFT$(C$,192-LEN(H$
(H)))+">>IF ERROR OR BREAK USE G
OTO 1Ø":NEXTH:H=Ø:'HELP SCREENS
6ØØ Q$=CHR$(9)+CHR$(8)+CHR$(93)+
CHR$(21)+CHR$(94)+CHR$(1Ø)+CHR$(
32)+CHR$(12)+CHR$(13)+"@!H"+CHR$
(91)+CHR$(95)+CHR$(92)+"$&'%)(=I
ABCDEFG123456789Ø#+-.><;OLTVP":'
MAIN STRING
61Ø M$="12345678":'I/O STRING
62Ø C=Ø:'CURSOR POSITION
63Ø I=1:'PAGE POINTER
64Ø R=3:'REPEAT COUNTER
65Ø Q=9ØØØ:'DATA LINE #
66Ø A=1Ø:'LINE # INCREMENT
67Ø D=-1:'DEVICE #
68Ø F=1:'RESTART FLAG SET
69Ø RETURN
7ØØ DATA"SYMBOLS:          LENGTH
L1-L255                    TEMPO
T1-T255  ABCDEFG           PAUSE
P1-P255  1; - 12;          OCTAVE
O1-O5    #+-.<>;           VOLUME
V1-V31"
71Ø DATA"CURSOR:              (SHIF
TED)     <- LEFT            <- LEFT
 TEN     -> RIGHT           -> RIGH
T TEN    UP HOME            UP LAST
 PAGE    DN END             DN LAST
 PAGE      (CLEAR TO DELETE)
72Ø DATA"PLAY ROUTINES:
          SPACE  PLAY THIS PAGE
          ENTER  PLAY WITH REPE
AT              @  PLAY ALL PAGES
                $  CHANGE REPEAT
COUNTER"
73Ø DATA"TRANSFER ROUTINES:
         ! EXTEND          ) INSER
T PAGE   % EXCHANGE        ( DELET
E PAGE   ' REPLICATE       = COPY
PAGE     & APPEND          I I/O M
ENU       (SHIFT/CLEAR TO ERASE
PAGE)"
74Ø END
```

Listing 2: SOUNDISK

```
1Ø 'CHANGES FOR DISK OPERATION
44Ø PRINT"4  SAVE ALL PAGES (DAT
A)","5  LOAD PAGE",,"6  LOAD ALL
 PAGES","7  LPRINT ALL PAGES","8
  SAVE MAIN PROGRAM","9  DIRECTO
RY":GOSUB1ØØ
46Ø ON N GOSUB47Ø,48Ø,49Ø,5ØØ,51
Ø,52Ø,53Ø,54Ø,545:GOTO43Ø
47Ø PRINT"SAVE PAGE";I:INPUT"FIL
ENAME";K$:PRINT "SAVING PAGE";I:
OPEN"O",#D,K$:PRINT#D,N$(I):PRIN
TN$(I):CLOSE#D:RETURN
48Ø PRINT"SAVE ALL PAGES:":INPUT
"FILENAME";K$:PRINT "SAVING PAGE
S";1;"TO";Z:OPEN"O",#D,K$:FORK=1
TOZ:PRINT#D,N$(K):PRINTN$(K):NEX
TK:CLOSE#D:RETURN
49Ø PRINT"SAVE PAGE (DATA)";I:IN
PUT"FILENAME";K$:PRINT"SAVING PA
GE";I;"(DATA)":OPEN"O",#D,K$:K$=
STR$(Q)+" DATA "+N$(I):PRINT#D,K
$:PRINTK$:CLOSE#D:RETURN
5ØØ PRINT"SAVE PAGES (DATA):":QQ
=Q:INPUT"FILENAME";K$:PRINT"SAVI
NG ALL PAGES (DATA)";I:OPEN"O",#
D,K$:FORK=1TOZ:K$=STR$(QQ)+" DAT
A "+N$(K):PRINT#D,K$:PRINTK$:QQ=
QQ+A:NEXTK:CLOSE#D:RETURN
51Ø PRINT"LOAD PAGE:";I:DIR:INPU
T"FILENAME";K$:PRINT"LOADING PAG
E";I:OPEN"I",#D,K$:INPUT#D,N$(I)
:PRINTN$(I):CLOSE#D:RETURN
52Ø PRINT"LOAD ALL PAGES:":DIR:I
NPUT"FILENAME";K$:PRINT"LOADING
PAGES";1;"TO";Z:OPEN "I",#D,K$:F
ORK=1TOZ:INPUT#D,N$(K):PRINTN$(I
):NEXTK:CLOSE#D:RETURN
53Ø PRINT"LINEPRINTING ALL PAGES
":INPUT"PRINTER ON";K$:IFK$<>"Y"
THENRETURNELSEFORK=1TOZ:PRINTN$(
K):PRINT#-2,N$(K):PRINT#-2:NEXTK
:RETURN
54Ø PRINT"SAVING MAIN PROGRAM:":
SAVE"SP":RETURN
545 DIR:GOTO1ØØ
61Ø M$="123456789":'I/O STRING
67Ø D=1:'DEVICE #
```

CoCo Dares You to Name That Tune

By Marge Rutter

We've all watched those people on TV winning the big bucks just for naming a couple of tunes. And haven't you, at least once, thought to yourself, "I can do that"? But could you? Under all that pressure? Are you really quicker than the other guy?

Here's your chance to see! *Name That Song* challenges two players with all that pressure in the comfort of your own home.

Listing 1 loads 48 songs, with their titles and clues about their identity, into disk files. The titles are camouflaged so typing in the program won't reveal any answers. Most songs are not listed in their entirety but enough is there to recognize the tune. Type in and run Listing 1. When it is finished, the files are loaded for future use. Listing 1 doesn't have to be run again.

Listing 2 is the game. Here, two players, joysticks in hand, can battle it out against each other. Keep in mind that the computer is doing many different things between each note, so the joysticks are not very sensitive. A quick press does not necessarily register. The key is to push the firebutton and hold it down until the song stops. If the joysticks don't have any effect on the song, you

Marge Rutter is currently studying to become a computer science teacher and holds a bachelor's degree in education/foreign languages. She lives in Phoenixville, Pennsylvania with her husband, two children and Color Computer.

need to change lines 5110, 5120 and 5135. The numbers 126 and 125 should be substituted for the numbers 254 and 253, respectively. Apparently, some CoCos produce one set of these numbers when the firebutton is pressed and others produce the other set.

Each song plays for only 30 seconds before the computer goes on to another song. If you want more time, increase the timer in Line 5125.

When the song is stopped, the computer allows time for the player to announce the answer verbally, before giving the correct answer. The players decide whether the answer will be accepted or not.

If the players decide to set a time limit and one of them takes too long, simply mark that answer as wrong, so there will be no point given.

Finally, since the songs are selected randomly some of them could easily be played two or more times during the course of the game.

However, flags are set on songs that have been played and each new song is checked to make sure it hasn't been played before. Occasionally, the program appears to lock up when it's trying to find a new song. If this happens, relax. Think of it as a commercial and it will be right back.

The game is divided into five parts:

Melody Roulette — Melody Roulette starts out with a spinning wheel to determine how much money you are playing for. The best out of five songs wins this part. A tiebreaker is played if necessary.

Tune Topics — The 48 songs are divided into six categories. One of these categories is randomly chosen and the five songs are selected from that category. Once again, the best out of five wins and tiebreakers are played in the event of a tie.

This is the one area in which the program could lock up permanently. In the unlikely event that too many songs from the chosen category were already played during Melody Roulette (leaving less than five songs to choose from) or if too many tiebreakers empty out the category, the program goes into an endless loop, searching for a song in the category when one doesn't exist. Just press BREAK and start over.

Bid-a-Note — On TV, if the player who bids can't name the song correctly, the other player gets the point. This has never seemed fair to me. So in my version of the game, I've made it impossible to win Bid-a-Note by default. If you don't bid, you don't win.

There is nothing in the program to prevent a player from bidding higher than the previous bid. Similarly, there is nothing to stop the first player from passing on the first bid. If the first player does pass the first time around, the second player gets the bid for 15 notes. Again, the best out of five wins.

Tiebreaker — Melody Roulette and Tune Topics are each worth 10 game points. Bid-a-Note is worth 20. So, it is possible to have a tie at the end of the first three parts. A simple, sudden death tiebreaker decides who goes on to the Golden Medley.

Golden Medley — Now one of the players is on his own and the pressure is really on. He has 30 seconds to name five songs. The timer runs only while the music is playing. Press the firebutton (using the right joystick) to stop the timer for the answer. Or, if not sure, pass and come back to it afterwards. Remember, one wrong answer ends the game! If you need reminders on how to play, there are optional directions before each section.

(Questions about this program may be directed to the author at 48 Kenalcon Drive, Phoenixville, PA 19460, phone 215-933-8612. Please enclose an SASE when writing.) □

```
260 .....84   1430 .....243
550 .....79   1530 .....97
630 .....105  1620 .....222
710 .....80   1740 .....114
790 .....239  1880 .....45
900 .....60   2010 .....150
1000 .....171 3025 .....175
1090 .....105 3100 .....104
1210 .....110 3165 .....227
1310 .....101 END .....175
```

Listing 1: SONGS

```
1Ø OPEN "D",#1,"SONGS/DAT",3
15 FIELD#1,3 AS NO$
2Ø FOR X=2ØØ TO 96ØØ STEP 2ØØ
3Ø Z=X
```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```
4Ø FOR C=1 TO 2
5Ø READ S$
6Ø RSET NO$=S$
7Ø PUT#1,Z
8Ø Z=Z+1
9Ø IF S$="P2Ø" THEN C=2 ELSE C=1
1ØØ NEXT C
11Ø NEXT X
12Ø CLOSE#1
13Ø OPEN"O",#2,"TITLES/DAT"
14Ø FOR X=1 TO 6
15Ø READ CA$
16Ø WRITE#2,CA$
17Ø FOR Y=1 TO 8
18Ø READ NO
19Ø FOR Z=1 TO NO
2ØØ READ CH
21Ø A$=A$+CHR$(CH)
22Ø NEXT Z
23Ø WRITE #2,A$
235 A$=""
24Ø NEXT Y
25Ø NEXT X
26Ø CLOSE#2
3ØØ OPEN"D",#1,"CLUES/DAT",1ØØ
31Ø FOR X=1 TO 48
32Ø READ CL$
33Ø WRITE#1,CL$
34Ø PUT#1,X
35Ø NEXT X
36Ø CLOSE#1
5ØØ DATA T2,L8,O3,G,E,L4,G,L8,G,
E,L4,G,L8,A,G,F,E,D,E,L4,F,L16,E
,F,L8,G,C,L16,C,C,L8,C,L16,C,D,E
,F,L4,G,L8,G,D,D,F,E,D,L4,C,P2Ø
51Ø DATAT2,O2,L4,G,L8,G,G,L4,G,L
8,G,G,L4,B,L8,O3,D,D,O2,B,B,L4,G
,A,L8,A,L4,A,L8,A,A,L4,F#,L8,A,A
,F#,F#,L4,D
52Ø DATAL8,G,G,G,G,L4,G,L8,G,G,L
4,B,L8,O3,D,D,O2,B,B,G,L3,O3,D,L
8,C,C,O2,B,A,A,L2,G,P2Ø
53Ø DATAT3,O3,L2,G,L4,E,L2,C,L6,
C,L8,D,L4,E,L2,G,L4,E,L2,C,G,L4,
E,L2,C,L4,D,E,L2,F#,G,A,L4,G,L8,
A,L4,A#,A,G,L4,E,D,D,L8,E,L4,F,E
,L8,D,G,G,G,P2Ø
54Ø DATAT3,O3,L4,C,L8,C,L4,C,L8,
D,L4,E,E,L8,E,L4,D,L8,C,L4,D,L8,
E,L2,C,L4,E,E,L8,F,L4,G,G,F,L8,E
,L4,F,L8,G,L4,E,P2Ø
55Ø DATAT4,O3,L4,C,C,C,L2,D,L4,D
,E,G,E,L2,C,O2,L4,G,O3,L2,C,L4,C
,L2,D,L4,D,L2,E,L3,C,L4,O2,G,O3,
L2,C,L4,C,L2,D,L4,D,E,G,E,L2,C,L
4,A,P18,L4,D,F,L2,E,C,P2Ø
56Ø DATAT3,O3,L4,G,L8,G,L4,E,L8,
A,L3,G,E,L4,G,L8,G,L4,E,L8,A,L3,
G,E,G,E,G,L4,E,L8,G,L3,G,G,O4,C,
P2Ø
57Ø DATAT2,O3,L8,E,D,C,D,E,E,L4,
E,L8,D,D,L4,D,L8,E,G,L4,G,L8,E,D
,C,D,E,E,L4,E,L8,E,D,D,E,D,L2,C,
P2Ø
58Ø DATAT2,O3,L4,C,C,G,G,A,A,L2,
G,L4,F,F,E,E,L8,D,D,D,D,L2,C,L4,
G,G,F,F,E,E,L2,D,L4,G,G,F,F,E,E,
L2,D
59Ø DATAL4,C,C,G,G,A,A,L2,G,L4,F
,F,E,E,D,D,L1,C,P2Ø
6ØØ DATAT2,L4,O4,C,L8,C,C,C,L4.,
C,P8,O3,L8,A#,O4,D,O3,A#,L4,O4,C
,L8,D,O3,A#,O4,C,L4.,C,P4,O3,L4,
A,L8,A#,O4,C,L2,D,C,P8,L8,D,O3,A
#,G,L4,F,L8,F,E,L2,D,L4,C,P2Ø
61Ø DATAT2,L8,O4,D#,L4,C,L16,C,O
3,A#,O4,C,O3,A#,L8,O4,C,O3,G,L16
,O4,C,O3,A#,L8,O4,C,C,L16,C,O3,A
#,O4,C,C,L8,D#,C,O3,G
62Ø DATAP8,O4,D#,L4,C,L16,C,O3,A
#,O4,C,O3,A#,L8,O4,C,O3,G,L16,O4
,C,O3,A#,O4,C,O3,A#,L8.,O4,C,L16
,C,D#,C,C,O3,A#,O4,L8,C,O3,G,P2Ø
63Ø DATAT2,O3,L4,A,G,A,O4,C,D,L8
,O3,G,L4,G,L8,F,L4,G,G,L8,F,G,L4
,A,F,G,L8,C,L4,C,L8,C,L4,C,L8,C,
L4,C,L8,C,L4,C
64Ø DATAA,G,A,O4,C,D,L8,O3,G,L4,
G,L8,F,L4,G,G,L8,F,G,L4,A,F,G,L8
,C,L4,C,L8,C,L4,C,L8,C,L4,C,L8,C
,L4,C,P2Ø
65Ø DATAT2,L2.,O3,G,L4,O4,D,L2,C
,L4.,O3,B,L8,A,G,F,L2,G,L4,C,L4.
,B,L8,A,G,F,L2,G,L4,C,L2.,D
66Ø DATAL4,E,L2.,C,L4,G,L4.,E,L8
,D,L2.,C,L4,G,L4.,E,L8,D,L4,C,E,
G,L8,O4,C,L3,O3,B,L8,A,B,L3,A,L8
,G,L2.,A,P2Ø
67Ø DATAT2,L8,O3,A,B,A,G,L2,A,P4
,L8,A,B,A,G,G,L1,E,P4,L8,O4,C,C,
C,C,C,L2,C,P4,L8,C,C,C,L4,C,L1,O
3,B,P2Ø
68Ø DATAT2,L4,O3,G,L8,F,L3,F,P6,
L8,A,B,O4,C#,D,E,F,L6,E,L16,D,L2
,D
69Ø DATAL8,D,D,C,O3,A#,A,G,L4,A#
,L8,A,L4,A,G,F,L8,A,L4,G,L8,D,L4
,F,L8,A,L3,A,P2Ø
7ØØ DATAT2,O3,L2,A,G,L8,G,A,O4,C
,O3,B,A,G,L1,E,L8,D,E,G,E,G#,E,L
2,B,A,L16,D,E,L4.,D,L8,C,L1,E
71Ø DATAL8,C,E,L2,A,G,L8,G,A,O4,
```

```
C,O3,B,A,G,L1,E,L8,D,E,G,E,G#,E,
L2,B,A,L16,D,E,L4.,D,L8,C,L1,E,P
2Ø
72Ø DATAT4,O3,L4,G,A,G,F,E,F,L2,
G,L4,D,E,L2,F,L4,E,F,L2,G,L4,G,A
,G,F,E,F,L2,G,D,G,L4,E,L3,C,P2Ø
73Ø DATAT2,L8,O3,F#,L4,F#,L8,G,L
4,A,A,L8,G,L4,G,P6,L8,G,L4,G,L8,
A,B,L4,B,L2.,A,L8,F#,F#,F#,E,L4,
D,L8,E,D,L2.,C,L8,O2,B,B,L4,O3,D
,E,E,L2.,D,P2Ø
74Ø DATAT2,L8,O3,C,D,F,F,O4,C,O3
,L2.,A,L8,A#,O4,L1,C,L4,E,D,C,O3
,L4.,A,L8,G,L2,F,L8,F,O4,E,F,F,D
,C,L4.,O3,A,L8,A#,L2,G,L8,C,D,F,
F,O4,C,O3,L1,A,P2Ø
75Ø DATAT1,L8,O3,E,D,F,L16,E,L4,
E,L8,E,D,F,L16,E,L4,E,L8,E,D,F,L
16,E,L4,E,L8,D,C#,E,L16,D,L4,D,L
8,D,C#,E,L16,D,L4,D,L8,C
76Ø DATAO2,B,O3,D,L16,C,L4,C,L8,
O2,B,A,O3,C,L16,O2,B,L4,B,L8,B,A
,O3,C,L16,O2,B,L4,B,P2Ø
77Ø DATAT2,L2,O2,B,L4,O3,D#,E,L3
,F#,L4,D#,O2,B,L2,O3,G,L4,F#,E,L
2,B,P25,L4,B,L2,O4,C,L4,O3,B,A,L
2,B,L4,A,G,L2,F#,L4,G,F#,L2,E,P2
Ø
78Ø DATAT2,L8,O3,G,L3,G,L8,G,L3.
,G,P8,L8,G,L4,O4,C,O3,C,L8,D#,L4
,F,L2.,F,L8,O3,G,L3,G,L8,G,L3,G,
P4,L8,G,L4,G,G,A,B,L8,O4,C,L4,D#
,D#,P2Ø
79Ø DATAT3,O3,L8,E,G,L4,G,G,E,A,
L2,G,L8,D,E,G,L4,G,G,A,L2,E,L8,E
,L4,F,F,L8,F,L4.,G,L4,A,G,L8,E,L
4,D,L8,C,L1,C,L8,C,E,L4.,G,L8,G,
G,L4,G,A,L2,G
8ØØ DATAL8,C,D,L4,E,L8,D,L4,D,L8
,C,L2,D,L8,C,L4,F,L8,F,L4,F,F,A,
L8,A,L4,A,O4,C,O3,L8,A,L2,G,P2Ø
82Ø DATAT2,O3,L8,A,A#,L4.,O4,C,L
8,C,L4,C,L8,C,L4.,C,O3,L8,A#,L4,
A,L8,A#,O4,C,L4,C,O3,A#,A,L2.,F,
L8,F,L4,A#,A#,L8,A,L4,F,L2.,C
83Ø DATAL8,C,L4,C#,C#,F,L8,O4,C,
O3,F,L2.,G,L8,A,A#,L4.,O4,C,L8,C
,L4,C,L8,C,L4.,C,L8,O3,A#,L4,A,L
8,A#,L4,O4,C,L8,C,C,O3,A#,A,A,L2
.,F,P2Ø
85Ø DATA T3,O3,L2,E,L4,E,L8,B,L2
,B,L8,B,L4.,F#,L8,G,L4,F#,L1,E,L
4,B,O4,D,L2,E,L4,D,O3,B,O4,C#,O3
,A,L1,B
86Ø DATAO4,L4,E,L2,E,L4,E,L2,D,L
4,O3,B,B,A,G,L8,F#,L1,D,L2,E,L4,
B,L2,A,L4,G,F#,E,D,L1,E,P2Ø
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88Ø DATAT2,L4,O3,D,L8,D,L4,G,A,L
3,B,P5Ø,L8,B,L4,B,L8,B,L4,O4,C,O
3,A,L8,G,L3,A,P15,F,L8,F,A#,L4,O
4,C,D,P15,L8,D,L4,D,L8,D,L4,D#,L
3,C,L8,O3,A#,L2,O4,C,P2Ø
9ØØ DATAT2,L16,O3,G,L8.,G,L16,E,
L2,G,L8,E,L4.,C,L16,G,L8,A,L4,G,
L16,G,L8.,G,L16,E,L4,F,F,L8,D,L4
.,O2,B,L16,O3,G,L8,A,L4,G,L16,G,
L8.,G,L16,E,L2,G,L8,E,L4.,C,L16,
G,L8,A,L4,G
91Ø DATAL16,G,L8.,G,L16,G,L4,G,G
,F,D,L2,C,P2Ø
93Ø DATAT3,L4,O4,C,C,C,D,D,O3,B,
A,L2.,G,O4,L4,C,C,C,F,F,E,C,D,L8
,E,D,L2.,C,L4,C,C,C,D,D,O3,B,A,L
2.,G,O4,L4,C,C,C,F,F,E,C,D,L8,E,
D,L2.,C,P2Ø
95Ø DATAT3,L4,O3,E,F,L2.,G,L8,A,
G,A,L2.,G,L4,G,G,A,G,F,E,D,L2.,E
,L8,F,E,F,L2.,E,L4,E,E,F,E,D,C,O
2,B,O3,L2.,C,L8,D,C,O2,B,L2.,O3,
C,L2,C,L8,D,C,D,L4,C,L2.,A,L1,O4
,C,P2Ø
97Ø DATAT2,L8,O3,E,G,A,O4,C,O3,B
,A,L2,A,L8,E,G,A,O4,C,O3,B,A,L2,
A,L8,A,A,O4,C,E,D,E,L4,E,L8,O3,A
,O4,D,C,O3,A,G,A,L4,A,L8,O4,C,D,
L4,C,L8,O3,A,G,A,L2,A,P2Ø
99Ø DATAT2,O4,L2,C,O3,L8,B,O4,C,
L4,D,C,O3,L4.,B,L8,F#,L2.,G#,L4,
O4,E,L2.,D,L2.,O3,A,L8,F,G,L4,G#
,A#,A#,O4,C,L2.,C
1ØØØ DATAC,O3,L8,B,O4,C,L4,D,C,O
3,L4.,B,L8,F#,L2.,G#,O4,L4,E,L2.
,D,O3,A,L8,F,G,L4,G#,A#,A#,O4,C,
L2.,C
1Ø1Ø DATAP8,L2,C,C,L8,G,G,G,G,L4
,G,L8,G,F,E,L4,D,L8,C,O3,B,O4,L2
,C,C,P2Ø
1Ø3Ø DATAT2,O4,L8,D,C,C,O3,A,O4,
L4,C,O3,L8,A,O4,L4,C,O3,L4.,A,P3
Ø,O4,L8,D,D,C,L4,C,L8,C,L2.,O3,A
1Ø4Ø DATAO4,L8,D,D,C,O3,A,A,F,G,
F,G#,L4,G,F,L8,F,F,L4,A,L8,G,F,G
,F,D,L2,F,L8,F,F,G#,G#,G,F,G,G,L
4,F,L2.,F
1Ø5Ø DATAL8,D,C,L2.,A,L8,G,E,L2,
F,O4,L2,C,O3,L8,A,A#,G,A#,A,L4,F
,A,L8,O4,C,C,D,C,O3,A,F,G,L4,G,L
2,F,L4,A,L8,G,F,G,L4,G,L2,F,P2Ø
1Ø7Ø DATAT2,L8,O3,G,L4.,A,O4,L4,
C,O3,L8,B,L4,G,D,L8,E,E,L4,G,A,G
,O4,C,O3,L8,B,L4,G,D,E,L8,G,L4.,
A,L8,G,L4,O4,C,L8,O3,B,L4,A,G,O4
,C,O3,L8,B,L4,A,G,L2,A
1Ø8Ø DATAL8,G,L4,A,O4,C,L8,O3,B,
L4,G,L8,D,D,L4,E,L8,G,L4,A,G,O4,
C,O3,B,L8,G,D,L4,D,L8,E,E,G,L4,A
,L8,G,O4,L4,C,O3,B,A,G,O4,C,O3,B
,G,B,A
1Ø9Ø DATAO4,D,L2,D,L4,O3,B,B,O4,
C,O3,L8,B,L4.,G,L4,O4,D,L8,C,O3,
L4,B,O4,D,C,L8,O3,B,L4.,G,O4,L4,
D,L8,C,O3,L4,B,O4,D,L8,C,L4.,O3,
B,L4,A,L8,G,L4.,A,P2Ø
111Ø DATAT2,L4,O3,F,L8,G,L4,A,G,
L8,A,A#,L4,A,G,F,G,L8,A,L4,G,F,L
8,A,L2,G
112Ø DATAO4,L4,C,L8,O3,A,L4,G,A,
O4,L8,C,O3,A#,L4,A,G,F,L8,G,A,L4
,G,F,L8,A,L2,G,P2Ø
114Ø DATAT1,L8,O2,G,L4.,O3,C,L8,
G,L4.,F,L8,C,D#,F,L8.,D,L16,O2,A
#,L4.,O3,C,L8,G,L4.,A#,L8,A,A#,O
4,C,L8.,O3,A,L16,F,L2,G
115Ø DATAL8,G,A#,O4,D,L8.,C,L16,
O3,G,L4,G,L8,O4,C,O3,G,O4,C,L8.,
D,L16,O3,G,L2,G,L8,F,G,G#,A#,L8.
,G,L16,D#,L8,F,G,L8.,D#,L16,C,L2
.,D,P2Ø
117Ø DATAT4,L1,O3,G,L2.,G,L4,F#,
G,L2.,A,L4,G,L2,A,L4,G,A,L2,G,L4
,F#,L1,F,A,L2.,A,L4,G#,A,L2.,B,L
4,A,L2,B,L4,A,B,L2,A,L4,G#,L1,G,
P2Ø
119Ø DATAT2,O3,L4,D,E,C#,P22,C,D
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,D,O2,B,P22,O3,D,D,D,E,C#,C#,C#,
E,C,L4,C,O2,B
12ØØ DATAO3,L8,C,O2,B,O3,C,O2,B,
O3,C,O2,B,O3,C,O2,B,O3,C,O2,B,L4
,O3,C,C,P22,L16,O2,B,L8,O3,D,D,C
#,L4,C#,P22,L8,O2,A,O3,C,D,O2,L1
6,B,A,L4,G,L8,O3,D,E,L4,C#,L8,C,
L4,D,O2,B
121Ø DATAO3,L8,D,D,D,E,C#,C#,C#,
O2,A,P22,L16,A,O3,C,L8,D,O2,B,P2
2,O3,C,O2,B,O3,C,O2,B,O3,C,O2,B,
O3,C,O2,B,O3,C,O2,B,O3,C,O2,B,L4
,O3,C,P2Ø
123Ø DATAT3,O3,L16,D#,L8,E,L16,G
,L8,A,O4,L4,C,O3,B,A,G#,G,G#,A,P
22,L8,G,G,L4,G#,A,A#,B,P22,O4,C,
O3,B,A,G#,G,G#,A,P22,L8,G,G,L4,G
#,A,B,O4,C,P2Ø
125Ø DATAT2,O4,L2,C,O3,G,L8,G,L4
,A,L8,G,F,L2,E,C,L8,G,L4,A,L8,G,
A,L2,B,L3,G,L8,E,L4,F,L8,F,F,E,L
4,D,L2,C,P2Ø
127Ø DATAT2,L8,O3,C,F,G,L2,A,L8,
A,G,F,L2.,A,L8,A,A#,O4,C,L2.,O3,
A#,L8,A#,F,L2.,G,O2,L8,A#,O4,L2.
,C,L8,D#,C,O3,G#,L2.,A#
128Ø DATAL8,A#,A#,A#,L2.,A,L8,D,
E,F#,G,A,L2.,B,L8,B,L2.,A#,L8,D#
,F,G,G#,A#,O4,L4,C,L4.,O3,G,O4,L
8,E,D,C,O3,L4.,A#,A,L8,A,L2.,F,L
8,F,L4,G,L8,E,L2.,F,P2Ø
13ØØ DATAT2,O3,L4,C,L8,D,L4,E,L8
,C,L4,E,C,L2,E,L4,D,L8,E,F,F,E,D
,L2,F,L4,E,L8,F,L4,G,L8,E,L4,G,E
,L2,G,L4,F,L8,G,A,A,G,F,L2,A
131Ø DATAL4,G,L8,C,D,E,F,G,L2,A,
L4,A,L8,D,E,F,G,A,L2,B,L4,B,L8,E
,F,G,A,B,L2,O4,C,L4,C,L8,O3,B,L4
,A,F,B,G,O4,L2,C,O3,L8,C,D,E,F,G
,A,B,O4,L4,C,P2Ø
133Ø DATAT2,O4,L4,C,O3,A,F,C,L8,
D,E,F,L4,D,L6,F,L4,C,G,O4,C,O3,A
,F,L8,D,E,F,L4,G,L6,A,L4,G
134Ø DATAA,L8,A#,A,G,L4,O4,C,O3,
A,L8,G,L4,F,G,L3,A,L8,F,L4,D,L8,
F,D,L4,C,C,F,L8,A,L4,G,L8,C,L4,F
,L8,A,L4,G,L8,A,A#,O4,C,O3,A,F,L
4,G,L8,C,L3,F,P2Ø
136Ø DATAT2,L4,O3,G,A,L4,B,L8,G,
L2.,E,L4,A,L8,F#,L2.,D,L4,G,L8,E
,L4,C,G,E,L8,C,L4,E,G,L4,F#,L2,D
137Ø DATAL8,G,A,L4,B,L8,G,L2.,E,
L4,A,L8,F#,L2.,D,L4,G,L8,E,L4,C,
G,E,L8,C,L4,E,G,L1,G,P2Ø
139Ø DATAT2,L8,O2,B,O3,C,L16,D,L
8.,D,L8,D,L16,E,L6,D,L16,C,L8,O2
,B,O3,C,D,D,D,L16,E,L8,G,P8,G,A,
B,A,G,L16,E,L8,B,A,G,L16,G,L8,E,
L4,D
14ØØ DATAL16,O2,B,L8.,O3,C,L16,D
,L8.,D,L8,D,L16,E,L6,D,L16,C,L8,
O2,B,O3,C,D,D,D,L16,E,L8,G,P8,G,
A,B,A,G,L16,G,L8,B,G,G,A,L2,A,P2
Ø
142Ø DATAT2,O3,L2.,F,O4,C,L4.,D,
L8,C,O3,L4,A#,O4,L2.,C,O3,L8,F,F
,L4.,F,L8,D,L4,F,D,L2,C,L8,A,O4,
C,L2,D,L8,C,O3,A,O4,L2,C
143Ø DATAO3,L8,A,F,L4,G,L4.,F,L8
,D,L2.,F,L8,G,A,F,F,L4,F,L2,F,L2
.,F,P2Ø
145Ø DATAT2,O3,L8,C,D,F,D,L4,A,C
,L2,C,L8,C,D,F,D,L4,A,C,L2,C,L8,
A#,A,A,G,L4.,G,L8,D,A#,L4,A,L8,A
#,A,L4.,G
146Ø DATAL8,A#,A,A,A,L4.,G,L8,C,
A#,L4,O4,C,O3,A,L8,G,P8,C,D,F,D,
L4,A,C,L2,C,L8,C,D,F,D,L4,A,C,L2
,C
147Ø DATAL8,A#,A,A,G,L4.,G,L8,D,
L4,A#,L8,A,L4,A,G,L8,D,A#,O4,C,O
3,A#,A,L4.,G,L8,C,A#,A,G,L4,A#,L
8,O4,C,O3,A,A,L4,G,F,P2Ø
149Ø DATAT2,O3,L4,D,E,L2,B,L4,A,
G,L2,E,L4,D,E,L2,B,L4,A,D,L2,B,L
4,D,L8,E,D,L4,F#,L8,E,L4.,F#,L8,
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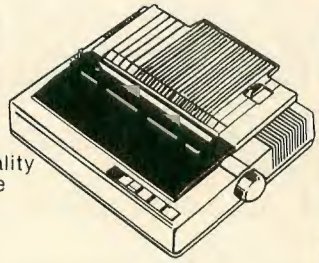

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```
F,F,F,F,L4,G,A,L1,E
15ØØ DATAL4,D,L8,E,D,L4,F#,L8,E,
L4,F#,L8,F,F,F,F,L4,G,A,L1,E,L4,
G,L8,A,G,L4,B,L8,A,L2,B,L8,B,B,B
,B,L4,O4,C,D,D,L8,O3,B,L2,B
151Ø DATAL8,B,B,B,B,L4,O4,C,D,O3
,B,L8,A,L2,G,L8,B,B,B,B,L4,O4,C,
D,L1,O3,G,P2Ø
153Ø DATAT2,O3,L2,A,L4.,F,L8,A,A
#,A,G,L4.,A,L8,A,A#,A,G,L4,A,L8,
G,F,L4,G,L16,E,D,L2,C,L8,A,O4,C,
L2,D,L4.,C,O3,L8,A,A#,A,G,L4,A,L
8,A,A#,A,G,L4,A,L8,G,F,L2,E,P2Ø
155Ø DATAT2,L2,O3,G,L8,A,B,O4,C,
O3,B,O4,C,O3,L4,B,L8,A,L4,B,L8,O
4,C,O3,B,O4,C,O3,L4,A,L8,A,B,O4,
L2,C,O3,L8,E,G#,L8,B,O4,L4.,C,L4
.,E,O3,L8,B,L4.,B,O4,L16,C,O3,B,
L4,A
156Ø DATAL4.,G,L16,A,G,L4.,F#,L2
,G,L8,A,B,O4,C,O3,B,O4,C,O3,L4,B
,L8,A,L4,B,O4,L8,C,O3,B,O4,C,L4,
O3,A,L8,B,O4,C,L8,O3,B,O4,C,L4,O
3,A
157Ø DATAP8,L8,G,A,A#,A,A,L4,A,L
8,G,A,A#,O4,L4,G,D,L8,C,O3,A#,L4
.,A#,O4,C,L8,O3,A#,A,L4.,A,L8,D,
B,G,L4.,G,P2Ø
158Ø DATA"CHILDREN'S TUNES"
159Ø DATA 12,84,72,73,83,32,79,7
6,68,32,77,65,78
16ØØ DATA 42,79,78,69,32,76,73,8
4,84,76,69,32,84,87,79,32,76,73,
84,84,76,69,32,84,72,82,69,69,32
,76,73,84,84,76,69,32,73,78,68,7
3,65,78,83
161Ø DATA 18,83,69,83,65,77,69,3
2,83,84,82,69,69,84,32,83,79,78,
71
162Ø DATA 17,73,84,9Ø,89,32,66,7
3,84,83,89,32,83,8Ø,73,68,69,82
163Ø DATA 19,8Ø,79,8Ø,32,71,79,6
9,83,32,84,72,69,32,87,69,65,83,
69,76
164Ø DATA 21,82,73,78,71,32,65,8
2,79,85,78,68,32,84,72,69,32,82,
79,83,73,69
165Ø DATA 22,77,65,82,89,32,72,6
5,68,32,65,32,76,73,84,84,76,69,
32,76,65,77,66
166Ø DATA 27,84,87,73,78,75,76,6
9,32,84,87,73,78,75,76,69,32,76,
73,84,84,76,69,32,83,84,65,82
167Ø DATA"ANOTHER TIME...ANOTHER
 PLACE"
168Ø DATA 12,71,85,65,78,84,65,7
```

```
8,65,77,69,82,65
169Ø DATA 18,83,85,77,77,69,82,3
2,73,78,32,84,72,69,32,67,73,84,
89
17ØØ DATA 31,68,79,32,89,79,85,3
2,75,78,79,87,32,84,72,69,32,87,
65,89,32,84,79,32,83,65,78,32,74
,79,83,69
171Ø DATA 1Ø,77,79,79,78,32,82,7
3,86,69,82
172Ø DATA 18,67,65,76,73,7Ø,79,8
2,78,73,65,32,68,82,69,65,77,73,
78
173Ø DATA 9,89,69,83,84,69,82,68
,65,89
174Ø DATA 15,84,72,69,32,87,65,8
9,32,87,69,32,87,69,82,69
175Ø DATA 14,76,79,78,68,79,78,3
2,66,82,73,68,71,69,83
176Ø DATA"LOVE SONGS"
177Ø DATA 21,73,7Ø,32,73,32,87,6
9,82,69,32,65,32,67,65,82,8Ø,69,
78,84,69,82
178Ø DATA 21,87,69,39,86,69,32,7
9,78,76,89,32,74,85,83,84,32,66,
69,71,85,78
179Ø DATA 15,84,72,69,32,87,65,8
9,32,79,7Ø,32,76,79,86,69
18ØØ DATA 16,65,78,78,73,86,69,8
2,83,65,82,89,32,83,79,78,71
181Ø DATA 26,84,72,73,83,32,71,8
5,89,83,32,73,78,32,76,79,86,69,
32,87,73,84,72,32,89,79,85
182Ø DATA 19,73,32,72,79,78,69,8
3,84,76,89,32,76,79,86,69,32,89,
79,85
183Ø DATA 2,73,7Ø
184Ø DATA 16,83,67,65,82,66,79,8
2,79,85,71,72,32,7Ø,65,73,82
185Ø DATA "AS THE WORLD TURNS"
186Ø DATA 14,85,8Ø,32,85,8Ø,32,6
5,78,68,32,65,87,65,89
187Ø DATA 37,72,69,39,83,32,71,7
9,84,32,84,72,69,32,87,72,79,76,
69,32,87,79,82,76,68,32,73,78,32
,72,73,83,32,72,65,78,68,83
188Ø DATA 31,89,79,85,32,65,82,6
9,32,84,72,69,32,83,85,78,83,72,
73,78,69,32,79,7Ø,32,77,89,32,76
,73,7Ø,69
189Ø DATA 28,89,79,85,32,65,78,6
8,32,77,69,32,65,71,65,73,78,83,
84,32,84,72,69,32,87,79,82,76,68
19ØØ DATA 17,65,73,78,39,84,32,7
8,79,32,83,85,78,83,72,73,78,69
191Ø DATA 22,84,72,69,32,65,73,8
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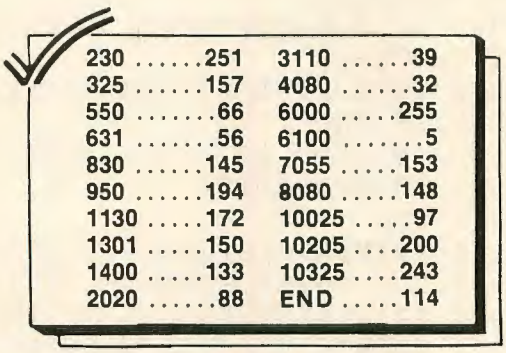
2,32,84,72,65,84,32,73,32,66,82,
69,65,84,72,69
192Ø DATA 16,74,79,89,32,84,79,3
2,84,72,69,32,87,79,82,76,68
193Ø DATA 14,79,78,32,65,32,74,6
9,84,32,8Ø,76,65,78,69
194Ø DATA "OLD FAVORITES"
195Ø DATA 23,84,72,69,32,76,73,7
9,78,32,83,76,69,69,8Ø,83,32,84,
79,78,73,71,72,84
196Ø DATA 6,69,88,79,68,85,83
197Ø DATA 17,66,69,69,82,32,66,6
5,82,82,69,76,32,8Ø,79,76,75,65
198Ø DATA 14,83,8Ø,73,78,78,73,7
8,71,32,87,72,69,69,76
199Ø DATA9,65,76,76,69,89,32,67,
65,84
2ØØØ DATA 9,66,79,82,78,32,7Ø,82
,69,69
2Ø1Ø DATA 15,67,79,76,79,85,82,3
2,77,89,32,87,79,82,76,68
2Ø2Ø DATA 9,68,79,32,65,32,68,69
,65,82
2Ø3Ø DATA"WOMEN"
2Ø4Ø DATA 5,68,65,73,83,89
2Ø5Ø DATA 21,72,69,89,32,84,72,6
9,82,69,32,76,79,78,69,76,89,32,
71,73,82,76
2Ø6Ø DATA 1Ø,73,32,65,77,32,87,7
9,77,65,78
2Ø7Ø DATA 4,74,69,65,78
2Ø8Ø DATA 5,77,65,78,68,89
2Ø9Ø DATA 15,77,89,32,67,72,69,8
2,73,69,32,65,77,79,85,82
21ØØ DATA 7,67,69,67,73,76,73,65
211Ø DATA 23,84,72,69,32,77,79,8
3,84,32,66,69,65,85,84,73,7Ø,85,
76,32,71,73,82,76
3ØØØ DATA"A CHILDREN'S COUNTING
AND RHYMING SONG"
3ØØ5 DATA"YOU CAN'T SING THIS IF
 YOU CAN'T COUNT TO 1Ø"
3Ø1Ø DATA"THEME SONG OF A POPULA
R TV SHOW"
3Ø15 DATA"LET YOUR FINGERS DO TH
E WALKING..."
3Ø2Ø DATA"THE MONKEY INITIATES T
HE CHASE"
3Ø25 DATA"IT MAY NOT MAKE SENSE.
..BUT ALL THE KIDS LIKE IT"
3Ø3Ø DATA"THIS SONG TELLS OF A V
ERY DEVOTED PET"
3Ø35 DATA"I WONDER WHERE THIS SO
NG CAME FROM"
3Ø4Ø DATA"A 196Ø'S TUNE ADAPTED
FROM A SPANISH SONG BY JOSE MART
I"
3Ø45 DATA"WORDS AND MUSIC BY JOH
N SEBASTIAN, STEVE BOONE AND MAR
K SEBASTIAN"
3Ø5Ø DATA"A DIONNE WARWICK HIT O
F THE 6Ø'S"
3Ø55 DATA"ANDY WILLIAMS EARNED A
 GOLD RECORD WITH THIS ONE IN 19
61"
3Ø6Ø DATA"RECORDED BY THE MAMAS
AND PAPAS ON DUNHILL RECORDS"
3Ø65 DATA"WORDS AND MUSIC BY JOH
N LENNON AND PAUL MCCARTNEY"
3Ø7Ø DATA"FROM THE COLUMBIA PICT
URE OF THE SAME NAME"
3Ø75 DATA"WE ALL HAVE TO FALL SO
METIME"
3Ø8Ø DATA"WORDS AND MUSIC BY TIM
 HARDIN"
3Ø85 DATA"A 17Ø CARPENTERS HIT"
3Ø9Ø DATA"MUSIC BY JACK DIEVAL"
3Ø95 DATA"FROM 'THE JOLSON STORY
'"
31ØØ DATA"SUNG AND MADE FAMOUS B
Y HERB ALBERT ON HIS 1968 TV SPE
CIAL"
31Ø5 DATA"YOU CAN BE SURE I'M TE
LLING THE TRUTH IN THIS SONG"
311Ø DATA"LET ME KNOW IF THIS SO
NG BY JOHN ROSTILL SOUNDS FAMILI
AR"
3115 DATA"ADAPTED BY PAUL SIMON
AND ART GARFUNKEL"
312Ø DATA"A FIFTH DIMENSION HIT
OF THE 6Ø'S"
3125 DATA"ADAPTED BY GEOFF LOVE"
313Ø DATA"WORDS AND MUSIC BY STE
VIE WONDER"
3135 DATA"A HELEN REDDY HIT"
314Ø DATA"WORDS AND MUSIC BY BIL
L WITHERS"
3145 DATA"WORDS AND MUSIC BY ALB
ERT HAMMOND AND MIKE HAZLEWOOD"
315Ø DATA"THREE DOG NIGHT'S 1971
 HIT"
3155 DATA"PETER, PAUL AND MARY R
ECORDED THIS TUNE BY JOHN DENVER
 IN 1969"
316Ø DATA"BASED ON A SONG BY SOL
OMON LINDA AND PAUL CAMPBELL"
3165 DATA"FROM THE MOVIE OF THE
SAME NAME"
317Ø DATA"THE OKTOBERFEST WOULDN
'T BE THE SAME WITHOUT THIS ONE"
3175 DATA"WORDS AND MUSIC BY DAV
ID C. THOMAS"
318Ø DATA"WHAT'S A WEDDING WITHO
UT THIS SONG?"
3185 DATA"COLUMBIA PICTURES AND
CARL FOREMAN PRESENT..."
```

```
319Ø DATA"FROM 'THE BALLET FOR A
 GIRL IN BUCHANNON'"
3195 DATA"FROM 'SOUND OF MUSIC'"
32ØØ DATA"THIS USED TO BE A STYL
ISH TUNE"
32Ø5 DATA"WORDS AND MUSIC BY EAR
L SHUMAN AND LEON CARR"
321Ø DATA"A HELEN REDDY HIT"
3215 DATA"FROM THE 2ØTH CENTURY-
FOX FILM 'THE PRIME OF MISS JEAN
 BRODIE'"
322Ø DATA"BARRY MANILOWS FIRST H
IT SONG"
3225 DATA"WORDS AND MUSIC BY STE
VIE WONDER, HENRY COSBY AND SYLV
IA MOY"
323Ø DATA"WORDS AND MUSIC BY PAU
L SIMON"
3235 DATA"WORDS AND MUSIC BY NOR
RIS WILSON, BILLY SHERRIL AND RO
RY BOURKE"
```



230	251	3110	39
325	157	4080	32
550	66	6000	255
631	56	6100	5
830	145	7055	153
950	194	8080	148
1130	172	10025	97
1301	150	10205	200
1400	133	10325	243
2020	88	END	114

Listing 2: SONGGAME

```
99 CLEAR 5ØØØ:PCLEAR 2
1ØØ DIM SPOT(75)
1Ø1 CLS
1Ø2 W=1
1Ø3 PRINT@73,"NAME THAT SONG"
1Ø4 PRINT@367,"BY"
1Ø5 PRINT@426,"MARGE RUTTER"
1Ø6 GOSUB 3Ø3Ø
11Ø 'LOAD ARRAYS
12Ø OPEN "I",#1,"TITLES/DAT"
13Ø FOR X=1 TO 6
14Ø INPUT#1,CA$(X)
15Ø FOR Y=1 TO 8
16Ø INPUT#1,SO$(X,Y)
17Ø NEXT Y
18Ø NEXT X
19Ø CLOSE#1
2ØØ OPEN"D",#1,"SONGS/DAT",3
2Ø1 DIM NO$(2ØØ)
2Ø5 DIM ST$(48)
2Ø6 ST=Ø
21Ø CLS
211 PRINT@41,"NAME THAT SONG"
212 PRINT@73,STRING$(14,45)
215 PRINT@162,"PLAYER#1'S NAME";
22Ø INPUT P1$
223 PRINT@258,"PLAYER#2'S NAME";
225 INPUT P2$
23Ø 'MELODY ROULETTE
235 'PICK PLAYING AMOUNT
24Ø CLS
241 PRINT@352,STRING$(32,45)
242 PRINT@96,STRING$(32,45)
243 PRINT@232,"MELODY ROULETTE"
244 PRINT@292,"INSTRUCTIONS? <Y>
 OR <N>
245 I$=INKEY$
246 IF I$<>"Y" AND I$<>"N" THEN
GOTO 245
247 IF I$="Y" THEN GOSUB 1ØØØØ
25Ø SPOT(1)=1ØØ
255 SPOT(2)=25Ø
26Ø SPOT(3)=5ØØ
265 SPOT(4)=75Ø
27Ø SPOT(5)=1ØØ
275 SPOT(6)=25Ø
28Ø SPOT(7)=5ØØ
285 SPOT(8)=75Ø
286 Y=225
29Ø FOR X=1 TO RND(2Ø)+8
291 Y=Y-1
292 SOUND Y,1
295 CLS
3ØØ PRINT@352,STRING$(32,45)
3Ø5 PRINT@96,STRING$(32,45)
31Ø PRINT@143,CHR$(133)
315 PRINT@173,SPOT(X)
32Ø PRINT@2Ø2,SPOT(X+7)
325 PRINT@232,SPOT(X+6)
33Ø PRINT@266,SPOT(X+5)
335 PRINT@3Ø1,SPOT(X+4)
34Ø PRINT@272,SPOT(X+3)
345 PRINT@242,SPOT(X+2)
35Ø PRINT@2Ø8,SPOT(X+1)
355 SPOT(X+8)=SPOT(X)
36Ø FOR Z=1 TO (15*X):NEXT Z
365 NEXT X
37Ø MONEY=SPOT(X-1)
375 PRINT@388,"WE'RE PLAYING FOR
 $";MONEY
39Ø FOR Z=1 TO 5ØØ:NEXT Z
4ØØ 'PLAY MELODY ROULETTE
41Ø FOR A=1 TO 2
42Ø 'SELECT RANDOM TUNE
43Ø TUNE=TUNE+1
44Ø X=RND(6)
45Ø GOSUB 4ØØØ
46Ø R=((X-1)*8+Y)*2ØØ
465 GOSUB 3ØØØ
```

```
47Ø GOSUB 5ØØØ
48Ø IF C=Ø THEN GOSUB 6ØØØ ELSE
CLS:PRINT@261,"TIMES UP...NEXT T
UNE:":FORW=1 TO 5ØØ:NEXT W:A=1
53Ø IF TUNE>=5 AND P1<>P2 THEN A
=2
54Ø NEXT A
55Ø IF P1>P2 THEN PL$=P1$ ELSE P
L$=P2$
56Ø CLS:PRINT@45,PL$
561 PRINT@1Ø2,"WINS MELODY ROULE
TTE,"
563 PRINT@169,"1Ø GAME POINTS,"
564 PRINT@239,"AND"
565 PRINT@297,MONEY;"  DOLLARS"
566 PRINT@451,"PRESS SPACEBAR TO
 CONTINUE"
567 W$=INKEY$:IF W$<>CHR$(32) TH
EN GOTO 567
57Ø IF PL$=P1$ THEN T1=T1+1Ø ELS
E T2=T2+1Ø
58Ø TUNE=Ø:P1=Ø:P2=Ø:F=Ø:X$="WRO
NG"
6ØØ 'TUNE TOPICS
6Ø1 CLS
6Ø2 PRINT@96,STRING$(32,45)
6Ø3 PRINT@352,STRING$(32,45)
6Ø4 PRINT@234,"TUNE TOPICS"
6Ø5 PRINT@292,"INSTRUCTIONS? <Y>
 OR <N>"
6Ø6 I$=INKEY$
6Ø7 IF I$<>"Y" AND I$<>"N" THEN
GOTO 6Ø6
6Ø8 IF I$="Y" THEN GOSUB 1Ø1ØØ
6Ø9 C$="YES"
61Ø 'SELECT CATEGORY
62Ø T=RND(6)+2Ø
625 FOR R=1 TO T
63Ø CLS
631 PRINT@96,STRING$(32,45)
632 PRINT@352,STRING$(32,45)
635 Y=RND(5Ø)+2ØØ
64Ø SOUND Y,1
645 IF X=6 THEN X=Ø
65Ø X=X+1
655 PRINT@((111+X*32)-(LEN(CA$(X
))/2)),CA$(X)
66Ø FOR W=1 TO 5Ø:NEXT W
665 NEXT R
67Ø PRINT@418,"WE'LL BE HEARING
SONGS FROM:";
675 PRINT@(463-(LEN(CA$(X))/2)),
CA$(X)
685 FOR W=1 TO 1ØØØ:NEXT W
69Ø 'PLAY TUNE TOPICS
7ØØ FOR A=1 TO 2
71Ø 'SELECT RANDOM TUNE
72Ø TUNE=TUNE+1
73Ø GOSUB 4ØØØ
75Ø R=((X-1)*8+Y)*2ØØ
755 GOSUB 3ØØØ
76Ø GOSUB 5ØØØ
77Ø IF C=Ø THEN GOSUB 6ØØØ ELSE
CLS:PRINT@261,"TIMES UP...NEXT T
UNE":FOR W=1 TO 5ØØ:NEXT W:A=1
825 IF TUNE>=5 AND P1<>P2 THEN A
=2
83Ø NEXT A
84Ø IF P1>P2 THEN PL$=P1$ ELSE P
L$=P2$
85Ø CLS:PRINT@1Ø9,PL$
851 PRINT@168,"WINS TUNE TOPICS"
852 PRINT@238,"AND"
853 PRINT@297,"1Ø GAME POINTS"
854 PRINT@451,"PRESS SPACEBAR TO
 CONTINUE"
855 W$=INKEY$:IF W$<>CHR$(32) TH
EN GOTO 855
86Ø IF PL$=P1$ THEN T1=T1+1Ø ELS
E T2=T2+1Ø
87Ø TUNE=Ø:P1=Ø:P2=Ø:F=Ø:X$="WRO
NG":C$="NO"
9ØØ OPEN"D",#2,"CLUES/DAT",1ØØ
9Ø3 'BID-A-NOTE
9Ø5 CLS
9Ø6 PRINT@96,STRING$(32,45)
9Ø8 PRINT@352,STRING$(32,45)
91Ø PRINT@235,"BID-A-NOTE"
911 PRINT@292,"INSTRUCTIONS? <Y>
 OR <N>
912 I$=INKEY$
913 IF I$<>"N" AND I$<>"Y" THEN
GOTO 912
914 IF I$="Y" THEN GOSUB 1Ø2ØØ
915 DIM BI$(25)
92Ø FOR A=1 TO 2
925 CLS
93Ø 'SELECT RANDOM TUNE
94Ø TUNE=TUNE+1
95Ø X=RND(6)
96Ø GOSUB 4ØØØ
97Ø R=((X-1)*8)+Y
98Ø GET#2,R
99Ø INPUT#2,CL$
1ØØØ PRINT@33,"YOUR CLUE IS:"
1ØØ1 PRINT@64,CL$
1ØØ2 PRINT@128,STRING$(32,45)
1ØØ8 BI$(J)="15"
1Ø1Ø FOR Z=1 TO 2
1Ø2Ø J=J+1
1Ø3Ø IF INT(J/2)=J/2 THEN PL$=P1
$ ELSE PL$=P2$
```

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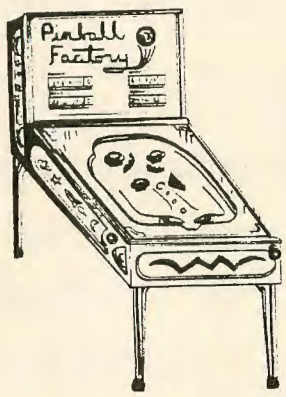

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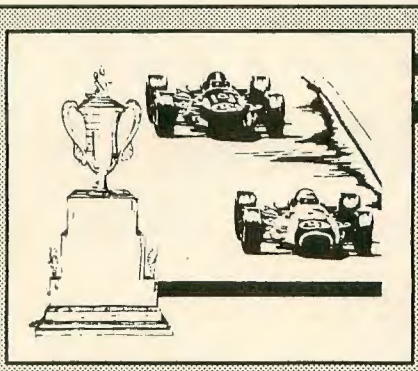
Change the rules: alter the gravity, bounce, and scoring!

64K Color Computer required. $34.95



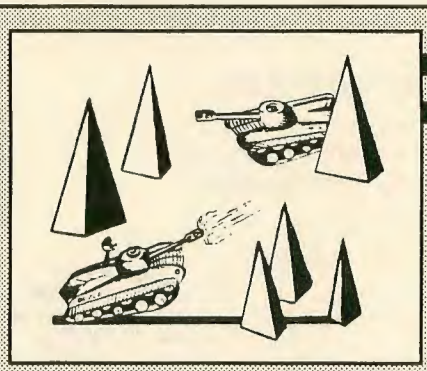
Speed Racer *by Steven Hirsch*

The checkered flag drops as your pulse rises in this lively new arcade game. The road twists to the horizon on the 3-D panorama that sets the stage for the most exciting race the CoCo has ever seen!

Vie for time as you speed through the curves at incredible speeds. Step through the gears to stay ahead of the pack, but step lively since some will stop at nothing to see the end of the race, or the end of you!

Four challenging raceways, complete with obstacles and colorful 3-D scenery, put your skills to the test in this Pole Position™ type game.

32K Color Computer required. $34.95



Rommel 3-D *by Kary McFadden*

You clutch the tank controls, searching for any sign of the enemy. Suddenly a blip appears on radar! Frantically, you move your tank into position. At last you spot the elusive enemy tank! Facing it, you race to lock sights and fire before he does!

Enter the ultimate battle-zone in this exciting 3-D tank combat game. Strategy, speed, and your tank's cannon are your only hope as you wind through a three-dimensional course inhabited by impenetrable barriers and enemy tanks.

Dazzling graphics and lifelike sound take you a step beyond the ordinary in this fast, machine-language arcade game. Enter the next dimension, ROMMEL'S troops are waiting for you!

32K Color Computer required. $29.95

MichTron

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```
104Ø PRINT"YOUR BID PLEASE ";PL$
;
105Ø INPUT BI$(J)
106Ø IF LEFT$(BI$(J),1)="P" THEN
 Z=2 ELSE Z=1
107Ø NEXT Z
108Ø IF PL$=P1$ THEN PL$=P2$ ELS
E PL$=P1$
109Ø R=((X-1)*8+Y)*2ØØ
11ØØ PRINT STRING$(32,45)
11Ø1 PRINT" YOUR CLUE WAS:"
11Ø2 PRINT CL$
111Ø PRINT "HERE ARE YOUR ";BI$(
J-1);" NOTES ";PL$
1111 FOR W=1 TO 2ØØØ:NEXT W
1115 GOSUB 3ØØØ
112Ø FOR K=1 TO VAL(BI$(J-1))
113Ø GET#1,R
114Ø INPUT#1,NO$
115Ø PLAY NO$
116Ø R=R+1
1165 IF INSTR(1,"#ABCDEFG",RIGHT
$(NO$,1))=Ø THEN K=K-1
117Ø NEXT K
118Ø GOSUB 6ØØØ
123Ø NEXT A
124Ø IF P1>P2 THEN PL$=P1$ ELSE
PL$=P2$
126Ø IF PL$=P1$ THEN T1=T1+2Ø EL
SE T2=T2+2Ø
127Ø IF T1>T2 THEN PL$=P1$ ELSE
IF T2>T1 THEN PL$=P2$ ELSE GOSUB
 7ØØØ
128Ø CLS
1281 PRINT@197,"AND THE WINNER I
S....."
1282 FOR W=1 TO 15ØØ:NEXT W:CLS
1283 PRINT@(2Ø6-(LEN(PL$)/2)),PL
$;"!!!"
1284 PRINT@328,"CONGRATULATIONS!
"
1285 PRINT@387,"YOU WILL NOW GO
ON ALONE TO"
129Ø PRINT@455,"THE GOLDEN MEDLE
Y!"
1295 FOR W=1 TO 25ØØ:NEXT W
13ØØ 'GOLDEN MEDLEY
13Ø1 CLS
13Ø2 PRINT@96,STRING$(32,45)
13Ø3 PRINT@352,STRING$(32,45)
13Ø4 PRINT@233,"GOLDEN MEDLEY"
13Ø5 PRINT@292,"INSTRUCTIONS? <Y
> OR <N>"
13Ø6 I$=INKEY$
13Ø7 IF I$<>"Y" AND I$<>"N" THEN
 GOTO 13Ø6
13Ø8 IF I$="Y" THEN GOSUB 1Ø3ØØ
13Ø9 CLS
131Ø PRINT@198,"PLEASE STAND BY.
...."
1311 PRINT@355,"WE ARE TRYING TO
 FIND 5 SONGSTHAT YOU HAVEN'T AL
READY HEARD."
1315 'PICK 5 TUNES AND LOAD ARRA
YS
132Ø DIM GM$(5),N2$(5,175)
133Ø FOR K=1 TO 5
1335 C$="NO"
134Ø GOSUB 4ØØØ
1345 GM$(K)=TUNE$
135Ø R=((X-1)*8+Y)*2ØØ
136Ø F=Ø
137Ø FOR C=1 TO 2
138Ø F=F+1
139Ø GET#1,R
14ØØ INPUT#1,N2$(K,F)
141Ø IF N2$(K,F)="P2Ø" THEN C=2
ELSE C=1
142Ø R=R+1
143Ø NEXT C
1435 RE$(K)="YES"
144Ø NEXT K
15ØØ 'PLAY GOLDEN MEDLEY
15Ø5 NT=Ø
151Ø FOR C=1 TO 2
152Ø FOR K=1 TO 5
153Ø IF RE$(K)="YES" THEN GOSUB
```


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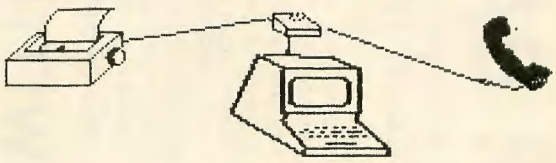
```
8ØØØ ELSE GOTO 156Ø
154Ø PRINT@38,"<A>NSWER OR <P>AS
S?"
1545 I$=INKEY$
155Ø IF I$<>"A" AND I$<>"P" THEN
 GOTO 1545
1555 IF I$="A" THEN RE$(K)="NO":
GOSUB 9ØØØ
156Ø NEXT K
1565 A$=""
157Ø FOR K=1 TO 5
158Ø IF RE$(K)="YES" THEN A$="AG
AIN"
159Ø NEXT K
16ØØ IF A$="AGAIN" THEN C=1 ELSE
 C=2
161Ø NEXT C
2ØØØ 'YOU WIN
2Ø1Ø CLS
2Ø15 PRINT@72,"CONGRATULATIONS"
2Ø2Ø PRINT@(111-(LEN(PL$)/2)),PL
$;"!"
2Ø25 PRINT@194,"IF THIS WERE THE
 REAL THING,   YOU WOULD HAVE JU
ST WON THE    OPPORTUNITY TO GO
ON TO PLAY FOR $1ØØ,ØØØ.  UNFORT
UNATELY, THIS   IS NOT THE REAL
THING."
2Ø3Ø GOTO 1Ø6ØØ
3ØØØ 'DRAW SOME NOTES
3Ø1Ø W=RND(8)
3Ø2Ø CLS(W)
3Ø3Ø F$=CHR$(128)
3Ø4Ø B$=CHR$(131+16*(W-1))
3Ø5Ø E$=CHR$(138+16*(W-1))
3Ø6Ø D$=CHR$(143+16*(W-1))
3Ø7Ø PRINT@171,E$+B$;
3Ø8Ø FOR W=1 TO 1Ø:PRINT D$;:NEX
T W
3Ø85 PRINT E$+B$;
3Ø87 FOR W=1 TO 14:PRINT D$;:NEX
T W
3Ø9Ø PRINTE$+B$+D$+D$+E$;
3Ø95 FOR W=1 TO 7:PRINT D$;:NEXT
 W
31ØØ PRINTE$+B$+D$+D$+E$;
31Ø5 FOR W=1 TO 15:PRINT D$;:NEX
T W
311Ø PRINTE$+D$+D$+F$+F$+D$+D$+D
$+E$+B$+D$+D$+E$+D$+D$+F$+F$;
312Ø PRINT@262,F$+F$;
3125 FOR W=1 TO 7:PRINT D$;:NEXT
 W
313Ø PRINTE$+D$+D$+F$+F$;
3135 FOR W=1 TO 12:PRINT D$;:NEX
T W
314Ø PRINT@3Ø2,F$+F$;
3145 FOR W=1 TO 16:PRINT D$;:NEX
T W
315Ø FOR W=1Ø24 TO 1Ø56
316Ø POKE W,42
317Ø NEXT W
318Ø FOR W=1 TO 14
319Ø POKE(1Ø55+W*32),42
32ØØ POKE(1Ø56+W*32),42
321Ø NEXT W
322Ø FOR W=15Ø3 TO 1535
323Ø POKE W,42
324Ø NEXT W
325Ø RETURN
4ØØØ 'PICK TUNE SUBROUTINE
4Ø1Ø FOR L=1 TO 2
4Ø2Ø TRY$="OK"
4Ø3Ø Y=RND(8)
4Ø35 IF C$<>"YES" THEN X=RND(6)
4Ø4Ø TUNE$=SO$(X,Y)
4Ø5Ø FOR J=1 TO ST
4Ø6Ø IF TUNE$=ST$(J) THEN TRY$="
NO"
4Ø7Ø NEXT J
4Ø8Ø IF TRY$="NO" THEN L=1 ELSE
L=2
4Ø9Ø NEXT L
41ØØ ST=ST+1
411Ø ST$(ST)=TUNE$
412Ø RETURN
```

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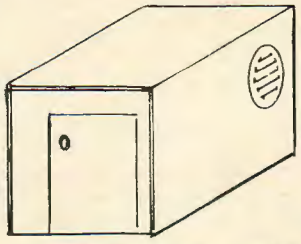

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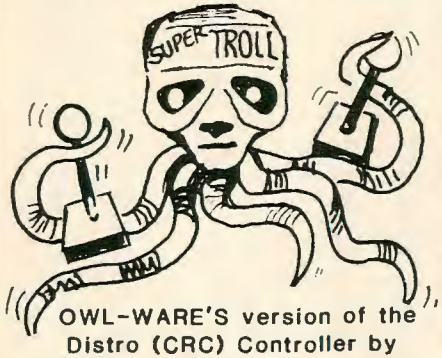

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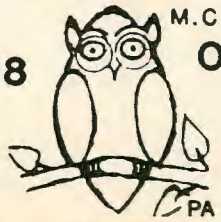

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```
4999 'PLAY TUNE SUBROUTINE
5000 F=0
5001 FOR C=1 TO 2
5010 F=F+1
5020 GET#1,R
5030 INPUT#1,NO$(F)
5040 IF NO$(F)="P20" THEN C=2 EL
SE C=1
5050 R=R+1
5060 NEXT C
5065 TIMER=0:C=0
5070 FOR H= 1 TO F
5080 PLAY NO$(H)
5100 P=PEEK(6528Ø)
5110 IF P=254 THEN PL$=P1$:H=F
5120 IF P=253 THEN PL$=P2$:H=F
5125 IF TIMER>=2000 THEN H=F:C=1
5130 NEXT H
5135 IF P<>254 AND P<>253 AND C<
>1 THEN GOTO 5070
5140 RETURN
6000 'ANSWERING SUBROUTINE
6005 CLS
6010 PRINT@12,PL$;"!!"
6015 PRINT@65,"PRESS SPACEBAR TO
 CHECK ANSWER"
6020 IF INKEY$=CHR$(32) THEN GOT
O 6030 ELSE GOTO 6020
6030 PRINT@129,"THE SONG TITLE I
S:"
6031 PRINT@197,TUNE$
6033 PRINT@256,STRING$(32,45)
6034 PRINT@295,"<R>IGHT OR <W>RO
NG?"
6035 ANSWER$=INKEY$
6036 IF ANSWER$<>CHR$(82) AND AN
SWER$<>CHR$(87) THEN GOTO 6035
6038 IF ANSWER$="R" THEN X$="RIG
HT"
6040 IF PL$=P1$ AND X$="RIGHT" T
HEN P1=P1+1 ELSE IF PL$=P2$ AND
X$="RIGHT" THEN P2=P2+1
6045 S1=(359-(LEN(P1$)/2))
6050 S2=(375-(LEN(P2$)/2))
6055 PRINT@ S1,P1$:PRINT@ S2,P2$
6060 PRINT@(S1+32),STRING$(LEN(P
1$),45)
6065 PRINT@(S2+32),STRING$(LEN(P
2$),45)
6070 PRINT@421,P1:PRINT@437,P2
6075 FOR W=1 TO 500:NEXT W
6080 IF P1<>3 AND P2<>3 THEN A=1
6090 IF TUNE>=5 THEN A=2
6095 IF A=2 AND P1=P2 THEN A=1
6100 X$="WRONG"
6110 RETURN
7000 'TIEBREAKER SUBROUTINE
7001 CLS
7002 PRINT@38,"!!!WE HAVE A TIE!
!!"
7003 PRINT@101,"YOU BOTH HAVE 20
 POINTS, SOWE WILL PLAY A TIEBRE
AKING SONG TO SEE WHO GOES ON TO
 THE GOLDENMEDLEY. PRESS YOUR FI
RE BUTTON  WHEN YOU KNOW THE SON
G. A WRONG ANSWER WILL LEAD TO A
NOTHER     SONG. ";
7004 PRINT"THE FIRST CORRECT ANS
WER  WILL END THE TIEBREAKER."
7005 PRINT@419,"PRESS SPACEBAR T
O CONTINUE"
7006 I$=INKEY$: IF I$<>CHR$(32)
THEN GOTO 7006
7007 GOSUB 3000
7008 FOR Z=1 TO 2
7010 C$="YES"
7020 GOSUB 4000
7030 R=((X-1)*8+Y)*200
7040 GOSUB 5000
7050 CLS
7053 PRINT@45,PL$;"!!"
7055 PRINT@97,"PRESS SPACEBAR TO
 CHECK ANSWER"
7056 W$=INKEY$:IF W$<>CHR$(32) T
HEN GOTO 7056
7057 PRINT@161,"THE SONG TITLE I
S:"
7058 PRINT@196,TUNE$
7059 PRINT@295,"<R>IGHT OR <W>RO
NG"
7060 ANSWER$=INKEY$
7061 IF ANSWER$<>CHR$(82) AND AN
SWER$<>CHR$(87) THEN GOTO 7059
7062 IF ANSWER$="R" THEN X$="RIG
HT"
7090 IF X$="RIGHT" THEN Z=2 ELSE
 Z=1
7100 NEXT Z
7110 RETURN
8000 'PLAY TUNE(GOLDEN MEDLEY)
8005 GOSUB 3000
8010 F=0:TIMER=NT
8011 T=VAL(RIGHT$(N2$(K,1),1))
8012 N2$(K,1)=LEFT$(N2$(K,1),1)+
STR$(T+1)
8020 FOR R=1 TO 2
8025 PRINT@27,INT(TIMER/66)
8030 F=F+1
8040 PLAY N2$(K,F)
8050 IF N2$(K,F)="P20" THEN F=0
8060 P=PEEK(6528Ø)
8070 IF P<>126 AND P<>254 THEN R
=1 ELSE R=2:NT=TIMER
8080 IF TIMER>=2000 THEN GOTO 10
500
8090 NEXT R
8100 CLS
8110 RETURN
```

```
9ØØØ 'ANSWER SUBROUTINE(GOLDEN M
EDLEY)
9Ø1Ø PRINT@65,"PRESS SPACEBAR TO
 CHECK ANSWER"
9Ø2Ø IF INKEY$<>CHR$(32) THEN GO
TO 9Ø2Ø
9Ø3Ø PRINT@129,"THE SONG TITLE I
S:"
9Ø32 PRINT@197,GM$(K)
9Ø34 PRINT@256,STRING$(32,45)
9Ø36 PRINT@295,"<R>IGHT OR <W>RO
NG?"
9Ø5Ø ANSWER$=INKEY$
9Ø6Ø IF ANSWER$<>CHR$(82) AND AN
SWER$<>CHR$(87) THEN GOTO 9Ø5Ø
9Ø7Ø IF ANSWER$=CHR$(87) THEN GO
TO 1Ø5ØØ
9Ø8Ø RETURN
1ØØØØ CLS
1ØØ5 PRINT@41,"MELODY ROULETTE"
1ØØ1Ø PRINT@73,STRING$(15,45)
1ØØ15 PRINT
1ØØ2Ø PRINT"THE WHEEL WILL SPIN
TO SEE HOW  MUCH MONEY YOU'RE PL
AYING FOR.  THEN YOU'LL LISTEN T
O A MAXIMUM OF 5 SONGS."
1ØØ25 PRINT"  IF YOU KNOW A SONG
, PRESS YOURJOYSTICK BUTTON. THE
 PLAYER WITHTHE MOST POINTS OUT
OF 5 SONGS  WINS THIS PART.  MEL
ODY ROULETTE IS WORTH 1Ø GAME PO
INTS."
1ØØ3Ø PRINT@451,"PRESS SPACEBAR
TO CONTINUE"
1ØØ35 I$=INKEY$
1ØØ4Ø IF I$<>CHR$(32) THEN GOTO
1ØØ35
1ØØ45 RETURN
1Ø1ØØ CLS
1Ø1Ø5 PRINT@43,"TUNE TOPICS"
1Ø11Ø PRINT@75,STRING$(11,45)
1Ø115 PRINT
1Ø12Ø PRINT"A RANDOM CATEGORY WI
LL BE CHOSENAFTER WHICH A MAXIMU
M OF 5 SONGSWILL BE PLAYED FROM
THE CHOSEN  CATEGORY. ONCE AGAIN
, PRESS YOURJOYSTICK BUTTON IF Y
OU KNOW THE SONG. TUNE TOPICS IS
 WORTH 1Ø   GAME POINTS."
1Ø125 PRINT@451,"PRESS SPACEBAR
TO CONTINUE"
1Ø13Ø I$=INKEY$
1Ø135 IF I$<>CHR$(32) THEN GOTO
1Ø13Ø
1Ø14Ø RETURN
1Ø2ØØ CLS
1Ø2Ø5 PRINT@43,"BID-A-NOTE"
1Ø21Ø PRINT@75,STRING$(1Ø,45)
1Ø215 PRINT
1Ø22Ø PRINT"A CLUE WILL BE GIVEN
, FOLLOWED  BY BIDDING. THE FIRS
T BIDDER CAN NOT PASS, ALTHOUGH
BIDDING CAN START AS HIGH AS 15.
 ONCE AGAIN, A MAXIMUM OF 5 SONG
S WILL BE   PLAYED.  BID-A-NOTE
IS WORTH 2Ø GAME POINTS.";
1Ø225 PRINT" THIS IS THE LAST
PART BEFORE THE WINNER GOES ON,
ALONE, TO PLAY THE GOLDEN MEDLEY
"
1Ø23Ø PRINT@451,"PRESS SPACEBAR
TO CONTINUE"
1Ø235 I$=INKEY$
1Ø24Ø IF I$<>CHR$(32) THEN GOTO
1Ø235
1Ø245 RETURN
1Ø3ØØ CLS
1Ø3Ø5 PRINT@41,"GOLDEN MEDLEY"
1Ø31Ø PRINT@73,STRING$(13,45)
1Ø315 PRINT
1Ø32Ø PRINT"YOU'RE ON YOUR OWN N
OW AND YOU  HAVE 3Ø SECONDS TO N
AME 5 TUNES. PRESS THE LEFT JOYS
TICK BUTTON TO STOP THE SONG. YO
U CAN EITHERNAME THE SONG OR PAS
S ON IT TILLYOU'VE NAMED THE RES
T.";
1Ø325 PRINT" THE TIMER ONLY RUNS
 WHEN THE MUSIC IS    PLAYING. T
HE GAME IS OVER AS    SOON AS YO
U ANSWER INCORRECTLY."
1Ø33Ø PRINT@451,"PRESS SPACEBAR
TO CONTINUE"
1Ø335 I$=INKEY$
1Ø34Ø IF I$<>CHR$(32) THEN GOTO
1Ø335
1Ø345 RETURN
1Ø5ØØ CLS
1Ø51Ø PRINT@77,"SORRY"
1Ø52Ø PRINT@(111-(LEN(PL$)/2)),P
L$;"!"
1Ø53Ø PRINT@194,"IT WAS A GOOD G
AME AND YOU    PLAYED WELL,BUT Y
OU DIDN'T QUITE MAKE IT TO THE E
ND. NOT TO      FRET...THERE WAS
 NO PRIZE FOR     WINNING THIS G
AME ANYWAY!"
1Ø6ØØ FOR W=1 TO 5
1Ø61Ø F=Ø
1Ø62Ø FOR J=1 TO 2
1Ø63Ø F=F+1
1Ø64Ø PLAY N2$(W,F)
1Ø65Ø IF N2$(W,F)="P2Ø" THEN J=2
 ELSE J=1
1Ø66Ø NEXT J
1Ø67Ø NEXT W
1Ø675 CLS
1Ø68Ø END
```

Teaching Language Idioms

By Steve Blyn
Rainbow Contributing Editor

This month's program is a playful one designed mainly for those in the middle grades. It's good for all of us to occasionally take a break from more serious educational programs. This program points out idioms, one of the peculiarities of our language. We are going to have fun with some idioms that refer to bodily figures of speech. We have included such expressions as "crossed fingers," "toe the mark" and "nose to the grindstone."

If your students are motivated to discover the derivation of these idioms, then we have accomplished even more than we set out to do. We'll demonstrate how to add to the list to make it more comprehensive. Our main purpose, though, is enjoyment. We intend to show students that the computer can easily produce fun and educational programs.

While testing the program with middle school students, we found that a great source of amusement was the errors made — some deliberately. Even after the students learned the idioms, they had a lot of fun entering answers other than the correct ones. "With tongue in cheek" became "with toe in cheek." "Feet of clay" became "nose of clay" and so forth. This experiment inspired a jovial atmosphere — laughing girls and boys, chuckling teachers, animated discussion, thinking out loud — it was delightful.

Lines 40 and 50 set the dimensions at 15 questions and answers. 'N' was set at 15 simply because we ran out of body-part idioms. If you can think of others, add more DATA lines and adjust the number on Line 40 accordingly. Lines 60-80 read these questions and answers from the DATA lines.

Line 100 chooses a random question and answer (variable 'R'). The program gives six answers from which to choose. The variable 'J' in Line 110 subtracts a number between one and five from the correct answer. The six answers printed start at the true number (R) less 'J' and include five more choices. The true answer is ensured a place among the six listed. Lines 170-190 print out the choices.

The only problem is the 'J' variable may fall below number one, or the 'J'-plus-five amount may exceed the 15 listed answers. If these situations occur, we encounter several BS errors. This indicates there is no such string. To prevent these problems, we set further restrictions on the 'J' values in lines 120 and 130.

Line 200 asks the question and Line 210 waits for the answer. Lines 220 and 230 evaluate whether the answer is correct. Line 240 prints the correct answer if the student gives an incorrect response. Lines 250-270 wait for the user to press the ENTER key to continue. If 'E' is pressed, the program ends.

We assumed that players would soon master this program completely since there are only 15 questions. Therefore, we did not include a scorecard. If it is needed, you could display the score at the bottom of the screen at all times. We included an extra variable (CR) on Line 220 to count the correct answers.

We hope your child or student enjoys learning these idioms. Perhaps you or they will be creative and produce a similar program with other idioms. Colors would be a good possibility, using questions such as "-- as a beet" or "-- with envy" or "feeling sad and --." We here at Computer Island always enjoy hearing from readers about their experiences with the programs in this column. □

Steve Blyn teaches both exceptional and gifted children, holds two master's degrees and has won awards for the design of programs to aid the handicapped. He owns Computer Island and lives in Staten Island, New York.

The listing: IDIOMS

```
1Ø REM"UNUSUAL USE OF OUR LANGUA
GE"
2Ø REM"STEVE BLYN,COMPUTER ISLAN
D,NY,1986
3Ø Z$=STRING$(32,255)
4Ø N=15
```

```
5Ø DIM A$(N),B$(N)
6Ø FOR T= 1TO N
7Ø READ A$(T),B$(T)
8Ø NEXT T
9Ø CLS:PRINT"      OUR STRANGE LA
NGUAGE"
1ØØ R=RND(N)
11Ø J=R-RND(5)
12Ø IF J<1 THEN J=1
13Ø IF J>1Ø THEN J=1Ø
14Ø PRINT@32,Z$
15Ø PRINT@288,Z$;
16Ø PRINT@32Ø,"";
17Ø FOR T=J TO J+5
18Ø PRINTB$(T),
19Ø NEXT T
2ØØ PRINT@64,A$(R):PRINT:PRINT"N
AME THE BODY PART - ";
21Ø LINEINPUT G$
22Ø IF G$=B$(R) THEN PLAY"O3L1ØØ
CCDECDEFFGGGG":CR=CR+1:GOTO 25Ø
23Ø IF G$<>B$(R) THEN PLAY"O1L1Ø
ØFFF"
24Ø PRINT:PRINT"     THE ANSWER I
S "B$(R)
25Ø PRINT:PRINT"     PRESS ENTER
TO GO ON";
26Ø EN$=INKEY$
27Ø IF EN$=CHR$(13) THEN 9Ø ELSE
 IF EN$="E" THEN END
28Ø GOTO 26Ø
29Ø DATA ------ OF CONTENTION.,B
ONE
3ØØ DATA SPLITTING ------.,HAIRS
31Ø DATA ------ TO THE WHEEL.,SH
OULDER
32Ø DATA WITH ------ IN CHEEK.,T
ONGUE
33Ø DATA TURN THE OTHER ------.,
CHEEK
34Ø DATA WITH ------ CROSSED.,FI
NGERS
35Ø DATA ------ THE MARK.,TOE
36Ø DATA ARMED TO THE ------.,TE
ETH
37Ø DATA ------ GREASE.,ELBOW
38Ø DATA ------ IN GLOVE.,HAND
39Ø DATA STAB IN THE ------.,BAC
K
4ØØ DATA ------ TO THE GRINDSTON
E.,NOSE
41Ø DATA DON'T STICK YOUR ------
 OUT.,NECK
42Ø DATA IN ONE ----- AND OUT TH
E OTHER.,EAR
43Ø DATA ------ OF CLAY.,FEET
```


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Robots: Their Place in Education

By Michael Plog, Ph.D.
Rainbow Contributing Editor

A young woman was spending a rainy summer vacation with a group of artistic people, including some major literary "names." The group, restricted to indoor activities, told eerie stories for amusement. One of the venerable members of the group suggested that everyone write a ghost story. The young woman, named Mary Godwin, wrote a horror story based on a dream she had a few nights after the suggestion. She later married one of the members of that group, Percy Bysshe Shelley. Whether or not you have heard of Percy or Mary, you certainly know Mary's horror story, *Frankenstein* (or, the *Modern Prometheus*).

Mary Shelley's book became a prototype for horror stories, particularly those concerning robots. Mary had never heard the term "robot." Her book was written in 1818 and the word robot came into being in a 1920 play by Karel Capek titled *R.U.R.* The word robot comes from the Czech word "robotnik," for worker or serf. Capek wrote about people creating mechanical beings to do work for humans.

Science fiction writer Isaac Asimov has been called "the father of robotics" because of the many stories he has written about the mechanical creatures. And for another important reason — Asimov's robots are not creatures who turn on their creators (like Frankenstein), but are manufactured by engineers to fit exacting specifications. The most important of these specifications is that robots may not harm human beings. Their circuits simply do not allow such an action. Thus, modern robot stories eliminate the fear (the Frankenstein complex) people have about mechanical intelligence.

Modern robots are industrial automations that perform a series of steps to complete a task. Robots are not yet made in the general shape of humans and have extremely limited intelligence. My daily life seldom brings me in touch with industrial robots, but I have a few contacts with other types. For example, I interact with a robot when making long distance telephone calls. I simply dial an 800 number, enter my access number, then dial the number I want to reach. This all takes place with the aid of robots.

Besides industrial robots, there are robot "toys" for the home. Some of these machines are built in a similar fashion to the *Star Wars* robots and can perform a variety of tasks. The home robots, as well as industrial robots, need to be programmed. Indeed, a robot has a computer "brain" to allow human programming.

Since robots use computers, and may be considered as a subcomponent of the field of computer science, it is only natural that robots function in schools as well as factories and homes. Generally, they are used in computer classes and electronics courses. Students learn about robots by building the mechanical workers and programming them to perform a task.

When computers first appeared in schools, educational leaders wondered and debated about their use. In the beginning, they were used in classrooms to teach *about* computers. More recently, myriad uses have been made of computers in schools. Students use

Michael Plog received his doctorate degree from the University of Illinois. He has taught social studies in high school, worked in a central office of a school district and currently is employed at the Illinois State Board of Education.

them for a multitude of purposes other than learning BASIC programming. In fact, students can be declared computer literate without ever knowing about binary addition and subtraction. Computers are being used more and more as learning tools in classrooms. Students use word processing packages to write reports, database programs are used to examine information from science experiments, and the list goes on.

The educational community has spent over a decade debating the computer's role in elementary and secondary education. The debate continues even today, although most educational professionals consider the computer to be an additional (and very important) tool for students in the classroom, with a wide variety of purposes. There is no reason to expect the debate over the educational role of robots to be any less active than the debate over computer uses. What are appropriate activities for robots in the school? Should students simply learn about them, then consider the utility of robotics finished? Should robots be used as another tool for students, in the same way computers are an educational tool?

Despite similarities, robots and computers are not the same thing. Computers tend to be more oriented toward mental activities. Robots, on the other hand, tend to interact with the physical environment in a much more direct way than computers. For example, consider students working with a word processing package. The actual printing of a page is a physical activity, but is much less important than the mental activity of the student creating the document.

When you sit down in front of the Color Computer to write a program, most of the activity is the relationship between your mind and the screen. Not so with a robot. The observable activity of a robot performing a task deals with physical objects. Screws are tightened, materials are moved from one place to another, objects are assembled, and so on. The programming of a robot may involve the same mental activity as the programming of the Color Computer, but the end result differs.

Another feature of modern robots is their level of intelligence is not (and may never be) that which exists in fiction. A robot teacher may exist in science fiction stories, but will not be a reality in a classroom during my lifetime. A robot message carrier, however, is a tangible reality.

With current technology, we can reasonably expect robots to perform any task a well-trained pet can perform. Before the end of this century, we may see a robot collecting lunch counts from teachers and delivering this information to the school cafeteria. It is not unreasonable to expect a robot to sweep the gym floor between classes, or to inform the administration when a child wanders away from the playground. But, I seriously doubt a robot will decide the grade a student should receive in math class, or referee an intramural basketball game.

The future of educational robots will probably be more interesting than the present fiction. The current reality of computers in education is much more than past science fiction writers ever dreamed. I would enjoy hearing about the uses of robots in your school. If there is such a creature (even if it deserves the nickname "Frankenstein") in your school, please let me know of your experiences. My address is 829 Evergreen, Chatham, IL 62629.

Two-Liner Contest Winner . . .

Here's a great little ski game. Use your right joystick to maneuver the player through as many of the 20 gates as possible. This would also be a good candidate for the speed-up POKE once you become experienced.

The listing:

```
1 CLS:PRINT"ski-run":FORI=1TO999
:NEXT:P=6:PRINT"READY":FORI=1TO9
99:NEXT:CLS:FORI=1TO21:G9=G:G=RN
D(1Ø)+2:FORJ=1TO16:FORZ=1TO5Ø:NE
XT:PRINT" *"TAB(14)"*":POKE1Ø24+
P,72:IFJOYSTK(Ø)<9THENP=P-1:IFP=
2THENP=3ELSEELSEIFJOYSTK(Ø)>54TH
ENP=P+1:IFP=13THENP=12
2 NEXT:IFI=21THENIFG9=P THENSC=S
C+5:SOUND99,1:PRINT" "STRING$(14
,"-")TAB(2Ø)"finish","SCORE->"SC
:ELSEPRINT" "STRING$(14,"-")TAB(
2Ø)"finish","SCORE->"SC ELSEPRIN
T" *"TAB(G-1)"! !"TAB(14)"*"TAB(
2Ø)"GATE"I:IFG9=P THENSC=SC+5:SO
UND99,1:NEXTELSENEXT
```

Jason Steele
Pensacola, Florida

(For this winning two-liner contest entry, the author has been sent copies of both *The Second Rainbow Book of Simulations* and its companion *The Second Rainbow Simulations Tape.*)

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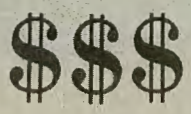

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An easy way to determine EPROM erasure times

Now You See It, Now You Don't!

By Marty Goodman

According to reports by the makers of CoCo EPROM programmers, over 2,000 Color Computer owners have EPROM programmers. These programmers are an essential tool for those wanting to customize their ROM software or wanting to make alternate character sets of their lower kits or 80-column cards.

All owners of EPROM programming devices will want to have an EPROM eraser. The eraser is simply a box with an ultraviolet light that has a particular peak wavelength output (2,537 Angstrom units). When this light is shined on an EPROM, it erases what has been programmed into it. But, how long does this process take? There is often much confusion about this and I have a simple answer.

Get several of the EPROMs you usually work with. Program them with all zeros. This sets every bit inside the EPROM (an erased EPROM is set at all ones). Be sure to clean the quartz windows on used EPROMs with lighter fluid because particles of grease and adhesive can impede erasure.

Put the programmed EPROMs into the eraser and expose them to the UV light for one minute. Take them out and check to see if they are erased. If they are, the eraser is too strong. Try to increase the distance between the EPROM and the light bulb and try again.

Continue the process of putting the EPROMs into the eraser and checking every 30 seconds. This way, you can determine the apparent time of erasure. This time should be between one and one-half and seven minutes. To determine the proper erasure time, multiply this apparent time by five. For example, if the chip is not erased at the one and one-half minute check, but is at two minutes, the time for that brand and type of chip in that particular erasure is 10 minutes.

There may be significant variations between different brands and types of chips. My tests indicate most 27 series EPROMs behave about the same, but the Motorola 6876X series appear to take somewhat more time to erase.

Note that this technique requires nothing other than a clock, an EPROM burner and the EPROM eraser. It is far simpler, and more accurate, than any attempt to calculate the theoretical time needed for erasure using the manufacturer's specification for "nominal erasing energy" reported in watt-sec/cm-cm and the rated energy output of your UV bulb.

My source for this information is an old article on erasing 1702-type EPROMs. Note it is not proper to merely expose an EPROM to UV for the minimum time needed for it to appear erased when read in the EPROM programmer. The cells in the EPROM that hold the information will not be fully discharged and may later cause it to behave erratically.

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator on CompuServe and Delphi.

RAINBOW Info

How To Read Rainbow

Please note that all the BASIC program listings in THE RAINBOW are formatted for a 32-character screen — so they show up just as they do on your CoCo screen. One easy way to check on the accuracy of your typing is to compare what character "goes under" what. If the characters match — and your line endings come out the same — you have a pretty good way of knowing that your typing is accurate.

We also have "key boxes" to show you the *minimum* system a program needs. But, *do* read the text before you start typing.

Finally, the little cassette symbol on the table of contents and at the beginning of articles indicates that the program is available through our RAINBOW ON TAPE service. An order form for this service is on the insert card bound in the magazine.

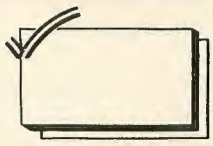
What's A CoCo?

CoCo is an affectionate name that was first given to the Tandy Color Computer by its many fans, users and owners.

However, when we use the term CoCo, we refer to both the Tandy Color Computer and the TDP System-100 Computer. It is easier than using both of the "given" names throughout THE RAINBOW.

In most cases, when a specific computer is mentioned, the application is for that specific computer. However, since the TDP System-100 and Tandy Color are, for all purposes, the same computer in a different case, these terms are almost always interchangeable.

The Rainbow Check Plus



The small box accompanying a program listing in THE RAINBOW is a "check sum" system, which is designed to help you type in programs accurately.

Rainbow Check PLUS counts the number and values of characters you type in. You can then compare the number you get to those printed in THE RAINBOW. On longer programs, some benchmark lines are given. When you reach the end of one of those lines with your typing, simply check to see if the numbers match.

To use *Rainbow Check PLUS*, type in the program and CSAVE it for later use, then type in the command RUN and press ENTER. Once the program has run, type NEW and press ENTER to remove it from the area where the program you're typing in will go.

Now, while keying in a listing from THE RAINBOW, whenever you press the down-arrow key, your CoCo gives the check sum based on the length and content of the program in memory. This is to check against the numbers printed in THE RAINBOW. If your number is different, check the listing carefully to be sure you typed in the correct BASIC program code. For more details on this helpful utility, refer to H. Allen Curtis' article on Page 21 of the February 1984 RAINBOW.

Since *Rainbow Check PLUS* counts spaces and punctuation, be sure to type in the listing exactly the way it's given in the magazine.

```
10 CLS:X=256*PEEK(35)+178
20 CLEAR 25,X-1
30 X=256*PEEK (35)+178
40 FOR Z=X TO X+77
50 READ Y:W=W+Y:PRINT Z,Y;W
60 POKE Z,Y:NEXT
70 IFW=7985THENB0ELSEPRINT
   "DATA ERROR":STOP
80 EXEC X:END
90 DATA 182, 1, 106, 167, 140, 60, 134
100 DATA 126, 183, 1, 106, 190, 1, 107
110 DATA 175, 140, 50, 48, 140, 4, 191
120 DATA 1, 107, 57, 129, 10, 38, 38
130 DATA 52, 22, 79, 158, 25, 230, 129
140 DATA 39, 12, 171, 128, 171, 128
150 DATA 230, 132, 38, 250, 48, 1, 32
160 DATA 240, 183, 2, 222, 48, 140, 14
170 DATA 159, 166, 166, 132, 28, 254
180 DATA 189, 173, 198, 53, 22, 126, 0
190 DATA 0, 135, 255, 134, 40, 55
200 DATA 51, 52, 41, 0
```

Using Machine Language

Machine language programs are one of the features of THE RAINBOW. There are a number of ways to "get" these programs into memory so you can operate them.

The easiest way is by using an editor/assembler, a program you can purchase from a number of sources.

An editor/assembler allows you to enter mnemonics into the CoCo and then have the editor/assembler assemble them into specific instructions that are understood by the 6809 chip, which controls your computer.

When using an editor/assembler, all you have to do, essentially, is copy the relevant instructions from THE RAINBOW's listing into CoCo.

Another method of getting an assembly language listing into CoCo is called "hand assembly." As the name implies, you do the assembly by hand. This can *sometimes* cause problems when you have to set up an ORIGIN statement or an EQUATE. In short, you have to know something about assembly to hand-assemble some programs.

Use the following program if you wish to hand-assemble machine language listings:

```
10 CLEAR200,&H3F00:I=&H3F80
20 PRINT "ADDRESS:";HEX$(I);
30 INPUT "BYTE";B$
40 POKE I,VAL("&H"+B$)
50 I=I+1:GOTO 20
```

This program assumes you have a 16K CoCo. If you have 32K, change the &H3F00 in Line 10 to &H7F00 and change the value of I to &H7F80.

The Rainbow Seal

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The Seal, however, is not a "guarantee of satisfaction." The certification process is different from the review process. You are encouraged to read our reviews to determine whether the product is right for your needs.

There is absolutely no relationship between advertising in THE RAINBOW and the certification process. Certification is open and available to any product pertaining to CoCo. A Seal will be awarded to *any* commercial product, regardless of whether the firm advertises or not.

We will appreciate knowing of instances of violation of Seal use.

Add an extra 22K of memory to Disk BASIC 1.1

Discover the 'Hidden' Five Tracks

By Jim Peake

If you own the new white Radio Shack disk drive (catalog number 26-3029) with Disk BASIC 1.1, you may have a 40-track drive masquerading as a 35-track drive. The new drives without the little tab to eject the disk are different from the old gray drives.

After more than three years of cassette loading, I broke open the piggy bank and bought a new drive in December 1983. Sure enough, it looks different. Rumor has it that it's a Model 4 drive from TPI. After six months of loyal service on my 1980-vintage D-board CoCo, I attached it to my new 64K CoCo 2. After experimenting to see how many tracks it really has, I discovered it works fine as a 40-tracker.

I've written a small program of POKEs to modify the disk ROM for 40 tracks. To use it, you must have a 64K CoCo. You must also have a program to load the BASIC ROMs into the upper 32K of RAM, and switch the CoCo to the all-RAM mode. And you must have the new Disk BASIC 1.1 ROM. This change does not work with the 1.0 ROM because all the POKE addresses are different and you would need 40-track drives rather than the 35- or 36-track gray drives.

So how do we make Disk BASIC 1.1 use 40 tracks? There are several things that must be done. First, move the ROMs to RAM and switch to the all-RAM mode so we can make changes with the POKE command. Second, BASIC must be modified to initialize 40 tracks with the DSKINI command. Third, the file allocation table, which keeps track of what granules have been used, must be enlarged to keep track of 78 granules instead of 68. Changes have to be made so it is all saved to disk and not cut off at 68. Next, FREE has to be modified to look for 78 granules.

I did not make the directory allow for more than 68 files because, as a practical matter, I cannot believe anyone would want that many files on one disk.

The file allocation table is easy enough to expand, but doing so limits the system to a maximum of three drives. This is because the system initialization routine reserves space for up to four file allocation tables. Since each table is 10 bytes bigger to hold 78 instead of 68 granule pointers, there is not enough room for more than three file allocation tables. Again, it's much too complicated to move all subsequent work addresses and not worth the trouble.

The advantages of this modification for using 40 tracks are many. You can save money by using fewer disks. This modification is fully compatible with the diskettes already formatted in the official 35-track format. They operate normally while in the 40-track mode and are protected from unsuccessful attempts to use the last five tracks. The file allocation table indicates to the modified 40-track system that those tracks are not available. BACKUP is the only command that invites disaster if you try to use 35-track diskettes while in the 40-track mode.

There are some disadvantages to this 40-track modification. If you run the system without loading the modification, the unmodified system wreaks havoc with 40-track diskettes. It shortens the file allocation table to 68 granules, thus losing forever the last five tracks. Any files or programs that used any or all of that area are unusable, and the diskette will be a 35-track disk until reinitialized to 40 tracks, which wipes out everything on the diskette. It is also a nuisance to have to load the necessary

Jim Peake lives in Northfield, Vermont, and is a systems analyst for the state. He has over 12 years of applications software experience. He purchased his first CoCo in 1980 and his family has rarely seen him since.

programs for converting to 40 tracks each time you turn on the computer.

Of course, if you have an older drive that does not support 40 tracks, attempts to use the last five tracks result in an I/O error. And if Radio Shack or its supplier adjusts the drives to prevent using the last five tracks, then this modification won't work. I think the system is set up for upgrading to 40-track drives and Radio Shack probably will. If they do, they will have to put in a few more checks than I did to ensure full compatibility with diskettes previously formatted for 35 tracks.

One last caution: This modification has not been rigorously tested in a variety of environments. Therefore, experiment carefully and test it to be sure it works dependably on your system before entrusting valuable data or hard work to it.

One does not start disassembling the ROMs without a good, comprehensive map of what's what. In my case, the map and guiding light was the complete CoCo memory map published in the July, August, September and December 1983 issues of THE RAINBOW.

In conclusion, the new 1.1 system can easily be modified to use 40 tracks for storing up to 178,000 bytes of data on each diskette.

(Mr. Peake can answer questions about this program at 802-485-8922, 7 p.m. to 9 p.m. EST only.) □

The listing: TRACK40

```
1ØØØ REM ROUTINE TO SET DISK
     BASIC 1.1 TO 4Ø TRACKS IN
     A 64K COCO
1ØØ1 ' WRITTEN JUNE 1984
     BY JIM PEAKE
1ØØ2 ' NOTE:: LIMITS TO A MAX OF
     3 DRIVES
1ØØ5 POKE&HD762,&HØ2 ' SETS
     DSKCON TO RETRY 2 TIMES
     INSTEAD OF 5. OPTIONAL MAY
     BE OMITTED.
1Ø1Ø POKE&HD65F,&H28:POKE&HD682,
&H28  ' SETS DSKTNI TO 4Ø TRACKS
1Ø15 POKE&HD534,&H27 ' SETS DSKI
1Ø2Ø POKE&HD29D,&H28 ' SETS DSKO
1Ø3Ø POKE&HC735,&H4E ' SETS MOVE
     OF FILE ALLOCATION TABLE TO
     1Ø MORE GRANULES
1Ø35 POKE&HC75A,&H54 ' INCREASES
     SPACE FOR EACH DRIVE'S FAT
     TO ALLOW 1Ø MORE GRANULES
1Ø4Ø POKE&HC7BB,&H4E ' SETS MOVE
     OF FAT TO 1Ø MORE GRANULES
1Ø45 POKE&HC7DØ,&H4E ' USE 78
     GRANULES NOT 68
1Ø5Ø POKE&HC7EF,&H4E ' USE 78
1Ø55 POKE&HCD26,&H4E ' SEARCH 78
     GRANULES
1Ø6Ø POKE&HCEB5,&H4E ' LET FREE
     COMMAND CHECK 78 GRANULES
1Ø65 POKE&HD44D,$H4E ' SET COPY
TO 78 GRANULES
1Ø8Ø POKE&HD7CØ,Ø:POKE&HD816,&H1
4 ' SET TO 6MS STEPPING RATE
```


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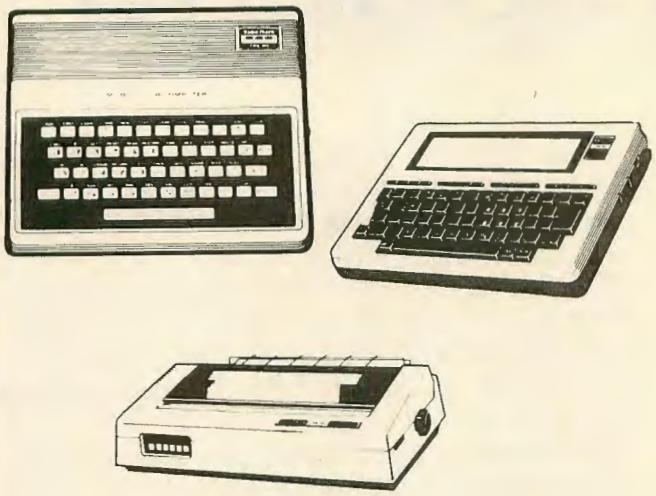

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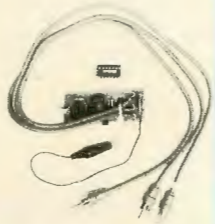

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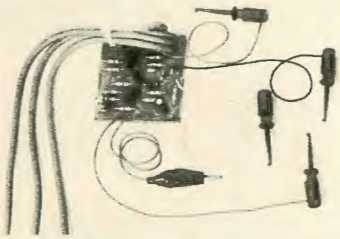

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Database Ditties . . .

By Cray Augsburg
Rainbow's CoCo SIGop

There have been a lot of goings-on in our Color SIG, including a large amount of activity in the databases. Because of this, most of this month's column is devoted to Marty Goodman's database report.

Color SIG is rapidly increasing in size. We have 2,989 members and expect to have well over 3,000 members within a few weeks.

We have unofficial reports of our Forum activity versus the message activity on CompuServe. We average 380 posted messages a week to CompuServe's 430. This ratio, too, is rapidly changing in our favor.

There is a decrease in the number of users having problems adjusting to Delphi. Most people are finding it easier to use than "that other system."

Contest Results

We recently had a contest to see who could write message number 6809. The "magic message" was written by Lloyd Pulley (FATONE). After winning, all Lloyd could say was, "I just logged on to see who won and now I find out it's me!" For his effort, he will receive a free 72-hour period on the Color SIG. Keep an eye open because we will be having similar contests in the future.

Missing Words

Here is a correction for the May "Delphi Bureau." At the top of Page 94, I describe how to locate specific RAINBOW ON TAPE files. Missing are the rules that explain this. They are:

1) To find a specific file, type
READ MM/YY XXX Title
where MM/YY is the date and XXX is the page number. The title may be omitted.
2) If the month (MM) has only one digit, such as February, then do *not* include a leading zero.
3) If the page number (XXX) has only two digits, then *do* use a leading space.

The examples should now make sense.

Strike up the Band Already!

Everything appears to be running smoothly on the Color SIG. We have lived up to our word and now submissions to the database are being enabled usually within 24 hours.

The only area that causes some concern is the Music topic of the database. As a music lover, I find the lack of activity there disconcerting (pun fully intended). I urge all members to search through their files at home. Surely you can find at least one or two music files you would like to submit.

Keep in mind that there are several people with considerable experience who "reside" on our Color SIG. If you have any questions, you can always leave them in Forum. They are sure to be answered quickly. Now let's see what good news Marty has to bring us . . .

Cray Augsburg serves as RAINBOW's technical assistant and holds an associate's degree in electrical engineering. He and his wife, Ruth Ann, have two children and live in Louisville, Kentucky. His username on Delphi is RAINBOWMAG.

Database Manager's Report

In the four weeks that have gone by since I assumed the job of database manager on Delphi, quite a lot has happened in our CoCo SIG database.

I have posted some new text files that may be of interest, including one on *legal* telephone "phreaking," describing how I cut my Delphi telephone bill from $150 to $13 per month. A new *NEWBOX* file is more speculation about the coming Color Computer. There's also an essay on the issue of *pornography*, and how it relates to our SIG.

Graphics

We have four new art galleries containing 12 to 20 pictures each by famous CoCo artists Ana Landa, Ron Kiyomura, Linda Neilson and Erik White. These are among the best CoCo art ever produced. Many are winners of RAINBOW's "CoCo Gallery" awards.

There are a number of new individual files, including *Red Riding Hood*, an enhanced video digitized image. Also in the Graphics section is a digitized and animated image of guess who, under the heading GUESS WHO.

Stephen Macri (**DRACMAN**) has given us a nice updated anatomical chart of the brain, with special attention to CoCo-related functions. Mark Kowit (**TOBOR8**) has contributed a set of three enhanced digitized images, including a clever one called *Eat Strawberries*. Erik Gavriluk (**ERIKGAV**) has uploaded a gallery of 15 digitized images, including a particularly interesting one, *Baby*.

Graphicom is well-supported in the database, with alternative menus and font set screens. If more *Graphicom* users will drop me a line on the Forum or in MAIL, I can upload a *lot* more alternate *Graphicom* fonts and stamp sets. All you need do is ask. I have about a 50 or more such files.

We also have a fresh upload of *McPaint*, a "guiltware" product (you are asked to send the author a few bucks if you like and use the program). This is a graphics editor for the CoCo vaguely similar to *Graphicom* and *CoCo Max*. Along with the new *McPaint* upload, we have a set of about 15 fonts for *McPaint*. And from the same authors **(Eric Gavriluk and Greg Miller)** we have a set of *Animate* utilities that allow you to make (and hopefully later upload to us for all to see) short animation sequences from the pictures you draw. Best of all, Erik and Greg, the talented creators of *McPaint* and *Animate*, are available on our forum for questions.

Art Flexser has contributed his *MAXCMP* utility to our graphics section. This utility allows you to convert CoCo graphics screens from *Graphicom, CoCo Max* and other graphics editors into our *.PIX* format, an ASCII BASIC version of the picture that can be downloaded. I recommend that anyone who wants to upload CoCo art to Delphi or other BBS systems get and use this file.

Loren J. Howell **(XENOS)** has given us a CGP-115 (color printer plotter from Tandy) screen dump for full-color dumps of *CoCo Max* files.

Hardware Hacking

I have uploaded in this section all of my software development tools for creating character generator ROMs for the PBJ *Word-Pak I*, and for all makes of CoCo lowercase kits. There are also some data files with my favorite fonts sets for such things. All you need to do is download those data files and burn them into an EPROM, and you can customize your screen character font if you own a lower kit or PBJ *Word-Pak*. There is also an article by Don Hutchison on how to interface a Microfazer buffer to the CoCo, and a chart I made of the pinouts of most common EPROMs.

Also in the Hardware Hacking database is an alternate driver software for the Intronics Ver. 2 EPROM programmer. With this patched software (which I wrote), you will have the option of proper slow programming of EPROMs, a needed option due to reports of unreliablity in the long-term data storage of EPROMs programmed with that programmer in its normal (fast) mode.

Data Communications

Art Flexser has uploaded a series of fixes for *Colorcom/E* Version 3. These patches allow you to correct some serious flaws in the currently released version.

Don Hutchison **(DONHUTCHISON)** has given us a superb discussion of the workings of 1200 Baud modems and addresses the question of whether or not it pays to get one.

Steve Bjork **(6809ER)** has uploaded the latest revision of his conferencing program, *COTERM*. Be sure to get this one if you use Delphi's conference area a lot. It offers a *split screen* to make it easy to compose your outgoing messages.

Also present are some patches for *Mikeyterm 4.0* to allow you to use its autodialer function (control 3) with a Hayes modem. Thanks once again to Mike Ward, its author.

Utilities

There is now a full set of Intel Hex to CoCo binary, and vice versa, utilities in this topic area, along with a full description of *just what* Intel Hex is. I wrote and uploaded this. Keith W. Smith **(UGLY)** has uploaded the *Ugly Wordprocessor*, a simple line editor for quick jobs. Cray Augsburg **(RAINBOWMAG)** has uploaded some tax preparation utilities (*TAX*), a pie chart utility (*PIE*), and some other new files as well.

Games

Cray Augsburg has submitted a number of new games from RAINBOW's collection. (None of these has appeared in the magazine, however.) And Stephen Macri has submitted a very clever golf Simulation.

Assembly Language

Don Hutchison has uploaded source code for three neat little ditties. *NUTRAX* formats an extra five tracks on 35-track CoCo disks without hurting existing information (great for hackers moving up to a 40-track version of Disk BASIC). *Color Zoom* is a visually pleasing bit of clever code that the authors of *Graphicom* got from an old CoCo game, modified and gave to me. I gave it to Don, and he commented it and turned it into a good assembly language tutorial.

Product News and Reviews

In this database topic are reviews of the latest Radio Shack games, *Pegasus, Donpan* and *Pitfall II*, and a report on the DS69A Video Digitizer. Also in this section is my reply to RAINBOW regarding their review of a newly released EPROM programmer.

I have a review of the VIDCODIT video digitizer, a $40 bare board kit sold by Dick Kinney that does a rather fine job of digitizing a video signal, though it is pretty hacker-oriented. Buried in that review are three digitized pictures of me, taken as samples of the performance of the unit.

OS-9

We have a description of how to make the *Version 2.0 OS9 CO80* driver work with the DISTO 80-column card.

Greg Forseth has given us some RAM disk software for OS-9 and the Banker 256K expansion.

Rob Wyatt **(ROBERTJR)** has uploaded a pause utility command.

Coming Attractions

Look for more product reviews, including one of the Tandy Hard Drive Controller and Drive for the CoCo. And look for a *Kermit* supporting terminal program in the Data Communications section of the database. In hardware, I hope to soon have a sophisticated, all-machine language driver program for the Green Mountain Micro Color Burner, complete with point-and-pick menus and bar graph displays of what percent of the EPROM is programmed. And, in Graphics, more pictures and more *Graphicom* font screens.

Coming soon to the Graphics section is a superb dedicated *Fat Bits*-type screen editor, one that has a mode in which you can do "fat bits" (enlarged) editing of artifact color screens with the magnified pixels appearing as red, blue, white or black on your screen. The total area shown in the magnifier is larger than in any other graphics editor's "fat bits" program, and the ease of use of this utility is good.

Soon, I will release my *C64-to-CoCo Converter*, a program that allows CoCo owners to download Commodore 64 *Doodle* format files, then view them on their CoCos. We will show a few representative converted *Doodle* art files, and you will be able to find many more on the Micro Artists (*MANIAC*) SIG on Delphi.

In the Data Communications topic area on our CoCo SIG, we hope to soon have the complete *WEFAX* program set and the full documentation for it and, later on, possibly some interface-less RTTY/CW software as well. (This last by the authors of *Graphicom* and *WEFAX*.) We may later feature a number of tutorial files in our assembly language database for beginning and intermediate ML hackers.

There has been a heavy emphasis on graphics in this report. This is due in part to my own great interest in this area. Remember, we welcome submission of all material. I will try to develop other areas now that the Graphics section is off to a good start. We cordially invite you to submit *your* favorite original or public domain programs, pictures and music to share with the CoCo Community. And, please feel free to speak up and share *your* thoughts about products you buy or reviews you read.

— Marty
(MARTYGOODMAN)
Delphi CoCo SIG Database Manager

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Investigating the CPU

By Tony DiStefano
Rainbow Contributing Editor

If you have been following the past several articles, you are familiar with how a memory chip works. A memory chip by itself is not useful and a Printed Circuit Board (PCB) full of memory chips cannot do much. We need something that can write to and read from this memory. What we need is a CPU. What is a CPU? It's a Central Processing Unit.

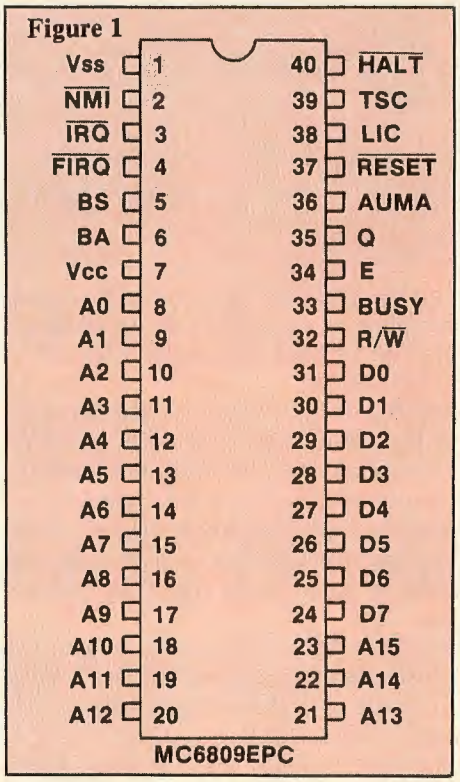
This chip is the workhorse of the computer. It does just about everything. In the CoCo, the CPU is made by Motorola. The part number for this chip is MC6809EPC. The "MC" stands for the company, the "6809" is the part number, the 'E' means it's driven by an external clock and the "PC" means it is a plastic package.

It's common knowledge that the 6809 is one of the most powerful eight-bit CPUs made. In fact, some people argue it is *the* most powerful. Whatever the case, we're going to dig into it and look at it from a hardware point of view.

The most important thing to know about this chip is the pinout. The 6809 is contained in a 40-pin DIP (Dual Inline Package) the same size and shape as the VDG, PIA and SAM chips also in the CoCo. Figure 1 shows this 40-pin chip and the pin names. The following is a pin-by-pin description of the 6809.

Tony DiStefano is well-known as an early specialist in computer hardware projects. He lives in Laval Ouest, Quebec.

Figure 1



Pin 1 — Vss. This is the ground pin to which all signals are referenced. It has a potential of zero volts.

Pin 2 —NMI. This normally high (five volts or logic state of one) input triggers on the negative edge of a pulse. This in turn requests that a non-maskable interrupt sequence be generated. A non-maskable interrupt (as the word indicates) cannot be inhibited by the program. It also has a higher priority than FIRQ, IRQ or software interrupts.

During recognition of this NMI, the entire machine state is saved on the hardware stack. After a reset, an NMI is not recognized until the first program load of the hardware stack pointer. The pulse width of the NMI low must be at least one E-cycle long before it is recognized.

Pin 3 — IRQ. This input triggers in the same way as the NMI except it initiates an interrupt request, providing the IRQ bit in the CC (Condition Code register) is clear. This also saves the entire machine state on the stack. The IRQ has a lower priority than the FIRQ. It is up to the service routine to clear the source of the interrupt before doing an RTI (Return from Interrupt).

Pin 4 — FIRQ. This input, like the IRQ, initiates a fast interrupt request, providing the FIRQ bit in the CC is clear. This has higher priority than the IRQ, but only saves the CC register and the program counter on the stack. The interrupt service routine should clear the source of the interrupt before doing an RTI.

Pins 5 and 6 — BS (Bus Status) and BA (Bus Available). Two outputs that work together to generate the condition of the CPU. When BS and BA are both low, a normal or running condition exists. When BS and BA are both high, it indicates the CPU is in the halt mode. When BS is high and BA is low, an interrupt or reset is acknowledged. And

finally, when BS is low and BA is high, the CPU is in a sync acknowledge mode.

Pin 7 — Vcc. This input powers the CPU with five volts.

Pin 8 to 23 — A0 to A15. These 16 pins are used to generate one of 65,535 different address locations the 6809 CPU can access for data transfer. When the processor does not require the bus for a data transfer, it sends out all that is on the address bus. The R/W line equals one, but BS equals zero. This is known as a dummy access or VMA cycle. All addressed bus lines go into a high-impedance state when BA is high or when TSC is driven high.

Pin 24 to 31 — D7 to D0. These eight bi-directional pins are used to transfer data to and from the CPU and other devices connected on the data bus.

Pin 32 — R/$\overline{W}$. This output signal indicates the direction of the data transfer on the data bus. A low indicates the CPU is writing data to the data bus. A high means the CPU is reading. When BA is high or when TSC is high, the output is made high-impedance.

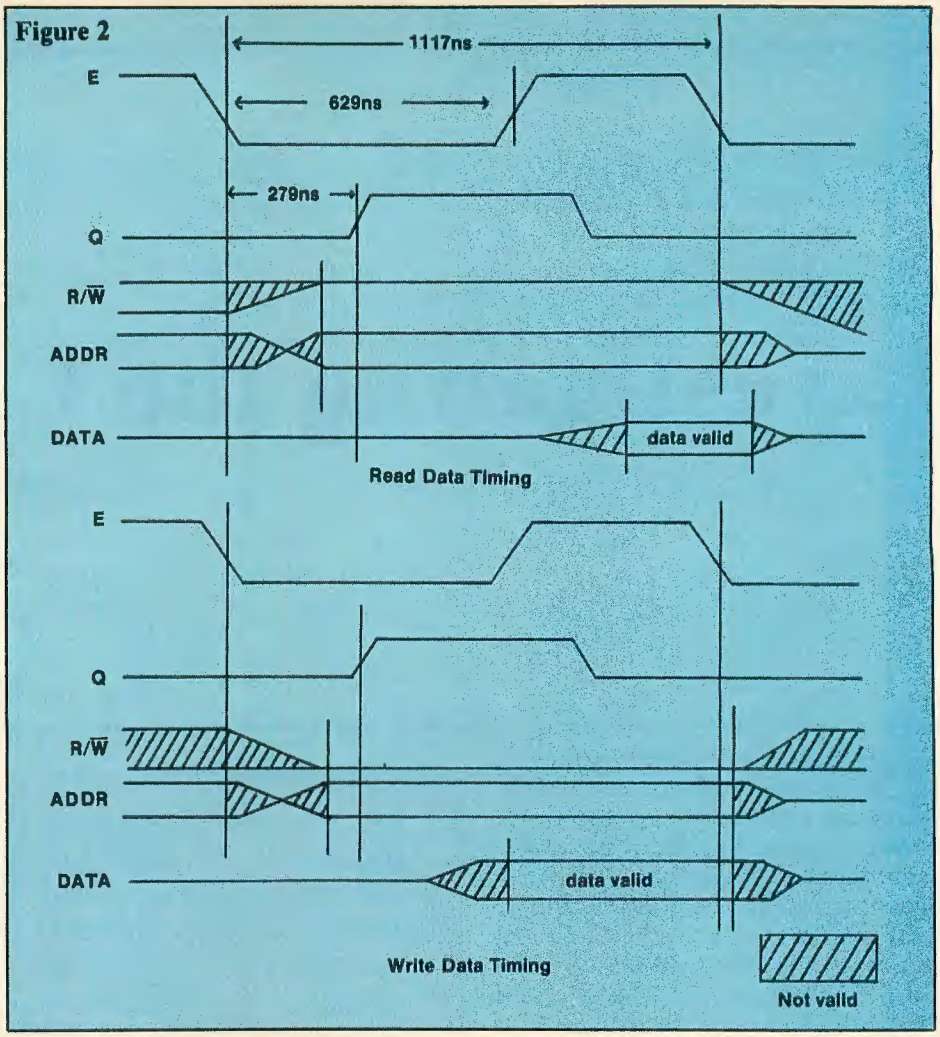
Pin 33 — BUSY. This output-pin signal indicates that bus re-arbitration should be deferred. Wow, what a mouthful! This means BUSY is high for the first two cycles of any instruction that first reads, then writes new data, high during the first byte of a double-byte access, and during the first byte of any indirect access.

Pin 34 and 35 — E and Q. These clock signals are required only by a 6809 that has an 'E' prefix. In the CoCo, these signals are generated by the SAM (MC6883) chip. These signals bring the CPU to life. The 'Q' clock must lead the 'E' clock. Addresses are valid after the falling edge of the 'E' clock, and data is latched from the bus by the falling edge of the 'E' clock. More on 'E' and 'Q' clocks later.

Pin 36 — AVMA. This output is the advanced VMA signal and indicates the CPU will use the bus in the following bus cycle. The predictive nature of the AVMA signal allows efficient shared-bus multiprocessor systems. When the CPU is in either a halt or sync state, the AVMA is low. The CoCo does not support this feature.

Pin 37 — $\overline{\text{RESET}}$. A low on this normally high input forces the CPU into a reset condition. The reset vectors are loaded into the program counter from locations $FFFE and $FFFF, then the CPU begins to execute the instructions it finds. Because the reset threshold voltage is higher than that of standard peripherals, it ensures all peripherals are out of reset state before the CPU goes to work.

Figure 2



Pin 38 — LIC. The last instruction cycle is high during the last cycle of every instruction, and its transition from high to low indicates the first byte of an opcode will be latched at the end of the present bus cycle. LIC is high when the CPU is halted at the end of an instruction.

Pin 39 — TSC. This three-state control causes the address, data and R/W lines to go into a high-impedance state. The control signals BA, BS, BUSY, AVMA and LIC do not go into the High-impedance state. To force the CPU into this state, TSC must be made high just before the end of the previous cycle. To regain access, TSC is brought low and the clocks for that processor restarted when the addresses become valid.

Pin 40 — $\overline{\text{HALT}}$. A low level on this input pin causes the CPU to stop running at the end of the present instruction and remain indefinitely without loss of data. When halted, the BA output becomes high, indicating the buses are free. While stopped, the CPU does not respond to external requests, although $\overline{\text{NMI}}$ or $\overline{\text{RESET}}$ will be latched for later response. During the halt state the 'Q' and 'E' clocks must continue to run normally.

Figure 2 is a diagram of the timing information of a read cycle and write cycle for memory or peripherals.

The complete read cycle for the CoCo is about 1,117 ns (nanoseconds) long. The cycle starts with the falling edge of the 'E' clock. Some 200 or so nanoseconds later, the address bus is stable. That means the bus holds a valid 16-bit address. At the same time, the R/$\overline{W}$ line is stable with a logic level of one. A little later, about 80 ns or so, the 'Q' clock changes to a high condition. But for now, it is not very important.

The next change is the 'E' clock. About 629 ns after the 'E' clock falls, it rises again. This change is important but I'll get to that later. Next, the 'Q'

clock falls to a zero state. Now, most important, when the falling edge of the 'E' clock occurs, the data on the data bus is transferred into the CPU.

There is a small catch: the data must have been valid (stable and not changing) 80 ns before the falling edge of the 'E' clock. It is up to the memory device or peripheral to make sure the data is there on time. The CPU does not wait; if the data is not there on time, wrong data is entered into the CPU.

The second part of Figure 2 is a write cycle. The complete write cycle is the same length as the read cycle, approximately 1,117 nanoseconds. Again, everything starts with the falling edge of the 'E' clock, and again the address bus is stable with a 16-bit address. This time the R/W line is stable with a logic level of zero. The 'Q' clock rises and the 'E' clock rises; the 'Q' clock falls and the 'E' clock falls. But this time, the CPU supplies the data.

The data is valid no later than 200 ns after the rising edge of the 'Q' clock, which occurs just before the rising of the 'E' clock. The data stays valid until about 20 ns after the falling edge of the 'E' clock. In that time, the memory of the peripheral device must take the data from the data bus. Then another cycle starts. The CPU decides whether it is a read or a write, depending on what it's doing next.

How the CPU decides depends on what it did in the previous cycle. When the computer is first turned on, the reset line keeps it from doing anything until everything stablizes. When the reset line starts the CPU going, it always does the same thing — two reads. These two reads are always at the same place, $FFFE and $FFFF. This is the reset vector, which is a pointer that points to a memory location. Because the 6809 can access 65,535 bytes of data (16 bits), the pointer must be exactly 16 bits long. Since the 6809 can access only eight bits at a time, the pointer must be two bytes long.

After the CPU reads these two bytes, it places them in an internal register called the program counter. This program counter always points to the CPU's next instruction. The CPU reads the first instruction. Instructions in the 6809 can be one to four bytes long, so the CPU has to read zero to three bytes more depending on the instruction. After the complete instruction has been read, the CPU acts on it. This instruction could be read data, write data or do something internal. Whatever the case, the CPU continues to read and write until turned off.

Now we know how a CPU accesses devices on the bus. It's time to join the CPU and the memory chips discussed in previous articles.

For example, let's use an 8K memory device. This could be a ROM or a RAM chip. It has 13 address lines, A0 to A12. Two to the power of 13 is 8K. Since the CPU can access 64K, eight of these memory chips can be used. But how? Some sort of decoding has to be set up. If we hook up the first 13 address lines to the CPU, we are left with three unused lines.

Now, we can use a three to eight decoder chip (explained in an earlier article). If we connect the three unused address lines of the CPU to this decoder, we have eight individual address locations. In turn, these eight lines can be used to control the chip enable lines of eight 8K memory devices. That brings our total to 64K of memory. Mixing the 8K devices between ROM and RAM would give us a complete computer. Well, almost.

Eight chips of memory do not a computer make. It needs a little more than that. Things like a keyboard, video, drives and joysticks are a must on a computer. These connect a computer to the real world. But these things are not as complex as you might think. They are just more devices connected to the CPU via address lines, data lines and control lines.

For instance, the keyboard is simply a bunch of switches and, through a device called a PIA (Peripheral Interface Adapter), the CPU monitors the switches and interprets them according to the software. Each switch represents a letter of the alphabet or a number. That's all. PIAs and other I/O devices take up little room in a memory map. A PIA only takes up four bytes. More decoder chips are needed in order to map it properly, but the same theory is used.

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SIX SHOOTER Tactical Electronics Corporation now offers an automatic parallel interface printer switch that lets up to six computers share one printer. It supports computers using a Centronics-type parallel port. The switch, which is available for under $500, is invisible to applications, allowing use with word processors and graphics screen dumps. Each connected computer is prioritized. If a shared printer is in use, the switch appears to be an offline printer to the computer. Switching is automatic and there is no data loss during switchover. Also, an automatic line feed can be provided for computers if necessary. *Contact Tactical Electronics Corporation, P.O. Box 1743, Melbourne, FL 32902, (305) 676-6907.*

* * *

EDUCATED CABLE The new User Programmable Interface Cable presents a solution to RS-232 asynchronous interface problems. The user may select, via DIP switches on the male-to-male cable, configurations covering 95 percent of applications. The DB25 cable is priced at $19.95 and is available in a 10 foot length. *Contact Craig Data Cable Co., 652 Glenbrook Road, Stamford, CT 06906, (800) 243-5760 (in Connecticut call 203-356-9315).*

* * *

BBS DREAM A new BBS package is under development for the CoCo by Software Interphase, Inc. The *SysLink* system is to support TeleLink Networking for private and public messages; *MicroMatch* for on-line computer dating; *FileMail* for sending private files to other users; *SuperVote* for surveys and polls; and much more. Also provided with the package will be manuals the SysOp may sell to system users. *Contact Software Interphase, Inc., 5 Bradley Street, Providence, RI 02908, (401) 274-LINK (voice) or (401) 272-1138 (300/1200 Baud).*

* * *

TWO-PORT BUFFER Proteus, a parallel two-port buffer that supports hardware or software switching of ports, is now available from Computer Friends. Proteus features multiple-copy capability on each port as well as flexible capacity buffering. This means each port is given as much memory as available. Cost is $199 for the 64K version and $299 for the 256K version. *Contact Computer Friends, Inc., 6415 SW Canyon Ct., Portland, OR 97221, (503) 297-2321.*

* * *

FREE OFFER Falcon Safety Products, Inc. has announced the availability of a free 16-page illustrated guide on preventive maintenance techniques for computers and other electronic office equipment. The booklet guides the reader through proper maintenance using products from the Falcon line of care products. Topics covered include dust removal, static control, platen restoration and safety measures. *Contact Falcon Safety Products, Inc., 1065 Bristol Road, Mountainside, NJ 07092.*

* * *

PUBLIC DOMAIN CompuServe has placed specifications for the asynchronous 'B' protocol file transfer program into the public domain. Protocol features include interrogation of remote computer characteristics such as transfer capabilities, cursor addressing and graphics modes, as well as host initiation of file transfers in either direction. The specification documents and C language sources for the generic implementation can be downloaded free of charge from the CompuServe Information Service.

* * *

PROTECTION Reuters News Service has reported that radiation emitted from computer monitors and televisions may be harmful. To combat the effects of the offending rays, RAM has introduced CRT Shields. Priced from $29.95, these shields are manufactured with lead and chemically treated to filter out harmful radiation. The non-glare shields also include a lifetime warranty. *Contact RAM, 8306 Wilshire Blvd., Suite 10, Beverly Hills, CA 90211, (800) 227-2001 (in California call 800-537-2001).*

* * *

BOOKWORM Howard W. Sams & Co. has recently introduced *Computerfacts* technical service data manuals for seven Tandy/Radio Shack products. These manuals provide the repair data necessary for service and maintenance of computer equipment. Included in the manuals are schematics, wave form photos, trouble-shooting tips and replacement parts lists. Priced from $19.95, the manuals are available for, among other Tandy products, the CoCo and CoCo 2 as well as the DMP-110 printer. *Contact Howard W. Sams & Co., 4300 W. 62nd Street, Indianapolis, IN 46268, (317) 298-5400.*

* * *

ALSO . . . Howard W. Sams & Co. has released *68000, 68010, 68020 Primer* — a book written to introduce novice or experienced programmers to the instruction set and addressing modes of the 68000 family. The book covers architecture of the chips, how to program in assembly language, code-mapping and how the chips are used in multi-user systems. For more information write to the address given above.

* * *

COVER UP Mousetop, the mouse cover with a "country look," has set out to give personality to computer "mice" nationwide. This cover fits most computers' mouse devices. Made from silver/gray fur, Mousetop comes in two varieties. One is slightly near-sighted and wears wire-rimmed "granny" glasses, and the other has 20/20 vision. The washable Mousetop is designed to protect your mouse from the grime of daily use. It retails at $5.95 with glasses and $5.49 with 20/20 vision. *Contact H&H Enterprises, Box 2672, Corona, CA 91718, (714) 737-1376.*

256K SUPER RAM 512K

HOME RUN!

- 256K Bd - $129.95
- 512K Bd - $169.95

(Requires RS Multi-Pak)

OS-9 DRIVER $24.95

The first 256K/512K memory bd for the CoCo II ! Inside this low noise metal case lives 256K/512K of memory and all the circuitry to access it as a RAMDISK ! Compatible w/all CoCo II's even 26-3127 & 26-3134A/B (see June '86 Rainbow Review)

10 MEG SUPER DISK 20 MEG

GRAND SLAM!

☆☆☆☆☆☆☆☆☆☆

Tony Di Stefano (Turn of the Screw Guru) has done it again ! ! ! Coming soon is SUPER DISK - a HARD DRIVE adapter that will fit inside the Super Controller or Super Ram. It will be able to access one or two FIVE, TEN or TWENTY MEGABYTE Hard Disk Drives. Write for more exciting details !

☆☆☆☆☆☆☆☆☆☆

256K THUNDER RAM 256K

STRIKE 1 - RAM!

(NOT available for CoCo II's)

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

Thunder Dupe 2 - Format & Backup a FULL diskette (68 grans) in ONE PASS! Up to 4 Disk Drives!!! $24.95

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

OS-9 DRIVER $24.95

The first 256K memory Bd for the CoCo! Load four 32K pgms at once, emulate a 40trk RAMDISK, 60K Print Spooler, FAST access, 30+ Hi-Res screens in memory!! $99.95 (see Sept '85 Rainbow Review)

DOUBLE RAM - Upgrades a THUNDER RAM from 256K to 512K giving TWO independent RAM Disks! $79.95

SUPER CONTROLLER

STRIKE 2 - DOS!

Uses 2764 ($6.95) or 27128 ($14.95) EPROMS !

EPROM Programmer ↓ $59.95 ↓ (Requires Super Controller)

The most AMAZING CoCo Disk Controller ever! Switch up to 4 DOS's (up to 16K) via a single software POKE! Choose between R/S 1.0/1.1, Spectrum DOS, ADOS, JDOS, Stearman DOS - $99.95

Spectrum DOS $29.95 and/or ADOS $39.95 w/purchase of Super Controller (Buy 'em both for $59)

Enhanced Display 80 - Add an 80x24 display, Real Time Clock & Centronics Parallel Printer interface to your Super Controller ! Includes SMOOTH SCROLLING & Switchable Video Input !! $129.95

NEW! OS-9 Driver for Display 80 $24.95

NEW VERSION COCO MAX II NEW VERSION

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Feature packed hardware & software Graphics System! Includes: Pull-Down Menus, Icon processing, multiple Font styles, full graphic editing plus a special Input Module for 256x192 joystick input.

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Requires Multi-Pak or Y-Cable ($29.95)

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*- Now with DELPHI & Compuserve XMODEM support! Download ML! COMPUSERVE 5hr Start Kit $29.95

SAVE $20 ! Get CC/E TW-64 TELEPATCH for only $99.95

BUY BOTH SAVE $10

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TELEPATCH - A TW-64 enhancer!!! True block move, Overstrike & TSPOOL mode, Type Ahead Buffer FASTER Disk I/O 64K Disk $19.95

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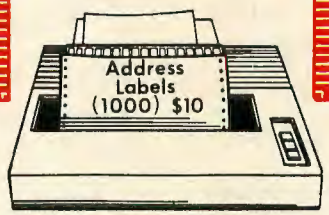
MODEM - 300 Baud - $59.95**
UNITECH Modem Phone - $79.95**
J-CAT Modem - Lowest priced auto/answer modem - $119.95
HAYES SM300 - "Programmable" auto-dial/auto answer-$169.95**
Hayes"CLONE"1200 Baud-$199.95**
** - Add $12.95 for Modem Cable



PRINTERS

GEMINI 10X - closeout $179.95
GEMINI SG-10 - 120 cps w/true descenders, 2K buffer, tract-frict feed, NLQ mode! - $239.95
BriteFace-The first INTELLIGENT Parallel Ptr Interface for CoCo Auto set Baud rates from 600 to 9600/NO switches to turn $59.95

KEYBOARDS

HJL-57 - Save $7.00 !! - $72.95
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-Specify Model/Revision Board-
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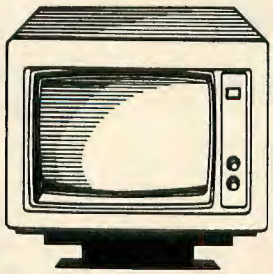

Monitor Stand $24.95

MONITORS

MONOCHROME Monitors - CRISP 80x24 Hi-Res screens! $79.95
Universal Video Driver - Works w/all monitors & CoCos!- $29.95
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SPREADSHEET

	Competition	DYNACALC
Screen	32X16	51X24
Precision	9 digits	16 digits
Hi-Res Graphics	NO	YES
Visicalc cmd format	NO	YES

New low price! 64K Disk $69.95
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(DYNACALC & PCF 2.0 ONLY)
$99.95

DATA BASE MANAGER

PRO-COLOR FILE 2.0 - 60 Data Flds, 8 Report Fmts, 4 Screen Fmts, 1020 bytes/record, Sort 3 Fields, Global Search, FAST ML Sort, Create Files Compatible w/DYNACALC! - Disk $49.95
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DRIVE Ø & 1 System* - $299.95
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* PLUS: controller-manual-cable

GAME CONTROLLERS

Wico Command Adapter - Now you can hookup 2 Atari type joystks to your CoCo for only $19.95!
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4. Graphicom Part II $24.95
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6. Blackjack Royale $24.95
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4464 DRAMs - two chip 64K upgrade for 26-3134A and 26-3134B Korean CoCo II's ..$39.95
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FREE - Send for our CoCo catalog flier !!!
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Software submissions welcomed !

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This bundle of subroutines can lend audio effects to any program

Bleeps, Bloops, Bells and Whistles!

By William Mitchell

This program, *Soundbase*, represents an inventory of sounds used in games and educational programs I have written. They have been developed over several months and saved so they can be appended to any program, then called for subroutines as needed. When the program is completed, the unused subroutines are deleted, but I usually use all of them in most programs. *Soundbase* can be used to form a basis for many programs.

(Editor's Note: Unplug the disk controller, if you have one, before loading the program.) □

Dr. William Mitchell is a gynecologist trained at the University of Alabama Medical Center in Birmingham. He is a self-taught programmer who enjoys experimenting with the features possible with the 6809 chip. He has four children and lives in Enterprise, Alabama.

A SPECTRUM PROJECTS SHOPPING LIST

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68769 (Fits Disk Basic Skt) Eprom.$19.95
Basic ROM 1.3 (Newest version) ...$24.95
Disk ROM 1.1 (New DOS Command) ..$29.95
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Ext Basic 1.1 ROM - NEW LOW PRICE.$29.95
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Model 100 8K Upgrade - (SAVE $70).$49.95
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64K CoCo II - w/NEW keyboard $149.95
Eprom Prgmr (2ms speed/2K - 16K).$149.95
Tandy1000 512K Upgrade-SAVE $350.$169.95

COCO LIBRARY...

A History of the CoCo / 1980-1986 .$3.95
CoCo Memory Map $14.95
Basic Programming Tricks Revealed.$14.95
The FACTS - Inside "guts" of CoCo.$16.95
500 Pokes, Peeks 'N Execs $16.95
Basic 09 Tour Guide $19.95
Assembly Language Programming $19.95
Color Basic Unraveled $19.95
Extended Basic Unraveled $19.95
Disk Basic (1.0/1.1) Unraveled ...$19.95
New! CoCo II Service Manual* $24.95
SECOND Book & Tape of Adventures .$29.95
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The Complete Rainbow Guide to OS9.$19.95
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Printer/Modem 15' Extender Cable .$14.95
Tired of unplugging devices from your RS232 port? Try a RS232 "Y" Cable.$19.95
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Modem Cable - 6ft (DB25-DB25) $19.95
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CoCo Keybd Adapter - Convert 26-3016 & 277-1019 keybds to D/E CoCo's! ..$14.95
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EARS-CoCo's first Voice Recognition unit w/95% accuracy & 64 Voice Prints! $99.95
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Amdek Twin 3" Drvs w/controller .$249.95

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Something possibly wrong with your CoCo??? CoCo CHECKER is the answer!! Will test your ROMs, RAMs, Disk Drives & Controller, Printer, Keyboard, Cassette, Joysticks, Sound, PIAs, VDG, Internal Clock Speed, Multi-Pak Interface and more!! 16K TAPE/DISK **$19.95** (see Jan '85 Rainbow Review)

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Save ROMPAKs to your 64K Disk system using the RS Multi-Pak Interface. Eliminate constant plugging in of ROMPAKs now by keeping all your PAK software on disk. Includes POKEs for "PROBLEM" ROMPAKs- including the NEW 16K PAKS! (Demon Attack,Dragons Lair,etc) 64K DISK **$24.95**

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NEW!

All the FEATURES of TELEPATCH plus the classically proportioned characters of the WIZARD ($19.95) font w/TRUE lowercase descenders! Get BOTH & SUPERCHARGE your TW-64 for only **$29.95**

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A super upgrade from Disk Omni Clone! Back everything up! This amazing program handles "non standard" disks with ease. We haven't found any disk yet that it can't handle. Don't ever be caught without a backup again! Lowest price too! Beats most "copy protection" programs! 32K DISK **$29.95**

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The best screen dump program for the Panasonic, Epson & Gemini printers ever! Have the option of standard or reverse images w/regular or double sized proportional pictures. 600-9600 Baud too! A must for Graphicom and CoCo Calendar users. 16K TAPE/DISK **$19.95** (see Nov '84 Rainbow Review)

DISK UTILITY 2.1*

A multi-featured tool for USER FRIENDLY disk handling. Utilize a directory window to selectively sort, move, rename and kill file entries. Lightning fast Disk I/O for format, copy and backup. Examine contents of files, the Granule Table, plus the size, load addresses and entry points of all programs. Single command execution of both Basic and ML programs. 32K/64K DISK **$24.95** "Disk Utility has proven itself very quickly at my house" - Ed Ellers Oct '84 Rainbow Review pg. 220

SPECTRUM FONT GENERATOR

NEW!

Now you can write files using any CoCo Word Processor (Telewriter-64, VIP Writer, etc.) and convert them to special Highly Detailed character sets! Some of the character sets supported are Italics, Old English, Futuristic and Block. A character set editor is included to create custom sets or modify existing ones! Supports most dot-matrix printers! DISK **$29.95** (see Dec '85 Rainbow Review)

SPECTRUM DOS

Add 24 NEW Disk commands with 2 Hi-Res screens! Supports 40 track & Double-Sided drives, 6 ms stepping, auto disk search, error trapping & "EPROMABLE". 64K DISK ~~$49.95~~ New LOW price!! **$24.95**

SCHEMATIC DRAFTING PROCESSOR

Save time and design pro looking diagrams using a 480X540 pixel worksheet w/6 viewing windows. Over 30 electronic symbols w/10 definable symbols. (Even Logic gates & Multipin chips!) Print hard copy and save to disk. 64K DISK ~~$49.95~~ New LOW price!!! **$29.95** (see Jan '84 Rainbow Review)

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NEW!

Basic+ provides (23) of the most used BASIC cmds w/one keystroke plus scrolling & editing w/single key! Also included is a 32 character typahead BUFFERED keybd w/auto key & repeat plus a 32K Print Spooler & Ptr Echo!! 64K DISK **$29.95** (see Jan '86 Rainbow Review pg. 192)

COCO CHECKBOOK

Use your CoCo to keep track of your checking and savings accounts! Printout individual personal checks! 32K/64K TAPE **$29.95** DISK **$39.95** (see April'85 pg. 210 & Oct'85 pg. 197 Rainbow Reviews)

*** NOW AVAILABLE BY EXPRESS ORDER AT YOUR LOCAL RADIO [illegible]CK STORE -**

#90-0289 COCO CHECKER - #90-0290 DISK UTILITY 2.1

BUY ANY 5 PROGRAMS GET A DRIVE Ø FOR $159.95 !*

***- No other discounts can be applied.**

DEMAND TO SEE THE R/S DEMO DISKS ! (FC#0249 & FC#0919)

COLORFUL UTILITIES

NEW!

COCO TEXT UTIL

Includes utilities that most CoCo word processors (TW-64, VIP Writer, etc.) leave out! Reset margins to correct length for uploading, convert all UPPER CASE text to mixed upper/lower, display total BYTE count, EASY rename & kill functions! DISK **$19.95** (see May '86 Rainbow Review)

COCO VIDEO TITLER

Start your VCR tapes with dazzling title frames followed by professional countdown to black fade-outs! Use a title page editor with several sizes of text & background colors! 16K TAPE **$19.95**

PENPAL

It's here! CoCo's answer to 1-2-3! PENPAL combines Word Processing, Communications, Graphics, Data Base & Spread-sheet into a single integrated software package! 64K DISK INTRO PRICE **$69.95**

64K DISK UTILITY PACKAGE

Take advantage of an expanded 64K machine. Make an additional 8K of RAM available by relocating the Ext Basic ROM from $8000 to $D800. Copy ROMPAKS to disk (even "protected" PAKS) and create a 32K SPOOL buffer for printing. DISK **$21.95** (see July '83 Rainbow Review)

TAPE/DISK UTILITY

A powerful package that transfers tape to disk and disk to tape automatically. Does an automatic copy of an entire disk of programs to tape. Ideal for Rainbow On Tape to disk. Also copies tape to tape & prints tape & disk directories. TAPE/DISK **$24.95** (see Sept '83 Rainbow Review)

NEW!

SUPER DUPER UTILITIES

Finally! At last! A "SUPER DUPER" utility software package all rolled up into ONE!!! Includes such great utilities as: CoCo Disk Zap, Disk Encryption, Disk Mailing List, EZ Disk Master, Graphics ZOOM, Banner Creator, Function KEYS, Super INPUT/LINEINPUT, Basic Program PACKER, Alpha Directory, Basic SEARCH and much, much more!!! 32K DISK **$29.95** (see June '86 Rainbow Review)

COCO CALENDAR

Get organized for '86 TODAY with the CoCo Calendar! Designed for recording the entire year's occassions and daily appointments so you can plan ahead. You can store HUNDREDS of entries and our GRAPHIC Calendar will show all MEMOS! 32K DISK **$24.95** (see Mar '86 Rainbow Review)

THE OS-9 SOLUTION

NOW, a program that creates a "USER FRIENDLY" environment within OS-9! The OS-9 SOLUTION replaces 19 of the old "USER HOSTILE" commands with single keystroke, menu driven commands. No more typing in complex long pathnames or remembering complicated syntaxes! Set all XMODE parameters at the touch of keys! Requires OS-9 ver.01.01.00 **$39.95** (see Sept '85 Rainbow Review)

COCO-UTIL

NEW!

Now you can have the power to easily transfer Radio Shack Color Computer disk files to your MS-DOS machine - including the Tandy 1000 & IBM PC!!! You can also transfer MS-DOS files to your CoCo disk, even format CoCo disks! CoCo-Util will save you countless hours of retyping! No need to move your computer or printer anymore! Requires 128K MS-DOS computer w/2 disk drives - **$29.95**

NEW!

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Create an instant library of Spectrum Projects TOP Colorful Utility software. Select any of the following 12 programs to customize your own SPECTACULAR SOFTWARE BONANZA! CoCo Checker, Multi-Pak Crak, CoCo Screen Dump, Disk Utility 2.1, Spectrum Font Generator, Tape/Disk Utility, Fast Dupe II, 64K Disk Utility, Spectrum DOS, CoCo Calendar, Schematic Drafting Processor, OS-9 Solution, Graphicom, EZ Base or Blackjack Royale (a $300 plus value) for only **$99.95!!!**

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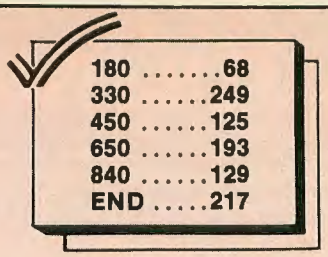

The listing: SOUNDBSE

```
1Ø '       SOUNDBASE
COPYRIGHT BY WILLIAM L. MITCHELL
             1Ø4 CLUBVIEW RD
             ENTERPRISE,AL 3633Ø
             NOV 1985
2Ø CLEAR 2ØØ
3Ø POKE359,Ø
4Ø GOSUB61Ø
5Ø GOTO65Ø
6Ø '          SOUND SUBROUTINES
7Ø '
BUZZER
8Ø FORV=3ØTO2STEP-2:PLAY"V31;L25
5;O3;5":NEXTV:RETURN
9Ø '
DEPTH SOUND
1ØØ PLAY"T2":FOR V=2ØTOØSTEP-5:P
LAY"O4;V"+STR$(V)+";L4;12"
11Ø FORDL=1TO2Ø:NEXTDL
12Ø NEXTV
13Ø FORDL=1TO3ØØ:NEXTDL
14Ø RETURN
15Ø '
SIREN WARNING
16Ø PLAY "V3Ø;L2ØØ;O4;1;2;3;4;5;
6;7;8;9;1Ø;11;12;O5;1;2;3;4;5;6;
7;L1ØØ;8"
17Ø RETURN
18Ø '
ZAP OF VOLTAGE
19Ø PLAY"V2Ø;L255;O1;1;2;3;2;3;4
;3;4;5;4;5;6;5;6;5;4;5;4;3;4;3;2
;3;2;1"
2ØØ RETURN
21Ø '
HISS OR FIZZ
22Ø PLAY"L255;O1;V3Ø;1;V5;2;V6;3
;V7;2;V5;3;V4;4;V3;5;V3;4;V4;3;V
6;4;V4;5;V5;6;V4;5;V3;4;V2;5;V3;
6;V2;7;V3;8"
23Ø RETURN
24Ø '
BLIPP
25Ø PLAY"L255;O1;V3Ø;1;V26;2;V22
;3;V18;4;V14;5;V12;6":SOUND 1,1
26Ø RETURN
27Ø '
28Ø '
SPRING
29Ø PLAY"O2;L255;V15;1;O3;V1Ø;1;
V9;2;V8;3;V7;4;V6;3;V5;4;V4;3;V3
;2;V2;1;V1;1;2;3;2;1;2;3;2;1;2;3
;2;1;2;3;2;1;2;3;2;1;2;3;2;1"
3ØØ RETURN
31Ø '
TAUNT
32Ø PLAY "V3;O3;L16;1Ø;1Ø;7;12;L
8;1Ø;7":RETURN
33Ø '
CHARGE
34Ø FORX=1TO2
35Ø PLAY "L4;V4;O4;L16.;1;L32;1;
L16.;1;L32;1;L16.;1;L32;1;L16.;1
;L32;5;L16.;8;L32;5;L16.;8;L32;5
;L16.;8;L32;5"
36Ø NEXTX:PLAY"1":RETURN
37Ø '
BIG SPRING
38Ø FORV=31TO1STEP-1:PLAY"O1;V"+
STR$(V)+";L255;8":NEXTV:RETURN
39Ø '
BOUNCING BALL
4ØØ PLAY"T2;L255;O1;V31;1;V2Ø;1;
V1Ø;1;P2;V9;1;P5;1;V8;P1Ø;1;V6;P
15;1;V4;P2Ø;1;V2;P25;1;V2;P3Ø;1;
P35;1;P45;1;P6Ø;1;P8Ø;1"
41Ø RETURN
42Ø '
SIREN
43Ø PLAY"T255;L255;O4;V1;1;2;V2;
3;4;;V3;5;6;V4;7;8;V5;9;1Ø;V6;11
;L4;12;L255;V5;1Ø;9;V4;8;7;V3;6;
5;V2;4;3;V1;2;L1;1"
44Ø FOR DLAY=1TO2ØØ:NEXTDLAY:RET
URN
45Ø '
WOLF WISTLE
46Ø PLAY"T255;L255;O4;V2;2;V2;2;
V3;3;V4;4;V5;5;V6;6;V7;7;V8;8;V9
;9;V1Ø;1Ø;V11;11;V12;12;O5;V13;1
;V14;2;V15;3;V16;4;V17;5;V18;6"
47Ø FORDLAY=1TO1ØØ:NEXTDLAY:GOSU
B43Ø:RETURN
48Ø '
MACHINE GUN
49Ø FORX=1TO6:PLAY"O1;L255;4;3;2
;1":NEXTX:RETURN
5ØØ '
HOORAY FOR THE RED WHITE & BLUE
51Ø PLAY "O4;V5;L8;C;C;O3;L16;A#
;A;L4;A;V5;L8;G#;A;L2;A":RETURN
52Ø '
FOR SCREEN DISPLAY
53Ø KOLOR=RND(7):PATTERN=RND(15)
54Ø FACTOR=128+(16*KO)+PA
55Ø FOR T=1TO2Ø
56Ø PRINT STRING$(32,CHR$(FA));
```

```
57Ø NEXTT
58Ø RETURN
59Ø '
6ØØ 'TO GET SCREEN LINES
61Ø DIMS$(17)
62Ø FORX=1TO17
63Ø READ S$(X)
64Ø NEXT:RETURN
649 '
65Ø PG=1:SCREENØ,1:GOSUB53Ø:PRIN
T@32,                "          PAGE
   ONE                ";:P=98
66Ø FORX=1TO8:PRINT@P,S$(X);
67Ø P=P+33:NEXT
68Ø PRINT@416,CHR$(255);
72Ø GOTO79Ø
74Ø '
75Ø PG=2:SCREENØ,1:GOSUB53Ø
76Ø PRINT@32,                    "
        PAGE    TWO                "
;
77Ø P=99
78Ø FORX=9TO17:PRINT@P,S$(X);:P=
P+33:NEXT
79Ø PRINT@416,CHR$(255);
8ØØ INPUTN
81Ø GOSUB1Ø6Ø
811 IFN=8THEN75Ø
812 IFN=17THEN65Ø
83Ø ON N GOSUB 8Ø,1ØØ,16Ø,19Ø,22
Ø,25Ø,29Ø,1Ø5Ø,49Ø,32Ø,34Ø,51Ø,3
8Ø,4ØØ,43Ø,46Ø,1Ø4Ø
84Ø IFPG=2THEN75Ø
85Ø IFPG=1THEN65Ø
855 PRINTPA:PRINTPA:PRINTPA:STOP
86Ø GOTO75Ø
87Ø DATA BUZZER---------1
88Ø DATA DEPTH SOUND----2
89Ø DATA SIREN WARNING--3
9ØØ DATA BLAST OF LASER-4
91Ø DATA HISS OR FIZZ---5
92Ø DATA BLIPP----------6
93Ø DATA SMALL SPRING---7
94Ø DATA * SECOND PAGE--8
95Ø DATA MACHINE GUN----9
96Ø DATA TAUNT---------1Ø
97Ø DATA CHARGE--------11
98Ø DATA HOORAY SONG---12
99Ø DATA BIG SPRING----13
1ØØØ DATA BOUNCING BALL-14
1Ø1Ø DATA SIREN---------15
1Ø2Ø DATA WOLF WHISTLE--16
1Ø3Ø DATA * FIRST PAGE--17
1Ø4Ø PG=2:GOTO75Ø
1Ø5Ø PG=1:GOTO65Ø
1Ø6Ø SCREENØ,Ø:RETURN
```


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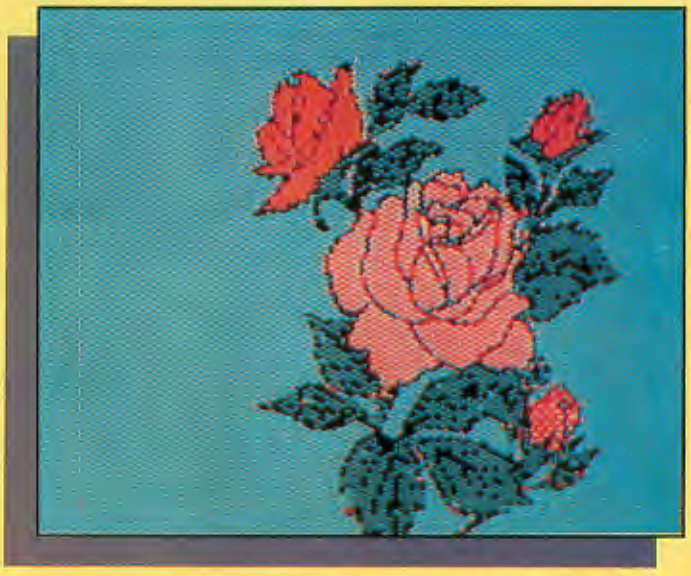
The CoCo Gallery

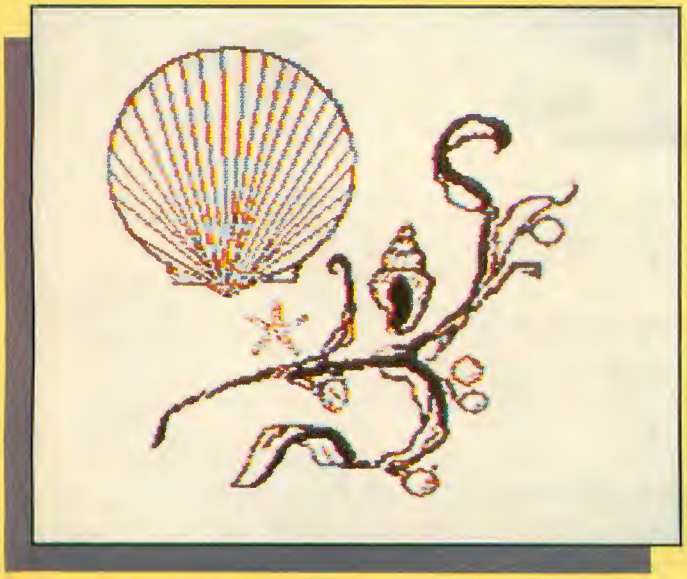
1st PRIZE

Harry McKinion
Cardinal
Our June Gallery opens with a familiar sight of summer, a brilliantly colored songbird heralding the end of winter. Harry lives in Semmes, Alabama and used *X-Pad* to create this picture.



2nd PRIZE

Clay Ambrose
Rose
June is when the roses bloom to their fullest beauty and this skillful rendition of one of nature's lovely embellishments was drawn using *CoCo Paint*. Clay lives in Bloomington, California.

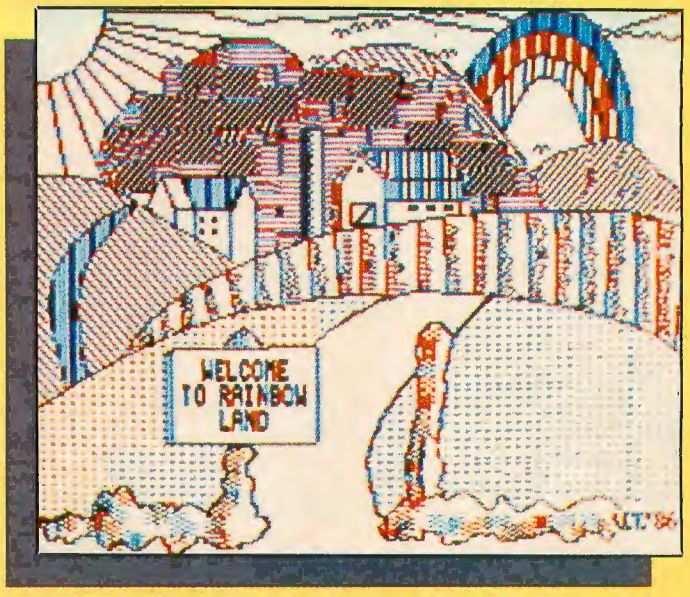


3rd PRIZE

Michael Wafkowski
Scallop 2
Michael lives in Elwood Park, New Jersey and used *CoCo Max* to create a charming arrangement of shells sure to make anyone long for the sea breezes and summer fun at the beach.

HONORABLE MENTION

Ken Miller
Sunset
Sundown in the city after a hot summer's day is always a welcome sight and apropos in our June Gallery. Ken lives in Yardley, Pennsylvania and used *CoCo Max I & II* for his work.



HONORABLE MENTION

Valerie Torres
Rainbowland
Summer is the season of daydreams and this winsome scene was drawn using BASIC. Valerie lives in Hollywood, California.

HONORABLE MENTION

Merwyn Bly
Egret
Another seaside scene familiar to beach lovers is a lone Egret swooping around looking for the best place to wade. Merwyn lives in Vienna, Virginia and used Extended Color BASIC to draw this picture.

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You are invited to nominate original work for inclusion in upcoming showings of "CoCo Gallery." Share your creations with the CoCo Community!

Be sure to send a cover letter with your name, address and phone number, detailing how you created your picture (what programs you used, etc.) and how to display it. Also, please include a few facts about yourself.

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We will award a first prize of $25, a second prize of $15 and a third prize of $10. Honorable mentions will also be given.

Monica Dorth, Curator

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Learning another valuable Life Skill . . .

A Measure of Success

By Fred B. Scerbo
Rainbow Contributing Editor

Editor's Note: If you have an idea for the "Wishing Well," submit it to Fred c/o THE RAINBOW. Remember, keep your ideas specific, and don't forget that this is BASIC. All programs resulting from your wishes are for your use but remain the property of the author.

This month's "Wishing Well" offers another Life Skills program designed to help youngsters or students sharpen a skill that is very important for everyday survival. The program, titled *Ruler*, is designed to help individuals master the detailed use of a common ruler (non-metric). Using only the commands available in 16K Color BASIC, we will create a slick program that not only quizzes these skills, but actually helps in the training and memorization required to use them.

Fred Scerbo is a special needs instructor for the North Adams Public Schools in North Adams, Massachusetts. He holds a master's in education and has published some of the first software available for the Color Computer through his software firm, Illustrated Memory Banks.

The Wish

Several years ago THE RAINBOW published a program by T. Gray called *Ruler Reader*. It was designed to help quiz the user on reading a ruler and measuring a randomly generated line on the screen. (Mr. Gray's program was based on another program called *King Komputer* by D.B. Allison in the April 1982 issue of *80 Micro* magazine.) The program was a real find for me, since I often spend much time creating from scratch most of the educational programs I need to use with my handicapped and special needs students. The students greatly enjoyed this ruler program.

There was one minor drawback to the program, however. The ruler drawn would only display a measuring stick with divisions down to an eighth of an inch. Since many of my students are involved in a graphic arts program, they are often required to have ruler reading skills down to one-sixteenth of an inch in order to accurately complete their tasks.

I resorted to making work sheets with an enlarged inch broken into 16 parts, all with the correct measurements written below. This proved to be very successful, but many of my fellow instructors lamented the lack of a $^1/_{16}$ inch program like the one that THE RAINBOW had provided.

Therefore, the time had finally come to grant a new wish: Create a ruler program that would go down to one-sixteenth of an inch and that would not only quiz, but instruct on the various parts of the displayed inch.

The Program

The concept behind *Ruler Reading Skill* is simple. Using the low resolution graphics of the Color Computer, we create an enlarged view of one inch. I am partial towards using a completely black screen with programs such as this, using `CLS(0)`. Since the inch we draw is with white screen blocks, the black background helps to emphasize the actual divisions on the screen.

Using a set of `FOR/NEXT` loops and the `GET` command, we draw this large inch with subdivisions of $^1/_{16}$ displayed. A set of subroutines is also included to label each of these marking lines as needed. This is done using screen `POKE`s so we can have reversed numbers for our fractional markings. This helps keep the consistency of the black screen. (Naturally, these `POKE`s will cause prob-

lems for those who may wish to type this into the MC-10. More on that later.) The overall look of the screen is quite effective.

One very important feature I have included in this program is the rewrite of the INPUT command using INKEY$, which I introduced several months ago. As I mentioned then, the major drawback to the INPUT command is that it reacts to the CLEAR key and thus wipes the screen clean of any work done by the user.

"One of the best features is the review section"

I am sure there are some memory POKEs that disable the CLEAR key, just as there are for the BREAK key. However, there is another major advantage to using this variation of the subroutine mentioned. I have included some IF/THEN statements to have it ignore any useless keys on the keyboard. Since we only want to have our student pressing the numbers and the slash (/) to create our fractions, the letters on the keyboard have been ignored. This prevents the entry of an additional character.

For example, if the answer is ½, the program would mark space ½ as incorrect. The space bar is one of the keys ignored for this reason. All of our possible answers in the quiz section are stored in DATA statements as strings. Therefore, the string "½" and " ½" would not be a match. This way, we avoid needless hassle, especially with some all-thumbs individuals.

Like the original ruler program, the screen gives a random length line that must be matched against the inch displayed. No value markings appear below the lines at this point. I have also taken great care to make the line and the markings on the screen large enough and close enough together so there will be no question as to which marking the line is matching up with.

The user must enter the correct fractional length of an inch using the numbers and the slash mark. The ENTER key must be pressed to record the answer. If the answer is correct, the screen indicates so, and places the marking labels below each inch.

If the answer is incorrect, the screen says: SORRY! TRY AGAIN: and allows another try. On the third try, the screen displays the value markings of each line. At this point, the student should be able to get the correct response. If not, the screen displays the correct answer.

The program may be interrupted at any time by pressing the '@' key and the score is displayed. Continue the quiz part of the program by pressing 'C', rerun the program by pressing 'Y' for yes, or stop by pressing 'N' for no. If you are using this program with students, I would not show them the 'C' (continue) function right away or they will be checking their score after every single problem.

One of the best features of this program is the review section, which appears at the beginning of the program. As you may recall from previous "Wishing Well" articles, I have a special pet gripe against software that claims to be educational but does not teach anything. Many programs just quiz a skill rather than teach it.

The review feature allows the student to walk through the parts of the ruler as many times as needed to be familiar with the material. The student advances through the parts of the ruler by pressing the ENTER key. After the review is complete, the screen reads:

```
DO YOU WANT TO TRY AGAIN (Y/N)?
```

Pressing 'Y' repeats the review while pressing 'N' goes directly to the quiz. You may choose to skip the review part altogether.

MC-10 Changes

I have taken a little different approach this time for the MC-10 changes. If you want to type this in, make the following changes. First, leave out Line 160 and include the following lines in its place:

```
160 X$=INKEY$:MU=(-9999):IFX$
=~R~THEN 170
161 IFX$=~Q~THEN500
162 GOTO160
```

Next, you must change lines 390-470 to adjust for the POKE variations on the screen locations. After each POKE we need to add MU+.

I have relisted them with the corrections included:

```
390 L=0:FORI=0TO18STEP4:L=L+2:PO
KEMU+1218+I,47+L:NEXT
400 L=0:FORI=21TO31STEP4:L=L+2:P
OKEMU+1216+I,49:POKEMU+1217+I,47
+L:NEXT
410 FORI=0TO31STEP4:POKEMU+1249+
I,45:POKEMU+1250+I,45:NEXT
420 FORI=0TO31STEP4:POKEMU+1281+
I,49:POKEMU+1282+I,54:NEXT:RETUR
N
430 L=0:FORI=0TO31STEP8:L=L+2:PO
KEMU+1316+I,47+L:NEXT
440 FORI=0TO31STEP8:L=L+2:POKEMU
+1348+I,45:NEXT
450 FORI=0TO31STEP8:POKEMU+1380+
I,56:NEXT:RETURN
460 POKEMU+1384,49:POKEMU+1400,5
1:POKEMU+1416,45:POKEMU+1432,45:
POKEMU+1448,52:POKEMU+1464,52:RE
TURN
470 POKEMU+1424,49:POKEMU+1456,4
5:POKEMU+1488,50
```

They are listed here in a 32-column format to help you out. You must add one more line as well:

```
35 MC=15360
```

This helps to ensure the screen POKEs are correct.

Conclusion

The reactions of my students and fellow teachers have been very positive toward this latest Life Skills program. While the inspiration came from other programs, it remains unique in and of itself. I hope you find it useful.

Oops! Correction

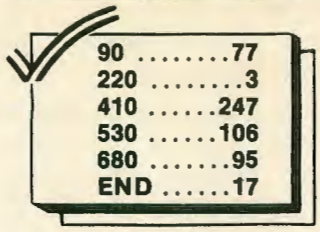
Last month I offered a program to create educational plans. I recently uncovered a small quirk that occurs when you scan through all the objectives. The program appears to end if you go all the way to the last objective. This can be solved by including a DATA line reading:

```
4338 DATA ~THIS IS THE END OF
THE OBJECTIVES. RETURN TO
THE MENU.~
```

This solves the problem by giving you a chance to exit. I hope no one was stymied by this little bug.

Next Month

A surprise for the five-year anniversary issue! □



The listing: RULER

```
1 REM****************************
2 REM* LIFE SKILLS INSTRUCTION *
3 REM*  RULER READING SKILLS1  *
4 REM*     BY FRED B. SCERBO    *
5 REM* 6Ø HARDING AV.N.ADAMS,MA*
6 REM*   COPYRIGHT (C)  1986   *
7 REM****************************
1Ø CLSØ:FORI=1TO32:PRINTCHR$(22Ø
);:NEXT
2Ø FORI=1TO192:READ A:PRINTCHR$(
A+128);:NEXT
3Ø DATA29,24,96,29,24,2Ø,3Ø,28,2
6,29,28,29,,,3Ø,28,26,29,,,3Ø,2Ø
,3Ø,2Ø,3Ø,16,2Ø,3Ø,,21,28,29
4Ø DATA21,,,21,,,26,96,24,21,,2Ø
,16,,26,,24,21,16,22,16,,26,,26,
,16,26,,21,,2Ø
5Ø DATA21,,,21,,,27,26,96,21,19,
18,,,27,19,18,21,22,16,,,26,,26,
,16,26,,21,19,19
6Ø DATA85,,,85,,,9Ø,24,,85,,,,,,
,9Ø,85,84,82,,,9Ø,,9Ø,,16,9Ø,,,,
85
7Ø DATA85,,9Ø,85,,,9Ø,,,85,,81,,
16,9Ø,,9Ø,85,,84,82,,9Ø,,9Ø,85,8
Ø,9Ø,85,85,8Ø,85
8Ø DATA87,83,9Ø,87,82,81,91,8Ø,,
87,83,87,,8Ø,91,83,9Ø,87,82,8Ø,9
1,81,91,81,91,87,81,91,87,85,83,
87
9Ø FORI=1TO32:PRINTCHR$(211);:NE
XT
1ØØ PRINT@324," INSTRUCTIONAL  P
ROGRAM ";
11Ø PRINT@356,"  RULER READING S
KILLS  ";
12Ø PRINT@388,"    BY FRED B.SCE
RBO    ";
13Ø PRINT@42Ø,"   COPYRIGHT (C)
1986   ";
14Ø PRINT@452,"   (R)EVIEW OR (Q
)UIZ   ";
15Ø DIMN$(15):FORI=1TO15:READ N$
(I):NEXT:FORI=1TO64:WO$=WO$+CHR$
(128):NEXT
16Ø X$=INKEY$:MU=(-TIMER):IFX$="
R"THEN17ØELSEIFX$="Q"THEN5ØØELSE
16Ø
17Ø GOSUB3ØØ
18Ø PRINT@Ø,"THE LONGEST LINE ON
 OUR INCH IS THE ONE-HALF INCH M
```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Adventure In Mythology
By Scott Cabit

An animated graphics adventure. Battle monsters and discover treasures as you assume the personalities of various heroes in ancient Greek mythology! You goal is to win the hand of the beautiful Atalanta, the swift-running huntress. But beware of the perils and obstacles that stand in your way as you journey through ancient Greece! Four-voice music and sound effects, automatic speech when using a Tandy SSC speech pak. Load and Save feature, over 250 locations. 64K Machine language.

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Fighter Pilot

An original arcade game! Wave after wave of attacking aircraft attempt to shoot you down as you maneuver your fighter into the wild blue yonder, blasting enemy fighter, bombers, and paratroopers out of the sky. Joystick or keyboard operation, "pause game" feature. Disk version saves high scores. 32K, 100% Machine Language. See February '86 Rainbow for review.

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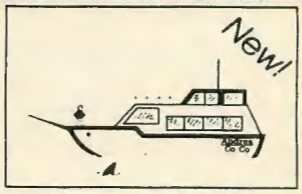

The Andrea CoCo
By Art Martin

Another great animated graphics adventure! All you came down to the Yacht Club for was to get a drink and maybe play a little poker. Heck, nobody would ever guess that the closest thing you owned to a real yacht was the one over your fireplace. It was in the bar that you heard rumors of earth-shattering events about to take place. You step out onto the wharf to get a little air when your natural curiosity and sense of adventure start to work...Can you save the world? Superb graphics, save & load feature. 64K, one disk drive required.

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Pumpman

You'll dig this 100% ML arcade game! The Pumpman carries a pump that he fires at aliens Pooky and Dragon as they change forms and chase him around underground. 15 different screens, "pause game" feature, bonuses. As fun and challenging as the original arcade game! 32K, one joystick required.

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```
ARKING LINE. ";:GOSUB47Ø
19Ø IFINKEY$<>CHR$(13)THEN19Ø
2ØØ PRINT@Ø,"THE NEXT TWO LINES
ARE OUR ONE- QUARTER AND THREE Q
UARTER LINES.";:GOSUB46Ø
21Ø IFINKEY$<>CHR$(13)THEN21Ø
22Ø PRINT@Ø,"THE NEXT FOUR LINES
 INDICATE THEEIGHTHS OF AN INCH
ON OUR RULER.";:GOSUB43Ø
23Ø IFINKEY$<>CHR$(13)THEN23Ø
24Ø PRINT@Ø,"OUR SMALLEST MARKIN
GS OF AN INCHARE THE SIXTEENTHS
OF AN INCH.  ";:GOSUB39Ø
25Ø IFINKEY$<>CHR$(13)THEN25Ø
26Ø PRINT@Ø,WO$;:PRINT@Ø,"DO YOU
 WANT TO TRY AGAIN (Y/N) ?";
27Ø X$=INKEY$:IFX$="Y"THEN17Ø
28Ø IFX$="N"THEN5ØØ
29Ø GOTO27Ø
3ØØ CLSØ
31Ø C=5
32Ø FORI=ØTO63:SET(I,6,C):NEXT
33Ø FORI=6TO28:SET(Ø,I,C):NEXT
34Ø FORI=ØTO63STEP4:FORY=6TO1Ø:S
ET(I,Y,C):NEXTY,I
35Ø FORI=ØTO63STEP8:FORY=1ØTO16:
SET(I,Y,C):NEXTY,I
36Ø FORI=ØTO63STEP16:FORY=16TO2Ø
:SET(I,Y,C):NEXTY,I
37Ø FORY=2ØTO22:SET(32,Y,C):NEXT
38Ø RETURN
39Ø L=Ø:FORI=ØTO18STEP4:L=L+2:PO
KE1218+I,47+L:NEXT
4ØØ L=Ø:FORI=21TO31STEP4:L=L+2:P
OKE1216+I,49:POKE1217+I,47+L:NEX
T
41Ø FORI=ØTO31STEP4:POKE1249+I,4
5:POKE125Ø+I,45:NEXT
42Ø FORI=ØTO31STEP4:POKE1281+I,4
9:POKE1282+I,54:NEXT:RETURN
43Ø L=Ø:FORI=ØTO31STEP8:L=L+2:PO
KE1316+I,47+L:NEXT
44Ø FORI=ØTO31STEP8:L=L+2:POKE13
48+I,45:NEXT
45Ø FORI=ØTO31STEP8:POKE138Ø+I,5
6:NEXT:RETURN
46Ø POKE1384,49:POKE14ØØ,51:POKE
1416,45:POKE1432,45:POKE1448,52:
POKE1464,52:RETURN
47Ø POKE1424,49:POKE1456,45:POKE
1488,5Ø
48Ø RETURN
49Ø DATA 1/16,1/8,3/16,1/4,5/16,
3/8,7/16,1/2,9/16,5/8,11/16,3/4,
13/16,7/8,15/16
5ØØ GOSUB3ØØ:TM=Ø
```


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See review in the May '86 issue of Rainbow Magazine.

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BASIC COMPILER

WASATCHWARE believes that users of the Color Computer deserve the right to use all 64k of RAM that is available in the computer, and have fast machine language programs that use the full potential of the 6809 microprocessor. That is why the BASIC compiler, called ML BASIC was developed. Here are some of the reasons that make this compiler one of the best bargains in this magazine:

- Programs can use all 64k of RAM for either program storage or for large numbers of variables and arrays like A(20000)
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   CALL END EXEC FOR STEP NEXT
   GOSUB GOTO IF THEN ELSE ERROR
   ON..GO RETURN STOP SUBROUTINE

3. Math Functions
   ABS ASC ATN COS CVN EOF
   EXP FIX INSTR INT LEN LOG
   LOC LOF PEEK POINT PPOINT RND
   SGN SIN SQR TAN TIMER VAL

4. String Functions
   CHR$ INKEY$ LEFT$ MID$ MKN$ RIGHT$
   STR$ STRING$

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   COLOR CLS CIRCLE DRAW LINE PAINT
   PCLEAR PCLS PLAY PMODE PRESET PSET
   RESET SCREEN SET SOUND

6. Other/Special Commands
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```
51Ø P=RND(15):K=P*4:FORI=ØTOK:SE
T(I,4,8):NEXT
52Ø PRINT@Ø,"HOW LONG IS THIS LI
NE? ";
53Ø GOSUB76Ø:IFK$=N$(P)THEN NC=N
C+1:GOTO6ØØ
54Ø PRINT@Ø,WO$;:IFTM=ØTHEN56Ø
55Ø GOSUB39Ø:GOSUB43Ø:GOSUB46Ø:G
OSUB47Ø
56Ø NW=NW+1
57Ø TM=TM+1:IFTM>3THEN59Ø
58Ø PRINT@Ø,"SORRY, TRY AGAIN: "
;:GOTO53Ø
59Ø PRINT@Ø,WO$;:PRINT@Ø,"SORRY,
 IT IS ";N$(P);" INCHES LONG.":G
OTO62Ø
6ØØ PRINT@Ø,WO$;:PRINT@Ø,"VERY G
OOD! PLEASE PRESS <ENTER>!";
61Ø GOSUB39Ø:GOSUB43Ø:GOSUB46Ø:G
OSUB47Ø
62Ø X$=INKEY$:IFX$=CHR$(13)THEN5
ØØELSEIFX$="@"THEN63ØELSE62Ø
63Ø CLS:PRINT:PRINT:PRINT
64Ø PRINTTAB(3)"PROBLEMS COMPLET
ED  = "NC+NW:PRINT
65Ø PRINTTAB(3)"CORRECT RESPONSE
S   = "NC:PRINT
66Ø PRINTTAB(3)"INCORRECT RESPON
SES = "NW:PRINT
67Ø TR=NC+NW:IFTR=ØTHENTR=1
68Ø SC=INT(NC/TR*1ØØ)
69Ø PRINTTAB(3)"YOUR TOTAL SCORE
   = "SC"%":PRINT
7ØØ PRINTTAB(3)"ANOTHER TRY (Y/N
) OR (C) ?";
71Ø X$=INKEY$:IFX$=""THEN71Ø
72Ø IFX$="Y"THEN RUN
73Ø IFX$="N"THEN CLS:END
74Ø IFX$="C"THEN 5ØØ
75Ø GOTO71Ø
76Ø PRINT"=> ";
77Ø Y$=""
78Ø X$=INKEY$:IFX$=""THEN78Ø
79Ø IFX$=CHR$(13)THEN88Ø
8ØØ IFX$=CHR$(8)THEN86Ø
81Ø IFX$="@"THEN63Ø
82Ø IFX$=" "THEN78Ø
83Ø IF ASC(X$)<13THEN78Ø
84Ø IF ASC(X$)>64 THEN78Ø
85Ø Y$=Y$+X$:PRINTX$;:GOTO78Ø
86Ø WW=LEN(Y$):IFWW=ØTHEN77Ø
87Ø PRINTX$;:Y$=LEFT$(Y$,WW-1):G
OTO78Ø
88Ø PRINT
89Ø K$=Y$
9ØØ RETURN
```


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Even if you don't know much about music, banging away on the keys of a piano can be a lot of fun. If you have always wanted to compose music, but didn't have an instrument or the time to learn how to play, now you do. The CoCo *Piano-Synthesizer/Composer* makes composing tunes easy. It turns the CoCo's keyboard into a piano keyboard, remembers the notes played and plays them back at any tempo you choose. It provides a powerful editor for correcting or altering the stored music data.

Martin and Jeremy Spiller are a father and son team from Shirley, Massachusetts. Martin is a dentist and enjoys programming in his spare time. Jeremy is 14 years old and hopes to own his own software company someday.

The CoCo piano allows you to save each composition on tape or disk, and to load them as stand-alone machine language programs that EXEC without the help of the BASIC language driver. Furthermore, it automatically creates PLAY statements complete with line numbers and stores them on tape or disk for merging into BASIC programs. This function is in addition to, and totally separate from, the ability to store the music as synthesized ML programs. You may reload your ML composition back into the BASIC editor at a later date and add to or edit the composition. Please note that the CoCo piano does not play chords, only single notes.

The CoCo *Piano-Synthesizer/Composer* can be programmed to sound like a wide variety of instruments (as well as non-instruments). It contains two envelope tables that can be programmed by the user. With a bit of experimentation, it can sound like a jazz piano, an organ, an echo chamber or like no instrument ever heard before. You can toggle from one envelope to the other at any time while composing. This change is recorded in the musical data and, on playback, toggles a change to the other envelope. When the composition is saved, any changes made in the envelope tables are automatically saved along with the music data.

How to Use the Program

There are two separate program listings. The first one boots the machine language synthesizer into memory and saves it on tape or disk as *PIANO/BIN*. Line 2 of the booter contains checksums for each of the data lines. Provided all

Out-Of-This-World Sounds

By Martin and Jeremy Spiller

of the entries in Line 2 are correct, the program tells in which line you have made a mistake in typing the rest of the data statements. Do not renumber this program! If you get an error report and can't find the error in the line reported, check to see if the checksum in Line 2 is correct.

The second program listing is the BASIC language utility that allows easy management of the ML program. While keying it in, it is best to include only those spaces between commands that you see in the listing. We economized on memory to allow 16K users to use the piano, and extra spaces use extra memory. Save this program on disk or tape as *PIANO/BAS*. *PIANO/BAS* loads *PIANO/BIN* each time it is run, so both programs should be on the same disk or tape. Run the BASIC program. A prompt asks if the ML program is to be loaded from tape or disk. Once the ML program has been loaded, the main menu appears.

Now press '1'. This puts you in the play/compose mode. Begin playing music and the computer stores the notes and their lengths. The length of the note depends mostly on the length of time your finger remains on the key. However, the program does record information on the length of time between keystrokes up to a maximum of one second.

In this mode, a text screen representation of the keyboard appears on the TV. The keyboard looks like a two-tiered organ keyboard. All of the keys in the second row and most of the keys in the bottom row are mapped to resemble the white keys on a piano. They are each marked with the note that the key plays when depressed. The keys above them represent the black keys on the piano. Notice that some of the keys in the first and third rows are colored blue on the map. These keys produce no sound when pressed, and are not recorded in music memory. They represent sharps and flats that do not exist on the chromatic scale; their omission gives the keyboard the appearance of a piano keyboard.

Three octaves are represented, starting at middle C. They go from the up-arrow key to the 'Y' key, from the 'U' key to the right-arrow key, and from the 'Z' key to the '<' key.

Some of the keys are colored red — these are control keys. They are the CLEAR, ENTER, SHIFT, '?' and space bar. These can be pressed at any time while

in the play/compose mode. The SHIFT key exits the synthesizer and returns to the main menu.

In order to simplify playing the keyboard, consider using black-and-white self-adhesive tabs to cover the appropriate keys. These can be obtained at any stationery store. If you can't find these, try small pieces of colored electrician's tape.

Playing versus Composing

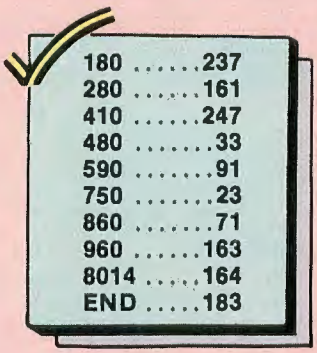
The machine code program was originally formulated to allow experimentation. The object was to allow the user to modify a pure tone by manipulating its volume over time. This is done by specifying the volume at discrete intervals in what is known as an envelope pattern. Some envelope patterns, such as the piano envelope, sound lovely if stretched out over a long period (a high envelope delay) and if played only once per key press. Others can give interesting effects if the delay is shortened and if the envelope pattern is repeated for as long as the key is pressed.

As the program evolved, however, the keyboard developed into a piano and we decided to store the notes and their lengths in memory. We discovered that when repeating patterns were used, memory filled up too fast. For this reason, we decided to allow composing only in the non-repeating mode. While you get meaningful note data in the repeating mode, the length data may not be correct. However, even when using a repeating pattern, only one note byte and two length bytes are stored per key strike, so memory is conserved.

The program is configured at execution for composing. We have chosen an arbitrary envelope delay (representing tempo) of 1100, and a non-repeating piano envelope as default. Whenever a note key is pressed in the play/compose mode, note and length data is stored in memory whether you want to keep the data or not. You will store meaningful length data as long as you do not switch to a repeating envelope pattern by pressing the space bar. If you mistakenly press the space bar, press it again to return to a non-repeating envelope pattern.

Now that you are in the play/com-

"It can sound like a jazz piano, an organ, an echo chamber . . ."



Listing 1: PIANOBIN

```
Ø GOTO1ØØØ
1 CLEAR2ØØ,&H2FFF
2 DATA 1847,2952,2629,2549,2518,
1653,18Ø6,1698,1525,2938,1478,17
37,1948,2446,2333,1796,1916,1631
,1711,1186,867,1187,118Ø,1ØØ6,16
98,879,1382,1Ø25,1322,1544,1951,
2Ø67,2Ø59,1813,19Ø7,2319,2268,16
Ø9,1754,2414,1878,2275,637
4 DIM SUM(43):FOR Z=1 TO 43:READ
SUM(Z):NEXT Z
1Ø DATA 8D,11,7F,31,78,8E,32,19,
BF,31,76,3Ø,88,1F,BF,31,7A,2Ø,1B
,B6
2Ø DATA FF,1,84,F7,B7,FF,1,B6,FF
,3,84,F7,B7,FF,3,B6,FF,23,8A,8
3Ø DATA B7,FF,23,1A,5Ø,39,1C,FE,
BE,31,76,BF,31,73,FE,31,7C,86,FF
,B7
4Ø DATA FF,2,C6,FF,5C,79,FF,2,B6
,FF,Ø,8A,8Ø,81,FF,26,6,C1,7,26
5Ø DATA EF,2Ø,DB,34,4,B7,31,75,C
6,FF,5C,46,25,FC,86,8,3D,EB,E4,3
5
6Ø DATA 2,C1,2F,26,23,7C,31,78,B
6,31,78,44,25,E,8E,32,19,BF,31,7
6
7Ø DATA 3Ø,88,1F,BF,31,7A,2Ø,C,8
E,32,3A,BF,31,76,3Ø,88,1F,BF,31,
7A
8Ø DATA C1,37,1Ø,27,2,1E,1Ø,8E,3
Ø,A2,E1,AØ,27,94,1Ø,8C,3Ø,AA,27,
A
9Ø DATA 2Ø,F4,1,6,B,1C,2Ø,23,27,
37,C1,1F,26,31,7C,31,79,B6,FF,Ø
1ØØ DATA 8A,8Ø,81,FF,26,F7,16,FF
,71,B6,FF,Ø,8A,8Ø,81,FF,26,F7,BE
,33
11Ø DATA D,86,2Ø,A7,1,17,2,3F,E7
,2,3Ø,3,BF,33,D,BC,31,7E,24,69
12Ø DATA 16,FF,4F,C1,31,26,F,BE,
33,D,3Ø,1D,8C,33,4C,25,C4,BF,33,
D
13Ø DATA 2Ø,BF,8E,31,8Ø,86,3,3D,
3A,A6,2,A7,9F,33,D,EC,84,34,6,A6
14Ø DATA 9F,31,73,84,FC,E6,E4,8D
,7,4F,E6,61,8D,2,2Ø,EF,5A,26,2F,
8A
15Ø DATA 2,B7,FF,2Ø,B6,FF,Ø,8A,8
Ø,B1,31,75,27,1F,32,64,FC,31,73,
B3
16Ø DATA 31,76,BE,33,D,E7,1,17,1
,D9,E7,2,3Ø,3,BF,33,D,BC,31,7E
```

pose mode, go ahead and try playing some music. For 16K users, about 1,000 notes can be stored before running out of room; 32K users should be able to bang away for most of the day before hitting the top of RAM. If this happens, don't worry. The binary program checks to see if the limit has been reached and returns to the menu. Nothing has been lost, and you can still play back, alter and save the stored data.

Each time a note key is pressed, the CoCo remembers the note and the length of time your finger was on the key. It also keeps track of the time between keystrokes up to a second. If you are inexperienced and spend a lot of time looking for the next key to press, the program takes no notice beyond one second. For experienced piano players, the only problem is getting used to the keyboard itself. Remember that if you press a second key while the first is still pressed, there will be no response until you take your finger off the first key.

The Control Keys

Correction of mistakes in the play/compose mode is limited to the CLEAR key. Whenever this key is pressed, the last note played is eliminated. Pressing it twice or three times eliminates the last two or three notes played. The entire composition can be eliminated this way. Any notes eliminated are replaced with the next note keys pressed.

When you are finished composing and want to return to the main menu, simply press either SHIFT key. If you mistakenly exit the play mode, return to the same position in the composition by pressing '2' at the menu. Beware. If the '1' is pressed, the program assumes you want to compose a new piece and dumps any music already in memory.

The computer keeps track of pauses that last up to one second. This creates a problem with longer or multiple pauses that normally occur in musical notation. The ENTER key makes it possible to place pauses in the music. It works the same way the note keys work. The pause lasts for as long as you press the ENTER key. During composition, this creates a high pitched noise that indicates something is being pressed. This noise does not occur on playback.

Of course, if you are only fooling around with the synthesizer and do not care about what is stored in memory, you do not need the pause button at all. You will, however, want to use the space bar. This control toggles between repeating envelopes and single envelope strikes. Remember that repeating envelopes do not give meaningful note length data and should be avoided when composing.

The final control key is the question mark-slash key. The synthesizer program contains two programmable envelope tables. The question mark key toggles between the two tables and allows playing of different parts of a composition with different sounding envelopes. Any time this control key is

```
17Ø DATA 24,3,16,FE,E9,39,33,5F,
11,83,Ø,Ø,26,C6,FE,31,7C,BE,31,7
3
18Ø DATA 3Ø,1,BC,31,7A,27,5,BF,3
1,73,2Ø,B4,B6,31,79,44,25,5,32,6
4
19Ø DATA 16,FF,52,BE,31,76,BF,31
,73,2Ø,A1,32,19,BF,32,19,Ø,Ø,32,
38
2ØØ DATA 4,4C,7F,FF,3F,3F,14,1,1
,8Ø,1F,1F,2Ø,25,25,1D,27,28,1C,9
Ø
21Ø DATA 9Ø,6,1,1,8Ø,2Ø,21,1F,1D
,1E,21,53,53,F,1A,1B,23,1,1,8Ø
22Ø DATA 15,16,26,19,19,24,1C,1C
,22,4B,4B,11,47,47,12,AC,AC,3,8Ø
,8Ø
23Ø DATA 8,2D,2D,1A,71,71,A,5E,5
E,D,22,22,1E,98,98,5,2A,2A,1B,65
24Ø DATA 65,C,3Ø,2F,19,C1,C1,1,1
,1,8Ø,37,39,16,31,31,18,Ø,Ø,Ø
25Ø DATA 1,1,8Ø,B6,B7,2,A2,A2,4,
1,1,8Ø,88,88,7,78,79,9,6B,6B
26Ø DATA B,1,1,8Ø,58,59,E,4F,4F,
1Ø,43,43,13,13,13,28,17,17,25,3B
27Ø DATA 3B,15,14,14,27,1,1,64,5
,5,FF,1,1,64,34,34,17,FF,CA,AA
28Ø DATA 91,7E,6B,5B,5Ø,46,3D,35
,2D,28,22,1D,1A,17,15,12,1Ø,F,D,
C
29Ø DATA A,9,8,7,6,5,4,3,2,1,FF,
89,44,4,E6,95,41,4,D2,91
3ØØ DATA 41,4,CØ,79,41,4,AD,7Ø,3
4,4,9A,63,2C,4,86,54,29,4,74,48
31Ø DATA 22,Ø,17,FD,B6,7F,31,78,
1Ø,8E,33,4C,8E,32,19,BF,31,76,FE
,31
32Ø DATA 7C,BE,31,76,BF,31,73,1Ø
,BC,33,D,27,37,E6,21,BE,31,76,3A
,BF
33Ø DATA 32,B1,E6,A4,8E,31,8Ø,C1
,64,26,1D,7C,31,78,B6,31,78,44,2
5,A
34Ø DATA 8E,32,19,BF,31,76,31,23
,2Ø,CC,8E,32,3A,BF,31,76,31,23,2
Ø,C2
35Ø DATA E1,2,27,7,3Ø,3,2Ø,F8,39
,32,33,EC,84,34,6,A6,9F,31,73,E6
36Ø DATA A4,C1,FF,26,1,4F,E6,E4,
8D,7,4F,E6,61,8D,2,2Ø,EA,5A,26,2
8
37Ø DATA 8A,2,B7,FF,2Ø,BE,31,73,
BC,32,B1,1Ø,23,FE,66,8D,55,CE,Ø,
32
38Ø DATA 33,5F,11,83,Ø,Ø,26,F8,3
Ø,1,BF,31,73,32,64,31,23,16,FF,7
2
39Ø DATA 33,5F,11,83,Ø,Ø,26,CD,F
E,31,7C,BE,31,73,3Ø,1,BF,31,73,2
Ø
4ØØ DATA CØ,33,4C,C6,1,7F,FF,2,B
6,FF,Ø,8A,8Ø,81,FF,1Ø,26,FE,26,4
F
41Ø DATA 1Ø,21,FD,A,1Ø,21,FD,6,4
C,27,2,2Ø,F3,5C,C1,FF,1Ø,27,FE,1
1
42Ø DATA 2Ø,DE,5F,4F,1Ø,21,FC,F2
,1Ø,21,FC,EE,4C,26,F5,5C,E1,22,1
```

pressed, a code is stored in the music memory that triggers a corresponding shift during playback.

Envelope Delay and Play Delay

How long is a whole note? The longest note stored in memory is a whole note and is proportional to the envelope delay. Press a note key in the default mode and listen carefully. The sound trails off to nothing. The length of time it takes for the sound to fade away totally is the longest note length stored in memory. Keeping your finger on a key longer does not lengthen the time between that note and the next during playback.

If you are playing a very slow tempo piece and need a longer whole note, simply increase the envelope delay. If you are playing a very fast piece and want to hear more of a fadeoff during short keystrokes, shorten the envelope delay. It is best to alter the envelope delay before storing data to keep. A short keystroke with a long envelope delay causes the program to store only a part of the entire envelope. Increasing the envelope delay after the data has been stored lengthens the note, but it does not increase the proportion of the envelope played. The envelope delay may be altered from the main menu by pressing the "change tempo" option. Numbers between one and 65,535 will work. Try the default envelopes using an envelope delay of 500.

The play delay can also be altered from the main menu by pressing "change tempo." While the envelope delay has an effect in both the play and playback modes, the play delay operates only in the playback mode. It accounts for a constant pause between notes when they are played back. It is included as a fine adjustment for playback timing. The default value is 50.

This is the first parameter to alter if the playback is too fast or too slow. Values between one and 65,535 are accepted. Small increases or decreases don't make much difference, so don't be afraid to change it by factors of 1,000. You may later the play delay or the envelope delay at any time, even after composing a piece. They do not affect the stored music data once it has been

```
Ø,27
43Ø DATA FF,66,2Ø,EB,D
435 Z=Ø:SUM=Ø:L=1Ø
44Ø FOR X=&H3ØØØ TO &H334C:READA
$:A$="&H"+A$:A=VAL(A$):POKEX,A:S
UM=SUM+A:Z=Z+1:IFZ=2Ø OR X=&H334
C THEN 45Ø ELSE NEXT X
45Ø PRINT"WORKING ON LINE #";L:
IF SUM<>SUM(L/1Ø) THEN CLS3:PRIN
T@257,"ERROR IN LINE #";L;:END
46Ø SUM=Ø:L=L+1Ø:Z=Ø:IF X=&H334C
 THEN 47ØELSE NEXT X
47Ø CLS:PRINT"ENTER SYSTEM SIZE
(16 OR 32)":INPUT A
48Ø IF A=16 THEN POKE&H317E,&H3F
:POKE&H317F,&H8Ø:GOTO 51Ø
49Ø IF A=32 THEN POKE&H317E,&H7F
:POKE&H317F,&H8Ø:GOTO51Ø
5ØØ GOTO 47Ø
51Ø CLS:INPUT"(C)ASETTE OR (D)IS
K";D$:IF D$="D"THEN SAVEM"PIANO"
,&H3ØØØ,&H334C,&H325A:END
52Ø CSAVEM"PIANO",&H3ØØØ,&H334C,
&H325A
1ØØØ PCLEAR1:GOTO1
```

```
80 ........92
180 .......54
320 .......85
410 ......226
END .......5
```

Listing 2: PIANOBAS

```
5 GOTO2ØØØØ
1Ø CLS:PRINT"PLEASE REMOVE JOYST
ICK FROM     RIGHT JOYSTICK PORT
":PRINT
14 CLEAR255,&H2FFF
2Ø INPUT"(C)ASETTE OR (D)ISK";D$
:IF D$="C"THENCLOADM"PIANO"ELSEL
OADM"PIANO"
4Ø DIMN$(12)
5Ø CLS:PRINT@14,"MENU":PRINT
6Ø PRINT"  1) COMPOSE MUSIC"
7Ø PRINT"  2) ADD ON TO MUSIC"
8Ø PRINT"  3) PLAY MUSIC"
9Ø PRINT"  4) SAVE MUSIC"
1ØØ PRINT"  5) LOAD MUSIC"
11Ø PRINT"  6) CHANGE ENVELOPE"
12Ø PRINT"  7) CHANGE TEMPO"
13Ø PRINT"  8) ASSEMBLE TO PLAY
COMMANDS"
14Ø PRINT"  9) EDIT YOUR COMPOSI
TION"
15Ø PRINT@48Ø," ";:A$=INKEY$:IFA
$=""THEN15Ø
16Ø B$=INKEY$:FORX=&H152 TO&H152
+7:IFPEEK(X)=255THENNEXT:GOTO17Ø
ELSE16Ø
17Ø ONVAL(A$)GOTO3ØØ,31Ø,32Ø,33Ø
,34Ø,36Ø,44Ø,8ØØØ,5ØØ
18Ø GOTO5Ø
19Ø CLS:A$="c d z f g a z c d z
f g a":B$="C D E F G A B C D E F
 G A B":FORX=1TOLEN(A$):C$=MID$(
A$,X,1):IF C$="z"THENMID$(A$,X,1
)=CHR$(175)
2ØØ IFC$=" "THENMID$(A$,X,1)=CHR
$(128)
21Ø NEXT:FORX=1 TOLEN(B$):C$=MID
$(B$,X,1):IFC$=" "THENMID$(B$,X,
1)=CHR$(138)
22Ø NEXT:CLSØ
23Ø PRINT@4,A$;:PRINT@67,B$;:A$=
CHR$(175)+CHR$(17Ø)+CHR$(175)+CH
R$(17Ø)+A$:A$=LEFT$(A$,22):A$=A$
+STRING$(4,255)+CHR$(128)+CHR$(2
55):PRINT@132,A$;:B$=STRING$(3,2
55)+CHR$(133)+B$:B$=LEFT$(B$,21)
```

placed in memory, but they affect the playback of that data.

Programming the Envelope Tables

Before programming an envelope, you must know something about synthesizing periodic sounds. The CoCo has no sound-generating circuitry. In order to produce sounds, the microprocessor must minutely manipulate the voltage output to the loudspeaker. (That it can do this quickly enough to produce a fantastic array of sounds is a testament to the extreme versatility of the 6809 and the Color Computer.)

In order to produce the sound of a particular instrument, most hardware synthesizers produce a particular sine wave electrical output varying between zero and five volts. This pure tone is then modified to produce the same general pattern of electrical output as the sound output of the instrument it is trying to mimic. The unmodified sine wave produces a pure tone of a particular volume depending upon the maximum voltage allowed by the circuitry. The envelope modifications are mainly constraints on the volume of the sine wave over time.

To produce the sound of a piano, it begins with a maximum volume when the key is struck, falling off rather quickly at first and then more slowly until it fades out entirely. This is exactly what the CoCo *Piano-Synthesizer* does: It produces a square wave instead of a true sine wave, the maximum voltage of which is controlled by the values in the envelope table.

Go back to the main menu and press '6'. When the prompt asks which table to use, press '1' and ENTER. Now remember what we said about the fast falloff and a gentle fadeout? The graph shown is the envelope used to produce the piano default sound. This envelope can be altered or a totally new one created by using the left joystick and firebutton. For example, position the cursor at the bottom left side of the screen and press the firebutton. The original point disappears and is replaced by the new one. Now move the cursor one position to the right and four above the one just set and press the firebutton again. Continue this process,

```
:B$=B$+CHR$(128)+CHR$(255)+CHR$(
128)+STRING$(3,255)
24Ø FOR X=1TOLEN(B$):IFMID$(B$,X
,1)=CHR$(138)THENMID$(B$,X,1)=CH
R$(133):NEXT ELSE NEXT
25Ø PRINT@196,B$;:PRINT@267,STRI
NG$(11,255);
26Ø PRINT@384,"ENTER = PAUSE : ?
 = NEW ENVELOP"
27Ø PRINT"SHIFT = MENU  : CLEAR=
BACKSPACE"
28Ø PRINT"     SPACEBAR=REPEAT T
OGGLE
29Ø RETURN
3ØØ GOSUB19Ø:POKE&H33ØD,&H33:POK
E&H33ØE,&H4C:EXEC&H3ØØØ:GOTO5Ø
31Ø GOSUB19Ø:EXEC&H3ØØØ:GOTO5Ø
32Ø GOSUB19Ø:EXEC&H325A:GOTO5Ø
33Ø CLS:S=&H3ØØØ:E=PEEK(&H33ØD)*
256+PEEK(&H33ØE):PRINT"SAVE":INP
UT"ENTER SONG NAME";F$:INPUT"(C)
ASETTE OR (D)ISK";D$:IF D$="D" T
HEN SAVEM F$,S,E,&H325A:GOTO5Ø
335 CSAVEMF$,S,E,&H325A:GOTO5Ø
34Ø CLS:PRINT"LOAD:":INPUT"ENTER
 SONG NAME:";F$:INPUT"(C)ASETTE
OR (D)ISK";D$:IFD$="C"THENCLOADM
F$ ELSELOADMF$
345 GOTO5Ø
35Ø IFC=ØTHENRESET(A,B):RETURNEL
SESET(A,B,3):RETURN
36Ø CLS:INPUT"WHICH ENVELOPE DO
YOU WANT TO    CHANGE (1 OR 2)";
E
37Ø IFE=ØTHENE=1
38Ø IFE=1THENE=&H3219 ELSEE=&H32
3A
39Ø CLSØ
4ØØ FORX=ØTO63STEP2:A=PEEK(E):SE
T(X,31-INT(PEEK(E)/8),3):E=E+1:N
EXT:E=E-32
41Ø Z=JOYSTK(Ø):A$=INKEY$:IFA$<>
""THEN5ØELSEA=JOYSTK(2):A=INT(A/
2):A=A*2:B=JOYSTK(3):B=INT(B/2):
C=POINT(A,B):SET(A,B,3):FORX=1TO
2Ø:NEXT:GOSUB35Ø:IFPEEK(&HFFØØ)=
253THEN43Ø
42Ø GOTO41Ø
43Ø POKEE+A/2,255-(B*8):FORY=Ø T
O31:RESET(A,Y):NEXT:SET(A,B,3):G
OTO41Ø
44Ø PLYDLY=PEEK(&H32E2)*256+PEEK
(&H32E3):ENVDLY=PEEK(&H317C)*256
+PEEK(&H317D)
45Ø CLS:PRINT"CURRENT PLAYDELAY=
";PLYDLY:PRINT"HIGHER OR LOWER V
ALUES WILL     LENGTHEN OR SHORT
EN PAUSES BE-  TWEEN NOTES ON PL
AYBACK ONLY.   ENTER NEW VALUE,
OR <ENTER>     TO LEAVE THE SAME
"
46Ø INPUTA:IFA<>ØTHENB=INT(A/256
):C=A-256*B:POKE&H32E2,B:POKE&H3
2E3,C
47Ø CLS:PRINT"CURRENT ENVELOPE D
ELAY=";ENVDLY:PRINT"LOWER VALUES
 WILL COMPRESS THE  ENVELOPE INT
O A SHORTER TIME    AND INCREASE
 THE TEMPO OF BOTH  COMPOSITION
AND PLAYBACK. ENTER NEW VALUE OR
 <ENTER> TO LEAVE   THE SAME"
48Ø INPUTA:IFA<>ØTHENB=INT(A/256
):C=A-256*B:POKE&H317C,B:POKE&H3
17D,C
49Ø GOTO5Ø
5ØØ CLS:S=&H334C:P=Ø:FS=Ø:CP=Ø:M
=256*PEEK(&H33ØD)+PEEK(&H33ØE):L
P=(M-S)/3:GOSUB51Ø:GOTO52Ø
51Ø N$(1)="C":N$(2)="C#":N$(3)="
D":N$(4)="D#":N$(5)="E":N$(6)="F
":N$(7)="F#":N$(8)="G":N$(9)="G#
":N$(1Ø)="A":N$(11)="A#":N$(12)=
```

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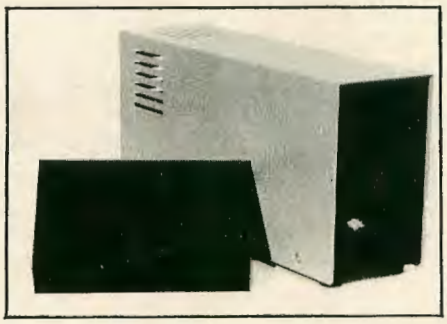

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depositing points three or four higher in each succeeding position, until it reaches the top of the screen. Then, for the next cursor position, move the cursor to the bottom of the screen and repeat the same process.

Do this until you reach the last cursor position on the right. You have created a series of upward sloping lines. To be really fancy, make the top of each succeeding line several positions lower than the last one to create a trail-off effect. When you are finished creating the envelope, press any key to return to the menu.

Now try playing any selection still in memory. If there is no stored data, just play something from the compose mode. Try changing the tempo. Type in an envelope delay of 100. Press '1' at the menu and get into play mode. Play a few notes and then press the space bar. Now play the same notes over. Interesting!

"Each note is represented in memory as three data bytes."

A word about coherent values. While you can type in literally any envelope pattern wanted, the best ones follow a pattern. Each succeeding value should bear a rational relationship to its neighbors rather than being a random scattering of points. Maybe the points follow some sort of curve, or a pair of curves. Maybe every third point is offset from the curve by some fixed amount. The possibilities are endless, and when combined with various envelope delays and repeating patterns, quite a collection of different sounds can be created. Both envelope tables are programmable. An organ-like effect can be produced by using an envelope that is a straight horizontal line at the top of the screen.

For those interested in experimenting with sound, try a rational envelope

```
"B":RETURN
52Ø FORX=Ø TO448STEP32
53Ø IFP=LP THENFORZ=X TO448STEP3
2:PRINTSTRING$(16,CHR$(175)):NEX
TZ:GOTO62Ø
54Ø N=PEEK(S+3*P):IFN=255THENN$=
"PAU":PRINT@X,P:PRINT@X+5,N$:GOT
O57Ø
55Ø IFN=1ØØTHENN$="env":L1=Ø:L2=
Ø:GOTO58Ø
555 GOSUB56Ø:GOTO57Ø
56Ø O$=RIGHT$(STR$(INT((N-1)/12)
+2),1):Z=N-12*INT((N-1)/12):N$=N
$(Z):N$=O$+N$:RETURN
57Ø L1=PEEK(S+3*P+1):L2=PEEK(S+3
*P+2)
58Ø PRINT@X,P:PRINT@X+5,N$:IFN=1
ØØTHEN6ØØ
59Ø PRINT@X+1Ø,RIGHT$(STR$(L1),2
);L2
6ØØ P=P+1
61Ø NEXT X
62Ø 'EDIT MENU
63Ø PRINT@17,"1.PLAY SEGMENT":PR
INT@51,"TO CURSOR":PRINT@81,"2.P
LAY START":PRINT@115,"TO CURSOR"
:PRINT@145,"3.PLAY CURSOR":PRINT
@179,"TO END":PRINT@2Ø9,"4.NEW S
EGMENT":PRINT@241,"5.CHANGE NOTE
":PRINT@273,"6.INSERT NOTE":PRIN
T@3Ø5,"7.DELETE NOTE"
64Ø PRINT@337,"8.MAIN MENU":PRIN
T@369,"9.QUICK CHANGE":PRINT@4Ø3
,"TEMPO BYTES"
65Ø X=4:P=FS:CP=Ø
66Ø PRINT@X,CHR$(128);
67Ø A$=INKEY$:IFA$=""THEN67Ø
68Ø IFA$=CHR$(94)OR A$=CHR$(1Ø)T
HEN72Ø
69Ø IFVAL(A$)<1OR VAL(A$)>9 THEN
67Ø
7ØØ ONVAL(A$)GOTO79Ø,8ØØ,81Ø,82Ø
,845,948,98Ø,71Ø,1ØØØ
71Ø GOTO5Ø
72Ø IFA$=CHR$(1Ø)THEN74Ø
73Ø IFX=4THEN67ØELSEPRINT@X," ";
:X=X-32:CP=CP-1:GOTO66Ø
74Ø IFX=452OR FS+CP+1=LP THEN67Ø
ELSEPRINT@X," ";:X=X+32:CP=CP+1:
GOTO66Ø
75Ø M1=PEEK(&H33ØD):M2=PEEK(&H33
ØE):RETURN
76Ø A1=INT((S+3*FS)/256):A2=(S+3
*FS)-A1*256:RETURN
77Ø A1=INT((S+3*FS+3*(CP+1))/256
):A2=(S+3*FS+3*(CP+1))-A1*256:RE
TURN
78Ø EXEC&H325A:FORZ=1 TO3ØØ:NEXT
Z:PRINT@X,CHR$(255);:FORZ=1TO255
STEP2Ø:SOUNDZ,1:NEXT:POKE&H3262,
&H33:POKE&H3263,&H4C:POKE&H33ØD,
M1:POKE&H33ØE,M2:GOTO66Ø
79Ø GOSUB75Ø:GOSUB76Ø:POKE&H3262
,A1:POKE&H3263,A2:GOSUB77Ø:POKE&
H33ØD,A1:POKE&H33ØE,A2:GOTO78Ø
8ØØ GOSUB75Ø:GOSUB77Ø:POKE&H33ØD
,A1:POKE&H33ØE,A2:GOTO78Ø
81Ø GOSUB75Ø:GOSUB77Ø:Z=256*A1+A
2:Z=Z-3:A1=INT(Z/256):A2=Z-A1*25
6:POKE&H3262,A1:POKE&H3263,A2:GO
TO 78Ø
82Ø CLS:PRINT"PLEASE TYPE POSITI
ON NUMBER FOR NEW SEGMENT":INPUT
Q
84Ø FS=Q:P=Q:GOTO52Ø
845 GOSUB85Ø:GOTO52Ø
85Ø FOR Z=16TO464STEP32:PRINT@Z,
STRING$(15," "):NEXTZ:Z=S+3*FS+3
*CP:PRINT@17,"ENTER NEW NOTE":PR
INT@49,"ENTER TO EXIT":PRINT@81,
```

using very short delays (say 50) and a repeating pattern. Note that different keys vary in tonal quality as well as in pitch. The reason for this involves the interference patterns produced as the envelope delay gets nearer to the frequency delay (the delay used to produce the desired pitch). You may hear different "beat frequencies" with different keys.

Saving and Loading Compositions

Once you have composed and perfected the music, *PIANO/BAS* provides the means to save it on disk or tape. This is done from the menu and is self-prompting. It is saved with any altered envelope tables, envelope delay and play delay that are POKEd in while composing, so each composition has its own unique sound. You do not have to run the BASIC driver in order to play the music. Just LOADM or CLOADM whatever filename is used to store it. Then type EXEC and the piece plays.

If it needs further editing, run the BASIC driver and load the previously stored piece from the menu. Add to it, change the envelopes, the delays, or alter the note data and then resave the changes.

The Editor

We have done our best to confine the BASIC program in order to allow 16K owners to use the piano. The editor is simple, but adequate for manipulation of program data. It windows any 15-note segment of your composition, and allows replaying any part of that segment from the beginning to the cursor position.

Play something from the compose mode and press '9' at the main menu. The first column on the left is the note position. It starts at zero and increments for each note in the composition. The other columns represent actual note data. Each note is represented in memory as three data bytes. The second editor column translates the first data byte into an octave and a note. The third column contains the note length. These numbers go from one to 32; 32 is the longest note played. (If most of these numbers are less than 15, you might consider resetting the envelope delay to a smaller number and replaying the piece. That way, more of the envelope is heard during each keystroke.)

The last column is the pause interval that keeps track of the time between keystrokes. It is a number between one and 255. The higher the number, the longer the pause. This pause is not to be confused with the pauses intentionally placed in the data by pressing the ENTER key. Those pauses are stored just like any other note, with a note length and an interval pause.

The cursor can be moved up or down by pressing the appropriate arrow keys. Notes may be changed, inserted or deleted by positioning the cursor at the note position to be changed or deleted.

```
"";:INPUTN$
86Ø IFN$=""THENP=FS:RETURN
865 IF N$="ENV"THENPOKEZ,1ØØ:POK
EZ+1,Ø:POKEZ+2,Ø:RETURN
875 IF N$="PAU"THENPOKEZ,255:GOT
O93Ø
89Ø PRINT@113,"OCTAVE?":PRINT@14
5,"";:INPUTO:IFO<2ORO>4THEN89ØEL
SEFORX=1 TO12:IFN$<>N$(X)THENNEX
TELSEN=(O-2)*12+X:POKEZ,N:GOTO93
Ø
892 IF N$="PAU"THENPOKEZ,255:GOT
O93Ø
894 IF N$="ENV"THENPOKEZ,1ØØ:GOT
O93Ø
9ØØ GOTO845
93Ø PRINT@177,"NOTE LEN(1-32)":P
RINT@2Ø9,"";:INPUTN:IF N>32OR N<
1 THEN 93Ø
935 POKEZ+1,N
94Ø PRINT@241,"PAUSE? (1-255)":P
RINT@273,"";:INPUTN:IFN<1ORN>255
THEN94Ø
945 POKEZ+2,N:P=FS
947 RETURN
948 M=M+3:GOSUB95Ø:GOTO96Ø
95Ø PRINT@433,"thinking":M1=INT(
M/256):M2=M-M1*256:POKE&H33ØD,M1
:POKE&H33ØE,M2:RETURN
96Ø FOR Z=M TOS+3*FS+3*CP+1STEP-
1:A=PEEK(Z-1):POKEZ+2,A:NEXT
97Ø GOSUB85Ø:LP=(M-S)/3:GOTO52Ø
98Ø M=M-3:GOSUB95Ø:FORZ=S+3*FS+3
*CP TOM+2:A=PEEK(Z+3):POKEZ,A:NE
XT:LP=(M-S)/3:GOTO52Ø
1ØØØ :CLS:PRINT"THIS OPTION CHAN
GES ALL NOTE    LENGHTS AND/OR P
AUASE BYTES     FROM BEGINING OF
 SEGMENT TO THE CURSOR":PRINT:PR
```

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Insertions occur at the cursor position, and the remainder of the composition is moved one position higher in memory. Inserting and deleting may take some time in long compositions since the entire data array above the cursor position must be relocated, and this relocation is done from BASIC.

Insert intentional pauses by typing PAU in place of a note. Pauses are like any note in that you must specify a note length and pause length. An envelope table switch may be inserted by typing ENV.

For the inexperienced piano players, we have included an option that allows the user to change both the note lengths and interval pauses en masse. Pressing '9' while in the editor allows you to specify numbers that are automatically inserted into all note positions from the top of the screen to the cursor position. Since any note position can be specified as the first note in each segment (the top of the screen), you can make large-scale changes in tempo or timing with reasonable precision.

Assembling PLAY Statements

Pressing '8' at the main menu causes the computer to build BASIC PLAY statements. These are assembled directly to disk or tape as a BASIC program complete with line numbers. Load them and type RUN to hear them. Those with disk drives can merge them into their own programs after adjusting the line numbers using Extended BASIC's RENUM function.

Line 5 is a tempo line. This line may be altered to speed up or slow down the playback. Since these are run from BASIC without the help of the ML synthesizer, envelope changes are ignored. (Actually, there is a way to get a "pseudo envelope" in BASIC. Those interested should contact Jeremy Spiller for information on how to obtain the program for this.) The PLAY statements offer another method of editing compositions as they can be manipulated using Extended BASIC's editing functions.

Tuning Your Piano

While we feel reasonably competent to write computer programs, neither of us play the piano, nor do we even know much about music. We tuned the piano by ear and if you can do better, give it a shot. The key table is located at &H3180. The assembly listing shows it from lines 16100 to 31300.

Look carefully at the assembly listing. Each key is represented by three bytes. The name of the key is commented to the right of its first byte. (Don't confuse these with the three data bytes stored in memory while composing. These begin at &H334C.) The first two bytes are the frequency delays and these account for the pitch of the key. The third byte is the note "name" and is the value stored in the first of the three data bytes while you are composing. The higher the frequency delay values, the lower the sound produced by that key. Note that in most cases, both delay values are the same. Keeping them equal or close to equal keeps the wave square.

The wave shape could be altered toward triangular by drastically reducing one while increasing the other. The wave doesn't have to be square. The delay values can be from one to 255. To sharpen the sound of a key, locate that key in the comment column of the key table and reduce the numbers in the frequency bytes. (The actual memory address is the hexadecimal number in the column farthest to the left in the assembly source code listing. As an example, to sharpen the sound produced by the BREAK key, POKE numbers lower than 52 into addresses &H3216 and/or &H3217.)

To lower the entire keyboard an octave, POKE higher numbers into the

```
INT"ENTER NOTE  LENGTH (1-32)
    <ENTER> TO LEAVE  UNCHANGED"
:INPUTA:IFA=ØTHEN1Ø3ØELSEIFA<1OR
A>32THEN1ØØØ
1Ø1Ø FORZ=S+3*FS TOS+3*FS+3*CP S
TEP3:POKEZ+1,A:NEXT
1Ø3Ø PRINT:PRINT"ENTER NOTE PAUS
E <ENTER> TO     ESCAPE":INPUTA:
IF A=ØTHEN52ØELSEIFA<1OR A>255TH
EN1Ø3Ø
1Ø4Ø FORZ=S+3*FS TOS+3*FS+3*CP S
TEP3:POKEZ+2,A:NEXT:GOTO52Ø
8ØØØ 'PLAY STATEMENTS
8ØØ2 L=Ø:I=Ø:A=&H334C:E=PEEK(&H3
3ØD)*256+PEEK(&H33ØE):GOSUB51Ø
8Ø1Ø D=1:CLS:PRINT"PREPARE TAPE
RECORDER OR DISK   TO RECEIVE PL
AY STATEMENTS":PRINT:INPUT"FILEN
AME";F$:INPUT"(C)ASSETTE OR (D)I
SK";D$:IFD$="C"THENOPEN"O",#-1,F
$:D=-1:GOTO8Ø12
8Ø11 F$=F$+"/BAS":OPEN"O",#1,F$
8Ø12 B$="5 PLAY"+CHR$(34)+"T6"+C
HR$(34):PRINT#D,B$
8Ø14 L=L+1Ø:L$=STR$(L):L$=RIGHT$
(L$,LEN(L$)-1):A$=L$+" PLAY"+CHR
$(34)
8Ø2Ø FORX=A TOA+27STEP3:IFX=E TH
EN81ØØ
8Ø3Ø N=PEEK(X):IFN=255THEN8Ø4ØEL
SEIFN=1ØØTHEN816ØELSEGOSUB56Ø:N$
="O"+N$:IFRIGHT$(N$,1)="#"THENN$
=LEFT$(N$,LEN(N$)-1):N$=N$+"+"
8Ø4Ø L1=PEEK(X+1):L2=PEEK(X+2):I
FL1=ØTHENL1=1:IFL2=ØTHENL2=1
8Ø5Ø IF L1>16ANDL1<2ØTHENL1=16EL
SE IF L1>19ANDL1<28THENL1=3:GOTO
8Ø6Ø
8Ø55 L1=INT(1/(L1/32))
8Ø6Ø IF L2>128ANDL2<16Ø THEN L2=
127 ELSEIFL2>127ANDL2<224 THEN L
2=3:GOTO8Ø7Ø
8Ø65 L2=INT(1/(L2/255))
8Ø7Ø L1$=STR$(L1):L2$=STR$(L2):L
1$=RIGHT$(L1$,LEN(L1$)-1):L2$=RI
GHT$(L2$,LEN(L2$)-1)
8Ø75 IF N=255THEN818Ø
8Ø8Ø N$="L"+L1$+N$+"P"+L2$
8Ø9Ø A$=A$+N$:NEXTX
81ØØ A$=A$+CHR$(34):PRINT#D,A$:P
RINTA$
8114 IFX>=E THENCLOSE#D:GOTO5Ø
812Ø A=A+3Ø:GOTO8Ø14
816Ø IFX=E THEN5ØELSENEXTX
818Ø N$="P"+L1$+"P"+L2$:GOTO8Ø9Ø
2ØØØØ PCLEAR1:GOTO1Ø
```

frequency bytes of all the keys in the table. Do this by trial and error, sharpening or flattening each position until it sounds right. Once you get the table the way you want it, play a tune and save it as *PIANO/BIN*. Then, whenever you run the BASIC driver, it automatically loads the modified tables and becomes the new default. Have fun!

> ***"The editor is simple, but adequate . . ."***

Key Memory Addresses

&H3000	Execution address of play/compose segment.
&H325A	Execution address of playback segment.
&H330D and &H330E	LSB and MSB of address of last note played. POKE another address here to end playback at another note position.
&H334C	Address of first note of compositions.
&H3262 and H3263	Holds LSB and MSB of address of first note played (usually holds &H334C). POKE another address here to begin playback at another note.
&H3180	First byte of key table.
&H3219	First byte of envelope Table 1.
&H323A	First byte of envelope Table 2.
&H317E and &H317F	Holds top-of-RAM (&H7F80 in 32K systems).

(You may direct questions about this program to the authors at RFD 1, Box 504, Shirley, MA 01464, phone 617-448-2681. Please enclose an SASE when writing.) □

Listing 3: PIANO

```
3000                    0010 00         ORG     $3000
3000 8D   11            0020 00 START   BSR     INITLZ
3002 7F   3178          0021 00         CLR     ENVTOG
3005 8E   3219          0050 00         LDX     #ENVTA1
3008 BF   3176          0060 00         STX     ENVTAB
300B 30   88 1F         0070 00         LEAX    +31,X
300E BF   317A          0080 00         STX     ENDTAB
3011 20   1B            0090 00         BRA     INKEY
3013 B6   FF01          0100 00 INITLZ  LDA     $FF01   INITIALIZE PIA'S
3016 84   F7            0110 00         ANDA    #$F7
3018 B7   FF01          0120 00         STA     $FF01
301B B6   FF03          0130 00         LDA     $FF03
301E 84   F7            0140 00         ANDA    #$F7
3020 B7   FF03          0150 00         STA     $FF03
3023 B6   FF23          0160 00         LDA     $FF23
3026 8A   08            0170 00         ORA     #8
3028 B7   FF23          0180 00         STA     $FF23
302B 1A   50            0190 00         ORCC    #$50
302D 39                 0200 00         RTS
302E 1C   FE            0210 00 INKEY   ANDCC   #$FE     KEYBOARD POLLING
3030 BE   3176          0220 00         LDX     ENVTAB
3033 BF   3173          0230 00         STX     ENVPTR
3036 FE   317C          0240 00         LDU     ENVDLY
3039 86   FF            0250 00         LDA     #$FF
303B B7   FF02          0260 00         STA     $FF02
303E C6   FF            0270 00 IN01    LDB     #$FF
3040 5C                 0280 00 IN02    INCB
3041 79   FF02          0290 00         ROL     $FF02
3044 B6   FF00          0300 00         LDA     $FF00
3047 8A   80            0310 00         ORA     #$80
3049 81   FF            0320 00         CMPA    #$FF
304B 26   06            0330 00         BNE     PRINT
304D C1   07            0340 00         CMPB    #7
304F 26   EF            0350 00         BNE     IN02
3051 20   DB            0360 00         BRA     INKEY
3053 34   04            0370 00 PRINT   PSHS    B
3055 B7   3175          0371 0          STA     KEYSTR
3058 C6   FF            0380 00         LDB     #$FF
305A 5C                 0390 00 PRN02   INCB
305B 46                 0400 00         RORA
305C 25   FC            0410 00         BCS     PRN02
305E 86   08            0420 00         LDA     #8
3060 3D                 0430 00         MUL
3061 EB   E4            0440 00         ADDB    ,S
3063 35   02            0450 00         PULS    A
3065 C1   2F            0460 00         CMPB    #47     CHECK FOR ?/ KEY
3067 26   23            0470 00         BNE     SHIFT
3069 7C   3178          0480 00         INC     ENVTOG
306C B6   3178          0490 00         LDA     ENVTOG
306F 44                 0500 00         LSRA
3070 25   0E            0510 00         BCS     ENV2
3072 8E   3219          0520 00 ENV1    LDX     #ENVTA1
3075 BF   3176          0530 00         STX     ENVTAB
3078 30   88 1F         0540 00         LEAX    +31,X
307B BF   317A          0550 00         STX     ENDTAB
307E 20   0C            0560 00         BRA     SHIFT
3080 8E   323A          0570 00 ENV2    LDX     #ENVTA2
3083 BF   3176          0580 00         STX     ENVTAB
3086 30   88 1F         0590 00         LEAX    +31,X
3089 BF   317A          0600 00         STX     ENDTAB
308C C1   37            0610 00 SHIFT   CMPB    #55     CHECK FOR SHIFT KEY
308E 1027 021E          0620 00         LBEQ    SWI
3092 108E 30A2          0630 00         LDY     #NOKEY
3096 E1   A0            0640 00 NOKEY1  CMPB    ,Y+
3098 27   94            0650 00         BEQ     INKEY
309A 108C 30AA          0660 00         CMPY    #NOKEY+8
309E 27   0A            0670 00         BEQ     PRN030
30A0 20   F4            0680 00         BRA     NOKEY1
30A2      01            0690 00 NOKEY   FCB     1       TABLE OF KEYS NOT PLAYED
30A3      06            0700 00         FCB     6
30A4      0B            0710 00         FCB     11
30A5      1C            0720 00         FCB     28
30A6      20            0730 00         FCB     32
30A7      23            0740 00         FCB     35
30A8      27            0750 00         FCB     39
30A9      37            0770 00         FCB     55
30AA C1   1F            0780 00 PRN030  CMPB    #31     CHECK FOR SPACEBAR
30AC 26   31            0790 00         BNE     ST01
30AE 7C   3179          0800 00         INC     TOGGLE
30B1 B6   FF00          0810 00 WAIT2   LDA     $FF00
30B4 8A   80            0811 0          ORA     #$80
```

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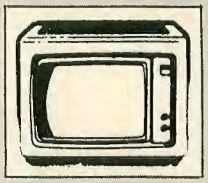

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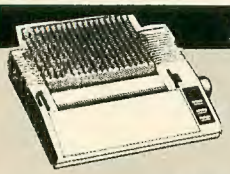

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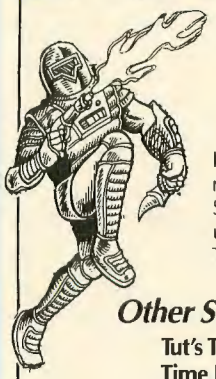

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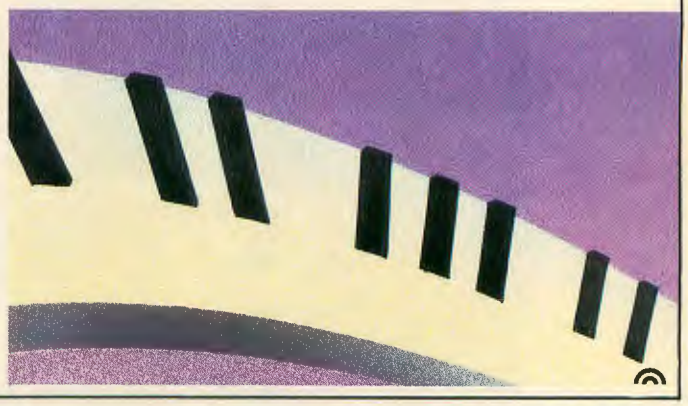
```
3ØB6 81   FF          Ø82ØØ          CMPA   #$FF
3ØB8 26   F7          Ø83ØØ          BNE    WAIT2
3ØBA 16   FF71        Ø84ØØ          LBRA   INKEY
3ØBD B6   FFØØ        Ø85ØØ WAIT     LDA    $FFØØ
3ØCØ 8A   8Ø          Ø851Ø          ORA    #$8Ø
3ØC2 81   FF          Ø86ØØ          CMPA   #$FF
3ØC4 26   F7          Ø87ØØ          BNE    WAIT
3ØC6 BE   33ØD        Ø88ØØ          LDX    MEMORY
3ØC9 86   2Ø          Ø89ØØ          LDA    #32
3ØCB A7   Ø1          Ø9ØØØ          STA    +1,X
3ØCD 17   Ø23F        Ø91Ø0          LBSR   TWEEN
3ØDØ E7   Ø2          Ø92Ø0          STB    +2,X
3ØD2 3Ø   Ø3          Ø93ØØ          LEAX   +3,X
3ØD4 BF   33ØD        Ø94ØØ          STX    MEMORY
3ØD7 BC   317E        Ø95ØØ          CMPX   RAMEND
3ØDA 24   69          Ø96ØØ          BHS    RETURN
3ØDC 16   FF4F        Ø97ØØ          LBRA   INKEY
3ØDF C1   31          Ø98ØØ ST0Ø1    CMPB   #49      CHECK FOR CLEAR
3ØE1 26   ØF          Ø99ØØ          BNE    ST02Ø
3ØE3 BE   33ØD        1ØØ8Ø          LDX    MEMORY
3ØE6 3Ø   1D          1Ø99Ø          LEAX   -3,X
3ØE8 8C   334C        1ØØØØ          CMPX   #COMPOS
3ØEB 25   C4          1Ø1ØØ          BLO    WAIT2
3ØED BF   33ØD        1Ø2ØØ          STX    MEMORY
3ØFØ 2Ø   BF          1Ø5ØØ          BRA    WAIT2
3ØF2 8E   318Ø        1Ø6ØØ ST02Ø    LDX    #TABLE
3ØF5 86   Ø3          1Ø7ØØ          LDA    #3
3ØF7 3D               1Ø8ØØ          MUL
3ØF8 3A               1Ø9ØØ          ABX
3ØF9 A6   Ø2          11ØØØ          LDA    +2,X
3ØFB A7   9F 33ØD     111ØØ          STA    [MEMORY]
3ØFF EC   84          112ØØ          LDD    ,X
311Ø 34   Ø6          113ØØ          PSHS   A,B
3112 A6   9F 3173     114ØØ ST015    LDA    [ENVPTR]
3116 84   FC          115ØØ          ANDA   #$FC
3118 E6   E4          116ØØ          LDB    ,S
311A 8D   Ø7          117ØØ          BSR    SOUND
311C 4F               118ØØ          CLRA
311D E6   61          119ØØ          LDB    +1,S
311F 8D   Ø2          12ØØØ          BSR    SOUND
3121 2Ø   EF          121ØØ          BRA    ST015
3123 5A               122ØØ SOUND    DECB
3124 26   2F          123ØØ          BNE    ENVLOP
3126 8A   Ø2          1231Ø          ORA    #2
3128 B7   FF2Ø        124ØØ          STA    $FF2Ø
312B B6   FFØØ        125ØØ QKKEY    LDA    $FFØØ    SEE IF KEY STILL PRESSED
312E 8A   8Ø          1251Ø          ORA    #$8Ø
3130 B1   3175        126ØØ          CMPA   KEYSTR
3133 27   1F          127ØØ          BEQ    RETURN
3135 32   64          128ØØ          LEAS   +4,S
3137 FC   3173        129ØØ          LDD    ENVPTR
313A B3   3176        13ØØØ          SUBD   ENVTAB
313D BE   33ØD        131ØØ          LDX    MEMORY
3140 E7   Ø1          132ØØ          STB    +1,X
3142 17   Ø1D9       1321Ø          LBSR   TWEEN
3145 E7   Ø2          1322Ø          STB    +2,X
3147 3Ø   Ø3          1323Ø          LEAX   +3,X
3149 BF   33ØD        1324Ø          STX    MEMORY
314C BC   317E        1325Ø          CMPX   RAMEND
314F 24   Ø3          1326Ø          BHS    RETURN
3151 16   FEE9        135ØØ          LBRA   INKEY
3154 39               136ØØ RETURN   RTS
3155 33   5F          137ØØ ENVLOP   LEAU   -1,U    ENVELOPE COUNTDOWN
3157 1183 ØØØØ        138ØØ          CMPU   #Ø
315B 26   C6          139ØØ          BNE    SOUND
315D FE   317C        14ØØØ          LDU    ENVDLY
3160 BE   3173        141ØØ          LDX    ENVPTR
3163 3Ø   Ø1          142ØØ          LEAX   +1,X
3165 BC   317A        143ØØ          CMPX   ENDTAB
3168 27   Ø5          144ØØ          BEQ    RESET
316A BF   3173        145ØØ          STX    ENVPTR
316D 2Ø   B4          146ØØ          BRA    SOUND
316F B6   3179        147ØØ RESET    LDA    TOGGLE
3172 44               148ØØ          LSRA
3173 25   Ø5          149ØØ          BCS    CONTIN
3175 32   64          15ØØØ          LEAS   +4,S
3177 16   FF52        151ØØ          LBRA   WAIT
317A BE   3176        152ØØ CONTIN   LDX    ENVTAB
317D BF   3173        153ØØ          STX    ENVPTR
3180 2Ø   A1          154ØØ          BRA    SOUND
3182      ØØØØ        155ØØ ENVPTR   FDB    Ø        POINTS TO CURRENT ENV VALU
3184      ØØ          1551Ø KEYSTR   FCB    Ø        STORES CURRENT VAL OF FFØØ
3185      ØØØØ        156ØØ ENVTAB   FDB    Ø        POINTS TO CURRENT ENV TABLE
3187      ØØ          157ØØ ENVTOG   FCB    Ø        ENV TABLE TOGGLE BYTE
3188      ØØ          158ØØ TOGGLE   FCB    Ø        REPEATING ENV TOGGLE BYTE
318A      ØØØØ        159ØØ ENDTAB   FDB    Ø        POINTS TO END CURRENT ENV TAB
318C      Ø44C        16ØØØ ENVDLY   FDB    11ØØ     ENVELOPE DELAY
318E      7FFF        16Ø5Ø RAMEND   FDB    $7FFF    POINTS TO TOP OF RAM
3190      3F          161ØØ TABLE    FCB    63       @ FIRST BYTE KEY TAB
3191      3F          162ØØ          FCB    63       ?
3192      14          163ØØ          FCB    2Ø
3193      Ø1          164ØØ          FCB    1        A
3194      Ø1          165ØØ          FCB    1
3195      8Ø          166ØØ          FCB    128
3196      1F          167ØØ          FCB    31       B
3197      1F          168ØØ          FCB    31
3198      2Ø          169ØØ          FCB    32
3199      25          17ØØØ          FCB    37       C
319A      25          171ØØ          FCB    37
319B      1D          172ØØ          FCB    29
319C      27          173ØØ          FCB    39       D
319D      28          174ØØ          FCB    4Ø
319E      1C          175ØØ          FCB    28
319F      9Ø          176ØØ          FCB    144      E
31AØ      9Ø          177ØØ          FCB    144
31A1      Ø6          178ØØ          FCB    6
31A2      Ø1          179ØØ          FCB    1        F
31A3      Ø1          18ØØØ          FCB    1
31A4      8Ø          181ØØ          FCB    128
31A5      2Ø          182ØØ          FCB    32       G
31A6      21          183ØØ          FCB    33
31A7      1F          184ØØ          FCB    31
```

```
3198  1D  1859    FCB  29   H
3199  1E  1869    FCB  30
319A  21  1879    FCB  33
319B  53  1889    FCB  83   I
319C  53  1899    FCB  83
319D  0F  1909    FCB  15
319E  1A  1919    FCB  26   J
319F  1B  1929    FCB  27
31A0  23  1939    FCB  35
31A1  01  1949    FCB  1    K
31A2  01  1959    FCB  1
31A3  80  1969    FCB  128
31A4  15  1979    FCB  21   L
31A5  16  1989    FCB  22
31A6  26  1999    FCB  38
31A7  19  2000    FCB  25   M
31A8  19  2010    FCB  25
31A9  24  2020    FCB  36
31AA  1C  2030    FCB  28   N
31AB  1C  2040    FCB  28
31AC  22  2050    FCB  34
31AD  4B  2060    FCB  75   O
31AE  4B  2070    FCB  75
31AF  11  2080    FCB  17
31B0  47  2090    FCB  71   P
31B1  47  2100    FCB  71
31B2  12  2110    FCB  18
31B3  AC  2120    FCB  172  Q
31B4  AC  2130    FCB  172
31B5  03  2140    FCB  3
31B6  80  2150    FCB  128  R
31B7  80  2160    FCB  128
31B8  08  2170    FCB  8
31B9  2D  2180    FCB  45   S
31BA  2D  2190    FCB  45
31BB  1A  2200    FCB  26
31BC  71  2210    FCB  113  T
31BD  71  2220    FCB  113
31BE  0A  2230    FCB  10
31BF  5E  2240    FCB  94   U
31C0  5E  2250    FCB  94
31C1  0D  2260    FCB  13
31C2  22  2270    FCB  34   V
31C3  22  2280    FCB  34
31C4  1E  2290    FCB  30
31C5  98  2300    FCB  152  W
31C6  98  2310    FCB  152
31C7  05  2320    FCB  5
31C8  2A  2330    FCB  42   X
31C9  2A  2340    FCB  42
31CA  1B  2350    FCB  27
31CB  65  2360    FCB  101  Y
31CC  65  2370    FCB  101
31CD  0C  2380    FCB  12
```

```
31CE  30  2390    FCB  48   Z
31CF  2F  2400    FCB  47
31D0  19  2410    FCB  25
31D1  C1  2420    FCB  193  UP ARR
31D2  C1  2430    FCB  193
31D3  01  2440    FCB  1
31D4  01  2450    FCB  1    DN ARR
31D5  01  2460    FCB  1
31D6  80  2470    FCB  128
31D7  37  2480    FCB  55   LT ARR
31D8  39  2490    FCB  57
31D9  16  2500    FCB  22
31DA  31  2510    FCB  49   RT ARR
31DB  31  2520    FCB  49
31DC  18  2530    FCB  24
31DD  00  2540    FCB  0    SPACE
31DE  00  2550    FCB  0
31DF  00  2560    FCB  0
31E0  01  2570    FCB  1    0
31E1  01  2580    FCB  1
31E2  80  2590    FCB  128
31E3  B6  2600    FCB  182  1
31E4  B7  2610    FCB  183
31E5  02  2620    FCB  2
31E6  A2  2630    FCB  162  2
31E7  A2  2640    FCB  162
31E8  04  2650    FCB  4
31E9  01  2660    FCB  1    3
31EA  01  2670    FCB  1
31EB  80  2680    FCB  128
31EC  88  2690    FCB  136  4
31ED  88  2700    FCB  136
31EE  07  2710    FCB  7
31EF  78  2720    FCB  120  5
31F0  79  2730    FCB  121
31F1  09  2740    FCB  9
31F2  6B  2750    FCB  107  6
31F3  6B  2760    FCB  107
31F4  0B  2770    FCB  11
31F5  01  2780    FCB  1    7
31F6  01  2790    FCB  1
31F7  80  2800    FCB  128
31F8  58  2810    FCB  88   8
31F9  59  2820    FCB  89
31FA  0E  2830    FCB  14
31FB  4F  2840    FCB  79   9
31FC  4F  2850    FCB  79
31FD  10  2860    FCB  16
31FE  43  2870    FCB  67   *
31FF  43  2880    FCB  67
3200  13  2890    FCB  19
3201  13  2900    FCB  19   +
3202  13  2910    FCB  19
3203  28  2920    FCB  40
3204  17  2930    FCB  23   <
3205  17  2940    FCB  23
3206  25  2950    FCB  37
3207  3B  2960    FCB  59   =
3208  3B  2970    FCB  59
3209  15  2980    FCB  21
320A  14  2990    FCB  20   >
320B  14  3000    FCB  20
320C  27  3010    FCB  39
320D  01  3020    FCB  1    ?
320E  01  3030    FCB  1
320F  64  3040    FCB  100
3210  05  3050    FCB  5    ENTER
3211  05  3060    FCB  5
3212  FF  3070    FCB  255
3213  01  3080    FCB  1    CLEAR
3214  01  3090    FCB  1
3215  64  3100    FCB  100
3216  34  3110    FCB  52   BREAK
3217  34  3120    FCB  52
3218  17  3130    FCB  23
3219  FF  3140 ENVTA1 FCB  255  ENVELOPE TABLE #1
321A  CA  3150    FCB  202
321B  AA  3160    FCB  170
321C  91  3170    FCB  145
321D  7E  3180    FCB  126
321E  6B  3190    FCB  107
321F  5B  3200    FCB  91
3220  50  3210    FCB  80
3221  46  3220    FCB  70
3222  3D  3230    FCB  61
3223  35  3240    FCB  53
3224  2D  3250    FCB  45
3225  28  3260    FCB  40
3226  22  3270    FCB  34
3227  1D  3280    FCB  29
3228  1A  3290    FCB  26
3229  17  3300    FCB  23
322A  15  3310    FCB  21
322B  12  3320    FCB  18
322C  10  3330    FCB  16
322D  0F  3340    FCB  15
322E  0D  3350    FCB  13
322F  0C  3360    FCB  12
3230  0A  3370    FCB  10
3231  09  3380    FCB  9
3232  08  3390    FCB  8
3233  07  3400    FCB  7
3234  06  3410    FCB  6
3235  05  3420    FCB  5
3236  04  3430    FCB  4
3237  03  3440    FCB  3
3238  02  3450    FCB  2
3239  01  3460    FCB  1
323A  FF  3470 ENVTA2 FCB  255  ENVELOPE TABLE #2
323B  89  3480    FCB  137
```

```
323C    44      3499Ø       FCB     68
323D    Ø4      35ØØØ       FCB     4
323E    E6      351ØØ       FCB     23Ø
323F    95      352ØØ       FCB     149
324Ø    41      353ØØ       FCB     65
3241    Ø4      354ØØ       FCB     4
3242    D2      355ØØ       FCB     21Ø
3243    91      356ØØ       FCB     145
3244    41      357ØØ       FCB     65
3245    Ø4      358ØØ       FCB     4
3246    CØ      359ØØ       FCB     192
3247    79      36ØØØ       FCB     121
3248    41      361ØØ       FCB     65
3249    Ø4      362ØØ       FCB     4
324A    AD      363ØØ       FCB     173
324B    7Ø      364ØØ       FCB     112
324C    34      365ØØ       FCB     52
324D    Ø4      366ØØ       FCB     4
324E    9A      367ØØ       FCB     154
324F    63      368ØØ       FCB     99
325Ø    2C      369ØØ       FCB     44
3251    Ø4      37ØØØ       FCB     4
3252    86      371ØØ       FCB     134
3253    54      372ØØ       FCB     84
3254    29      373ØØ       FCB     41
3255    Ø4      374ØØ       FCB     4
3256    74      375ØØ       FCB     116
3257    48      376ØØ       FCB     72
3258    22      377ØØ       FCB     34
3259    ØØ      378ØØ       FCB     Ø
325A 17 FDB6    379ØØ PLAYBK LBSR    INITLZ  PLAYBACK SEGMENT
325D 7F 3178    3791Ø       CLR     ENVTOG
326Ø 1Ø8E 334C  38ØØØ       LDY     #COMPOS
3264 8E 3219    381ØØ       LDX     #ENVTA1
3267 BF 3176    382ØØ       STX     ENVTAB
326A FE 317C    383ØØ PLYØØ5 LDU     ENVDLY
326D BE 3176    384ØØ       LDX     ENVTAB
327Ø BF 3173    385ØØ       STX     ENVPTR
3273 1ØBC 33ØD  386ØØ PLY91Ø CMPY    MEMORY
3277 27 37      387ØØ       BEQ     SWI
3279 E6 21      388ØØ       LDB     +1,Y
327B BE 3176    389ØØ       LDX     ENVTAB
327E 3A         39ØØØ       ABX
327F BF 32B1    391ØØ       STX     ENVPT2
3282 E6 A4      392ØØ       LDB     ,Y
3284 8E 318Ø    393ØØ       LDX     #TABLE
3287 C1 64      394ØØ       CMPB    #1ØØ
3289 26 1D      3951Ø       BNE     PLYØ2Ø
328B 7C 3178    3952Ø       INC     ENVTOG
328E B6 3178    3953Ø       LDA     ENVTOG
3291 44         3954Ø       LSRA
3292 25 ØA      3955Ø       BCS     ENV22
3294 8E 3219    3956Ø       LDX     #ENVTA1
3297 BF 3176    399ØØ       STX     ENVTAB
329A 31 23      4ØØØØ       LEAY    +3,Y
329C 2Ø CC      4Ø1ØØ       BRA     PLYØØ5
329E 8E 323A    4Ø2ØØ ENV22  LDX     #ENVTA2
32A1 BF 3176    4Ø3ØØ       STX     ENVTAB
32A4 31 23      4Ø4ØØ       LEAY    +3,Y
32A6 2Ø C2      4Ø5ØØ       BRA     PLYØØ5
32A8 E1 Ø2      4Ø6ØØ PLYØ2Ø CMPB    +2,X
32AA 27 Ø7      4Ø7ØØ       BEQ     FOUND
32AC 3Ø Ø3      4Ø8ØØ       LEAX    +3,X
32AE 2Ø F8      4Ø9ØØ       BRA     PLYØ2Ø
32BØ 39         41ØØØ SWI    RTS
32B1    ØØØØ    411ØØ ENVPT2 FDB     Ø
32B3 EC 84      412ØØ FOUND  LDD     ,X
32B5 34 Ø6      413ØØ       PSHS    A,B
32B7 A6 9F 3173 414ØØ PLYØ3Ø LDA     [ENVPTR]
32BB E6 A4      415ØØ       LDB     ,Y
32BD C1 FF      416ØØ       CMPB    #255
32BF 26 Ø1      417ØØ       BNE     PLYØ4Ø
32C1 4F         418ØØ       CLRA
32C2 E6 E4      419ØØ PLYØ4Ø LDB     ,S
32C4 8D Ø7      42ØØØ       BSR     SND
32C6 4F         421ØØ       CLRA
32C7 E6 61      422ØØ       LDB     +1,S
32C9 8D Ø2      423ØØ       BSR     SND
32CB 2Ø EA      424ØØ       BRA     PLYØ3Ø
32CD 5A         425ØØ SND    DECB
32CE 26 28      426ØØ       BNE     ENV
32DØ 8A Ø2      4261Ø       ORA     #2
32D2 B7 FF2Ø    427ØØ       STA     $FF2Ø
32D5 BE 3173    428ØØ CKSTOP LDX     ENVPTR
32D8 BC 32B1    429ØØ       CMPX    ENVPT2
32DB 1Ø23 FE66  43ØØØ       LBLS    RETURN
32DF 8D 55      43ØØ2       BSR     BETWN
32E1 CE ØØ32    43Ø1Ø       LDU     #5Ø     <-<PLAYDELAY
32E4 33 5F      43Ø2Ø PLYDLY LEAU    -1,U
32E6 1183 ØØØØ  43Ø3Ø       CMPU    #Ø
32EA 26 F8      43Ø4Ø       BNE     PLYDLY
32EC 3Ø Ø1      431ØØ       LEAX    +1,X
32EE BF 3173    432ØØ       STX     ENVPTR
32F1 32 64      433ØØ       LEAS    +4,S
32F3 31 23      434ØØ       LEAY    +3,Y
32F5 16 FF72    435ØØ       LBRA    PLYØØ5
32F8 33 5F      436ØØ ENV    LEAU    -1,U
32FA 1183 ØØØØ  437ØØ       CMPU    #Ø
32FE 26 CD      438ØØ       BNE     SND
33ØØ FE 317C    439ØØ       LDU     ENVDLY
3303 BE 3173    44ØØØ       LDX     ENVPTR
3306 3Ø Ø1      441ØØ       LEAX    +1,X
3308 BF 3173    442ØØ       STX     ENVPTR
33ØB 2Ø CØ      443ØØ       BRA     SND
33ØD    334A    444ØØ MEMORY FDB     $334A   POINTS TO LAST NOTE STORED
33ØF C6 Ø1      4445Ø TWEEN  LDB     #1
3311 7F FFØ2    445ØØ       CLR     $FFØ2
3314 B6 FFØØ    446ØØ TWEENØ LDA     $FFØØ
3317 8A 8Ø      4461Ø       ORA     #$8Ø
3319 81 FF      447ØØ       CMPA    #$FF
331B 1Ø26 FE26  448ØØ       LBNE    RETURN
331F 4F         449ØØ       CLRA
3320 1Ø21 FDØA  4491Ø TWEEN3 LBRN    INKEY
3324 1Ø21 FDØ6  4492Ø       LBRN    INKEY
3328 4C         45ØØØ       INCA
3329 27 Ø2      451ØØ       BEQ     TWEEN4
332B 2Ø F3      452ØØ       BRA     TWEEN3
332D 5C         453ØØ TWEEN4 INCB
332E C1 FF      454ØØ       CMPB    #$FF
3330 1Ø27 FE11  455ØØ       LBEQ    RETURN
3334 2Ø DE      456ØØ       BRA     TWEENØ
3336 5F         457ØØ BETWN  CLRB
3337 4F         458ØØ BETWN1 CLRA
3338 1Ø21 FCF2  459ØØ BETWN2 LBRN    INKEY
333C 1Ø21 FCEE  46ØØØ       LBRN    INKEY
334Ø 4C         461ØØ       INCA
3341 26 F5      462ØØ       BNE     BETWN2
3343 5C         463ØØ       INCB
3344 E1 22      464ØØ       CMPB    +2,Y
3346 1Ø27 FF66  465ØØ       LBEQ    SWI
334A 2Ø EB      466ØØ       BRA     BETWN1
334C    ØØ      467ØØ COMPOS FCB     Ø       FIRST BYTE STORED MUSIC DATA
        325A    468ØØ       END     PLAYBK

ØØØØØ TOTAL ERRORS
```



Submitting Material To Rainbow

Contributions to THE RAINBOW are welcome from everyone. We like to run a variety of programs that are useful/helpful/fun for other CoCo owners.

Program submissions must be on tape or disk and it is best to make several saves, at least one of them in ASCII format. We're sorry, but we do not have time to key in programs. All programs should be supported by some editorial commentary explaining how the program works. Generally, we're much more interested in how your submission works and runs than how you developed it. Programs should be learning experiences.

We do pay for submissions, based on a number of criteria. Those wishing remuneration should *so state* when making submissions.

For the benefit of those who wish more detailed information on making submissions, please send a self-addressed, stamped envelope (SASE) to: Submissions Editor, THE RAINBOW, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. We will send you some more comprehensive guidelines.

Please do not submit programs or articles currently submitted to another publication.

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Data Directory
File1
Datafile
Budget
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Friends
Bulletin
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1
2
3

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Enhance Presentations with Text Panel Formatting

By Joseph Kolar
Rainbow Contributing Editor

Now hear this! I have developed 20 tutorials using Hi-Res graphics for the 16K ECB CoCo. Before presenting this 20-month series, I invite all interested readers to make their wishes known. Drop me a line and register your vote. Would you prefer that we continue our leisurely stroll through BASIC? Or would you like to settle in for a long session with Hi-Res graphics?

Our agenda for today is the text screen and how to format text panels in an interesting manner to enhance their presentation.

In many educational programs, text must be used extensively to explain or develop a theme. It behooves the novice programmer to make the text on the screen as appealing as possible. About two years ago, I presented a tutorial on this subject. To the newer readers of this column, what you learn here will stand you in good stead.

Hint for today. When keying in program lines, look at the TV/monitor screen and watch the characters appear as they are typed in rather than looking at your fingers. You will find that typing errors can be spotted as they are committed and can be corrected before completing the program line. There are two advantages to this: You will gradually develop a touch-typing system as you are weaned from being mesmerized by the keyboard and it eliminates a lot of errors before pressing ENTER.

When the program is run it may not produce an error message. It may carry an embarrassing misspelling in an otherwise impeccable program. When it is discovered, creative time is wasted searching out the right program line, correcting it and running the program to verify the correction. It is difficult enough to program without the bother of debugging silly spelling errors.

The veterans may want to skip Listing 1 and Listing 2 because they are old hat. Newcomers, key in Listing 1, carefully typing in the lines as they appear in the listing. Run the program. Press any key to advance. Faithfully follow the instructions. Perform all actions called for enclosed in brackets. If you skip over parts of the text/instructions, you will not get the entire picture.

Once this tutorial is completed, Line 2000 is altered. Refer to the listing and restore the line to its original condition.

In the educational program that we are going to develop in the next few months, we will be doing a lot of programming directly from the screen. Understanding how to format text and position a sentence(s) on the screen so it doesn't look disjointed or unbalanced is important. It's imperative that you practice programming sentences to make neat, well-placed text for display on the screen or you may encounter trouble later.

Long REM statements in a listing should be formatted with a different view in mind. REM statements are dormant during the execution of a program. When they are revealed in the course of listing a program, they must be neat, logical and readable just as text lines on the screen.

Forget the "invisible vertical line" gambit. Look at the screen and compose, alter and adjust the REM statement lines so they are instantly recognizable and readable.

Key in Listing 2. When finished, list it line by line, beginning with 3000 through 3080. The listing is the tutorial! Those who know how, may want to append Listing 2 to Listing 1.

Listing 3 is practically one giant

Florida-based Joseph Kolar is a veteran writer and programmer and specializes in introducing beginners to the powers of CoCo.

GOSUB program. It could have been divided further, but after a point too many GOSUBs can be counter-productive. Aside from the usual one-panel-at-a-time presentation of text on the screen, we will demonstrate scrolling, simple substitution and complex substitution methods.

Key in Listing 3. Line 10 demonstrates the usual panel replacement method (Lines 100-101, 110-111, 120 and 122).

The panels of text must be carefully crafted to fit in the available screen space. This means the contents of each panel may have to be revised. (Add a few words or delete a few words.)

Beginning with Line 123 and continuing through Line 128, the program changes to the scrolling method. Each set of definitions is scrolled upwards. Note that each set covers about one-half of the screen rows to maintain a nice, two-set display at all times.

The columns in each set created were based on one of the techniques in a tutorial we discussed a few months ago. It should be familiar, so we won't beat it to death. Here is a question to ponder — Why are there four commas after "red" in Line 123 rather than three commas after "English" in Line 122?

The languages in column one are Germanic and those in column two are Romance. It is easy to spot the similarities in the words in the two columns. Examine the "black" set. The three Germanic definitions are very closely related, as are the three Romance ones. They are called cognates; words that are linguistically related and that may have a common origin. The obsolete English word for "black" is "swart," which exists today in "swarthy." The progenitor of the Romance languages is Latin, while that of the Germanic trio is a hypothetical proto-Germanic language. "Black" is related to an old Anglo-Saxon form of unknown origin.

The simple substitution method can be observed in the text presentation in lines 20 and 30. Here the panel remains in place. The definitions are replaced simultaneously as one unit. Line 120, on the top half of the screen, briefly comments on the word lists to be depicted.

The bottom half of the display panel uses the same group of GOSUBs that were used in Line 10 to create the combo panel replacement and scrolling method. Note that in Line 20, PRINT@ ,255,"" becomes GOSUB200 in Line 30.

In order to utilize the same GOSUBs, we decided to print "nothing" in the last space on the right-hand side of the row above our starting row (beginning at space 256). The idea is to maintain the integrity of GOSUBs 122 through 128 and to maintain the same vertical location at all times. Also, the text on the top half of the screen is not partially scrolled up and off the screen. The PRINT@ allows us to designate the location of a GOSUB statement without altering its contents, which ends it effectively as a GOSUB.

Change the first 255 in Line 20 to 256 and you see how it ruins an effect we tried hard to achieve.

Line 40 uses the complex-substitution method. If you want sound, turn up the volume.

Line 300 sets the values for the location of the seven entries that will be substituted, one at a time, in each set. X$ is used as a blanking-out string variable.

Line 301 sets up the abbreviations that will remain in place throughout this program segment.

Line 303 locates and prints the "red" set. Between each PRINT@ word, there appears a slight pause and a sound, courtesy of GOSUB400. Note the ';' after the entries that contain 'B', 'D' and 'F'. They are required after the left-hand column. If they are omitted, the right-hand column is wiped out, losing the abbreviations that were meant to remain undisturbed.

Line 305 blanks out the definitions and pauses for two seconds.

Note that lines 303 and 310 end with EXEC44539:GOSUB305:RETURN. It waits for a key to be pressed, blanks out the definitions and returns. The temptation was too great to resist. A GOSUB500 was created to continue this program.

Line 99 was a temporary stop that became dormant once the program, (lines 10 through 40) was finished and a loop to repeat (Line 50) was added.

Line 399 ends the program abruptly and keeps the sound (GOSUB400) separated from the complex substitution segment. Delete or mask Line 399 with a REM and see what happens!

After CoCo runs through the complex substitution sets, instead of coming to the intended screeching halt, it goes berserk and makes three ever-decreasing loops encompassing white-yellow-green, yellow-green and green, before going back to the start of the program.

Obviously, CoCo is innocent. There is a hidden semi-error in the listing that is suppressed when 399 GOTO 399 is used. Guess who made the error. Can you track it down and save my day?

TRON and TROFF, the debugging aids, are often both useless and confusing in a large program. Listing 3 is ideally suited to try out the TRON feature of ECB.

Press BREAK, type in TRON, press ENTER and RUN. You'd think this program was made to order to demonstrate

"If it works, don't fool with it!"

TRON. Each number enclosed in square brackets gives the program line number that is executed.

If you follow it slowly, you will be able to determine at what point I caused CoCo to veer from the straight and narrow. It will nudge you toward the error(s). Put on your thinking cap and locate the mistake(s).

Sometimes, as happened in this program, it is possible to create a viable program with a submerged, latent error that is not readily apparent. If this program is enlarged and altered to head in a new direction, the error can surface and force you to cope with it. My motto is, "If it works, don't fool with it!"

With the TRON on, note that lines 10 through 40 are not displayed. Rather, all the GOSUBs are nicely labeled. Lines 200, 300, 301 and 400, which remain set at some point in the program, are in a stationary location. This is particularly obvious in the complex substitution segment.

Program lines that do nothing are not noted, such as locations that are not executed. Only that which is in the location is executed.

Work through Listing 3 with TRON and compare each bracketed number with the listing line number. You will find it helpful and enjoyable to romp through the program with CoCo. If you find the mistake, good. If not, have fun exploring this debugging tool anyway, and when finished, remember to pluck the REM out of Line 399 and get out of TRON mode with BREAK, TROFF and ENTER.

Everytime you turn on CoCo and program, you are having a learning experience. Enjoy it! □

Listing 1: TUTOR 1

```
Ø '<LISTING1>
1Ø CLS:GOSUB2ØØØ
11 '<RUN> THIS AND SEE HOW ODD I
T LOOKS!
12 EXEC44539:PRINT"  NOTE THE ST
ARTING SPACE IN THESECOND LINE O
F TEXT!
13 EXEC44539:PRINT:PRINT"  NOTE
HOW 'THAT' IS SPLIT ONTO TWO LIN
ES!"
14 EXEC44539:PRINT:PRINT"  <BREA
K> <LIST2ØØØ>  STUDY THE DISPLAY
!  WHAT MUST BE DONE TO  MOVE TH
E SECOND LINE ONE SPACE  TO THE
LEFT?  WHEN READY <RUN15><PRESS
ANY KEY>"
15 EXEC44539:GOSUB2ØØØ:
16 EXEC44539:PRINT"  WE MUST DEL
ETE THE BLANK SPACEAT THE BEGINN
ING OF THE SECOND  LINE BETWEEN
THE WORDS 'TEXT'   AND 'IN'.  DO
 SO NOW!  <BREAK>  <EDIT2ØØØ> <4
2> <SPACEBAR> <D>  <ENTER> <RUN1
8> <PRESS A KEY>."
18 EXEC44539:GOSUB2ØØØ:PRINT:PRI
NT"  NOTE 'THA' OF 'THAT' MUST B
E  MOVED TO THE NEXT LINE.  <BRE
AK><EDIT2ØØØ> AND INSERT THREE
   SPACES SO THAT 'THA' IS PUSHE
D  TO THE NEXT LINE.  <71> <SPAC
E- BAR> <I> <SPACEBAR (3 TIMES)>
"
19 PRINT"<ENTER> <RUN2Ø> <PRESS
KEY>.
2Ø EXEC44539:GOSUB2ØØØ:PRINT"  N
OTE THAT THE LEFT MARGIN BE- GIN
S VERTICALLY WITH A BLANK    SPA
CE;I;T.  <BREAK> <LIST2ØØØ>  AND
 NOTE WHERE THIS SEQUENCE OF LET
TERS FALL. <RUN21> <PRESS>.
21 EXEC44539:GOSUB2ØØØ:PRINT"  I
F YOU DREW AN INVISIBLE,     VER
TICAL LINE YOU WOULD NOTE    THA
T THIS FIRST COLUMN OF CHAR- ACT
ERS/SPACES FELL IMMEDIATELY  TO
THE RIGHT OF THE STARTING    'QU
OTE MARK'."
22 EXEC44539:GOSUB2ØØØ:PRINT"  N
OW YOU KNOW WHERE TO BEGIN   EAC
H LINE OF TEXT AS YOU ARE    KEY
ING IT IN.  IF A WORD MUST BEBRO
KEN UP INTO SYLLABLES, THE   TEC
HNIQUE IS THE SAME."
23 PRINT"  TO SEE HOW LINE22, (A
BOVE     PARAGRAPH), WAS ALLIGNE
D <BREAK><LIST22> SEE THE INVISI
BLE LINE AFTER THE STARTING QUOT
E MARK?  <RUN24> <PRESS A KEY>"
24 EXEC44539:PRINT"  SPACE;E;K;B
;T":PRINT:PRINT"  NO MATTER WHER
E THE START OF  THE TEXT LINE BE
GINS IN A ROW,  THE INVISIBLE LI
NE BEGINS RIGHT AFTER THE OPENIN
G QUOTE MARK OF THAT PARTICULAR
SENTENCE. "
25 EXEC44539:CLS:PRINT:PRINT"  R
EMEMBER THAT THAT OPENING    QUO
TE MARK IS THE VISUAL HINT ONTHE
 SCREEN, AS YOU KEY IN A PRO-GRA
M LINE.  IT ALERTS YOU WHEN  YOU
 ARE REACHING THE END OF A   TEX
T LINE OF 32 CHARACTERS/SPACES."
26 PRINT:PRINT"  THE RIGHT-MARGI
N WILL BE DI-  RECTLY UNDER THE
OPENING QUOTE  MARK.  ANY WORD T
HAT EXTENDS    PAST THE 32ND, RI
GHT MARGIN     SPACE, WILL HAVE
TO BE ADJUSTED,IN WHOLE OR IN PA
RT!"
27 EXEC44539:PRINT:PRINT"  IF TH
E ENTIRE WORD MUST BE    PLACED
ON THE NEXT LINE, THE    SPACES
BETWEEN THE LAST FULL    WORD AT
 THE END OF THE ROW AND  THE 1ST
 SPACE OF THE NEXT ROW,  WHERE T
HE IST LETTER OF THE NEXTWORD WI
LL BEGIN, MUST BE FILLED"
28 PRINT"WITH BLANK 'SPACES'.
29 EXEC44539:PRINT:PRINT"  IF TH
E WORD CAN BE BROKEN UP  INTO SY
LLABLES, CONSIDER THE TWOPARTS T
O BE TWO WORDS; THE FIRSTWORD, (
PART), IS FOLLOWED BY A  HYPHEN.
"
3Ø EXEC44539:PRINT:PRINT"  THE B
ALANCE OF THE ROW IS     FILLED
WITH 'BLANK SPACES'.  THESECOND
WORD, (PART), BEGINS AT  THE INV
ISIBLE LINE THAT MARKS   OFF THE
 LEFT-MARGIN.  YOU CAN   FIGURE
OUT THE FORMAT FROM THE  SCREEN
AS YOU CREATE THE TEXT
31 PRINT"LINE."
32 EXEC44539:PRINT:PRINT"  IF YO
U WANT TO DO THE WHOLE   TUTORIA
L OVER, EDIT LINE2ØØØ, BYINSERTI
NG A SPACE BETWEEN 'TEXT'AND 'IN
' AND DELETE 3 SPACES AF-TER 'SO
'.  <RUN>. IF NOT, <PRESSA KEY.>
"
33 EXEC44539:CLS:PRINT@2Ø2,"  TH
E END!"
34 GOTO34
2ØØØ CLS:PRINT"  WE WANT TO PRIN
T LINES OF TEXT IN A NEAT, LOGIC
```

```
AL MANNER SO THAT A PLEASING DIS
PLAY RESULTS.":PRINT:RETURN
```

Listing 2: TUTOR 2

```
Ø '<LISTING2>
3ØØØ REM THIS IS THE WAY A RAW R
EM LINE MIGHT LOOK, IF IT WERE K
EYED IN.-------<LIST ONE LINE AT
A TIME TO FOLLOW THIS TUTORIAL>.
3Ø1Ø 'IT WOULD BE A GOOD IDEA TO
HIGHLIGHT IT WITH A STRING OF 3
STARS.
3Ø2Ø '***THIS MAKES IT STAND OUT
SO IT CAN BE EASILY LOCATED.
3Ø3Ø '***DID YOU NOTICE IN LINE
3Ø2Ø THAT THE SPACE AFTER 'OUT'
WAS DELETED SO THAT 'SO' WOULD
RUN AT THE LEFT MARGIN?
3Ø4Ø '***DID YOU NOTE THAT IN
LINE3Ø3Ø, THE 'R' IN 'RUN' WAS
PUSHED DOWN, VIA A SPACE SO IT
BEGAN AT THE LEFT MARGIN?
3Ø5Ø '***IN LINE3Ø4Ø, YOU NO-
TICED THREE 'PUSHES' TO MAKE THE
WORDS BEGIN AT THE LEFT MARGIN!
3Ø6Ø '***DID YOU SEE HOW 'NO-
TICED' WAS SYLLABLIZED?  IF IT
WERE NOT, THE 'D' OF 'NOTICED'
IN LINES 3Ø4Ø AND 3Ø5Ø WOULD BE
HANGING ON THE NEXT LINE AND
MAYBE ADVERSELY AFFECT OTHER
WORDS IN A LONG REM LINE.
3Ø7Ø '***REMEMBER, YOU SHOULD BE
COMPOSING AND FORMATING REMS AT
THE SAME TIME.  YOU GET WHATEVER
REM LINE THAT YOU SEE ON THE
SCREEN AS YOU CREATE IT.  ADJUST
THE LINES AS YOU KEY THEM IN.
3Ø8Ø '***WHEN YOU HAVE A GROUP
OF REM LINES, YOU MAY FIND IT OF
VALUE TO SEPARATE THEM WITH A
LINE LIKE THE FOLLOWING:
      <3Ø75 '***> OR <3Ø75 '>
  NOW MAKE A REAL LINE3Ø75 AND
SEE HOW NICELY IT SEPARATES REM
STATEMENTS 3Ø7Ø-3Ø8Ø. <LIST>
```

Listing 3: GOSUBTUT

```
Ø '<LISTING3>
5 CLS:PRINT@194,"TO ADVANCE, PRE
SS ANY KEY":PRINT:PRINT" WELL, W
HAT ARE YOU WAITING FOR? ":EXEC4
4539
1Ø CLS:GOSUB1ØØ:GOSUB11Ø:GOSUB12
Ø:GOSUB123:GOSUB124:GOSUB125:GOS
UB126:GOSUB127:GOSUB128
2Ø CLS:GOSUB12Ø:PRINT@255,"":GOS
UB123:PRINT@255,"":GOSUB124:PRIN
T@255,"":GOSUB125:PRINT@255,"":G
OSUB126:PRINT@255,"":GOSUB127:PR
INT@255,"":GOSUB128
3Ø CLS:GOSUB12Ø:GOSUB2ØØ:GOSUB12
3:GOSUB2ØØ:GOSUB124:GOSUB2ØØ:GOS
UB125:GOSUB2ØØ:GOSUB126:GOSUB2ØØ
:GOSUB127:GOSUB2ØØ:GOSUB128
4Ø CLS:GOSUB12Ø:GOSUB3ØØ:GOSUB3Ø
1:GOSUB3Ø3:GOSUB31Ø:GOSUB315:GOS
UB32Ø:GOSUB325:GOSUB33Ø
5Ø GOTO1Ø
99 GOTO99
1ØØ PRINT:PRINT"  LET US EXPLORE
 A FEW METHODS  THAT ALLOW US TO
 PLACE PANELS OFTEXT ONTO THE SC
REEN IN A MAN-  NER DESIGNED TO
AVOID REPETI-  TION, BORDDOM AN
D PREDICTABIL-  ITY."
1Ø1 PRINT:PRINT"  THE FIRST METH
OD THAT COMES TOMIND, IS MERELY,
 TO CLEAR THE  SCREEN AND SPLAT
 ON THE NEXT  PANEL.  THIS SYS
TEM REQUIRES  CARE IN PREPARIN
G BLOCKS OF TEXTTHAT FIT EACH PA
NEL.":EXEC44539:RETURN
11Ø CLS:PRINT:PRINT"  THE CHANCE
S ARE THAT YOU WILL HAVE TO EXPE
```


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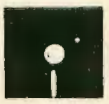

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```
RIMENT AND REWORD  THE TEXT TO
MAKE IT LOOK WELL- CENTERED, BO
TH HORIZONTALLY AND VERTICALLY.
111 PRINT:PRINT"  THE SAMPLE DIS
PLAY THAT WE AREGOING TO CREATE
IS A LIST OF    NAMES OF COLORS
IN SIX LAN-     GUAGES.  WE SHAL
L PRESENT THEM  IN THREE DIFFERE
NT STYLES TO ADDVARIETY IN OUR P
ROGRAMMING. ":EXEC44539:RETURN
12Ø CLS:PRINT"  THE FOLLOWING LI
ST CONTAINS   THE NAME OF COLORS
 THAT ARE VERYSIMILAR IN SOUND I
N MANY CASES.   THESE SIMILARLY
SPELLED AND   PRONOUNCED WORDS A
RE COGNATES;  WORDS THAT HAVE A
COMMON ANCES- TOR LANGUAGE. ":PR
INT
122 PRINT:PRINT"              ENGL
ISH",,,"  GERMAN","FRENCH","  DU
TCH","SPANISH","  SWEDISH","ITAL
IAN":PRINT:EXEC44539:RETURN
123 PRINT:PRINT"              RED"
,,,,"GER. ROT","FR. ROUGE","DU.
 ROOD","SP. ROJO","SW.  ROD","IT
. RUSSO":PRINT:EXEC44539:RETURN
124 PRINT:PRINT"              BLU
E",,,"GER. BLAU","FR. BLEU","DU.
  BLAUW","SP. AZUL","SW.  BLA","
IT. AZZURO":PRINT:EXEC44539:RETU
RN
125 PRINT:PRINT"              BLAC
K",,,"GER.  SCHWARZ","FR.  NOIR"
,"DU.   ZWART","SP.  NEGRO","SW.
   SVART","IT.  NERO":PRINT:EXEC
44539:RETURN
126 PRINT:PRINT"              WHIT
E",,,"GER.  WEISS","FR.  BLANC",
"DU.   WIT","SP.  BLANCO","SW.
 VIT","IT.  BIANCO":PRINT:EXEC44
539:RETURN
127 PRINT:PRINT"              YELL
OW",,,"GER.  GELB","FR.  JAUNE",
"DU.   GEEL","SP.  AMARILLO","SW
.   GUL","IT.  GIALLO":PRINT:EXE
C44539:RETURN
128 PRINT:PRINT"              GREE
N",,,"GER.  GRUEN","FR.  VERT","
DU.   GROEN","SP.  VERDE","SW.
 GRON","IT.  VERDE":PRINT:EXEC44
539:RETURN
2ØØ PRINT@255,"":RETURN
3ØØ A=3ØØ:B=356:C=372:D=388:E=4Ø
4:F=42Ø:G=436:X$="              "
3Ø1 PRINT@3ØØ,"ENGLISH",,,"GR.",
"FR.","DU.","SP.","SW.","IT.":FO
RX=1TO4ØØ:NEXT:RETURN
3Ø3 PRINT@A,"RED":GOSUB4ØØ:PRINT
@B,"ROT";:GOSUB4ØØ:PRINT@C,"ROUG
E":GOSUB4ØØ:PRINT@D,"ROOD";:GOSU
B4ØØ:PRINT@E,"ROJO":GOSUB4ØØ:PRI
NT@F,"ROD";:GOSUB4ØØ:PRINT@G,"RU
SSO":EXEC44539:GOSUB3Ø5:RETURN
3Ø5 PRINT@A,X$:PRINT@B,X$;:PRINT
@C,X$:PRINT@D,X$;:PRINT@E,X$:PRI
NT@F,X$;:PRINT@G,X$:FORX=1 TO 1Ø
ØØ:NEXT:RETURN
31Ø PRINT@A,"BLUE":GOSUB4ØØ:PRIN
T@B,"BLAU";:GOSUB4ØØ:PRINT@C,"BL
EU":GOSUB4ØØ:PRINT@D,"BLAUW";:GO
SUB4ØØ:PRINT@E,"AZUL":GOSUB4ØØ:P
RINT@F,"BLA";:GOSUB4ØØ:PRINT@G,"
AZZURO":EXEC44539:GOSUB3Ø5:RETUR
N
315 PRINT@A,"BLACK":GOSUB4ØØ:PRI
NT@B,"SCHWARZ";:GOSUB4ØØ:PRINT@C
,"NOIR":GOSUB4ØØ:PRINT@D,"ZWART"
;:GOSUB4ØØ:PRINT@E,"NEGRO":GOSUB
4ØØ:PRINT@F,"SVART";:GOSUB4ØØ:PR
INT@G,"NERO":GOSUB5ØØ
32Ø PRINT@A,"WHITE":GOSUB4ØØ:PRI
NT@B,"WEISS";:GOSUB4ØØ:PRINT@C,"
BLANC":GOSUB4ØØ:PRINT@D,"WIT";:G
OSUB4ØØ:PRINT@E,"BLANCO":GOSUB4Ø
Ø:PRINT@F,"VIT";:GOSUB4ØØ:PRINT@
G,"BIANCO":GOSUB5ØØ
325 PRINT@A,"YELLOW":GOSUB4ØØ:PR
INT@B,"GELB";:GOSUB4ØØ:PRINT@C,"
JAUNE":GOSUB4ØØ:PRINT@D,"GEEL";:
GOSUB4ØØ:PRINT@E,"AMARILLO":GOSU
B4ØØ:PRINT@F,"GUL";:PRINT@G,"GIA
LLO":GOSUB5ØØ
33Ø PRINT@A,"GREEN":GOSUB4ØØ:PRI
NT@B,"GRUEN";:GOSUB4ØØ:PRINT@C,"
VERT":GOSUB4ØØ:PRINT@D,"GROEN";:
GOSUB4ØØ:PRINT@E,"VERDE":GOSUB4Ø
Ø:PRINT@F,"GRON";:GOSUB4ØØ:PRINT
@G,"VERDE":EXEC44539
399 GOTO399
4ØØ FORZ=1TO2ØØ:NEXT:SOUND1ØØ,2:
RETURN
5ØØ EXEC44539:GOSUB3Ø5:RETURN
```


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CoCo Takes the Plunge: Pool Maintenance Made Easy

By Stephen Snider

Swimming Pool Maintenance is a program to give the new pool owner a helping hand in maintaining proper pool conditions. Although new owners will get the most benefit from this program, experienced owners can also find useful information.

The program is menu driven and user friendly. It runs on a 16K Extended BASIC computer. On initialization, the menu gives several choices:

1) Calculate Pool Size in Gallons — This information is needed in the next section. It calculates the size of either rectangular, oval or circular pools.

2) Adjust Chlorine Level — This section asks for the pool size in gallons, air temperature, water temperature and chlorine test results. It then determines the proper amount of chlorine to be added to bring it up to the desired level. It calculates the proper level for either stabilized or non-stabilized pools.

The calculations are taken from manufacturer's specifications. It may be necessary to adjust the results to individual circumstances discovered by daily testing. If the test results are high from day to day, then less chlorine needs to be added. Once a regular pattern has been established, this section will probably not be needed.

3) Adjust PH Level — This section asks for the results of the PH test. It then gives the chemicals needed (if any) to obtain the proper level.

4) Winterize Pool — This section is a data section only. It gives instructions to properly winterize the pool. It also gives additional suggestions on optional equipment to help minimize problems during the winter.

5) Open Pool — This is also a data section. It gives the proper procedure to open the pool at the beginning of swimming season.

6) Pool Problems — This section presents a menu of various pool problems that you might encounter. It lists the probable cause and one or more solutions.

I think pool owners of all kinds will find this program very useful. If you require any assistance, please contact me at P.O. Box 234, Energy, IL 62933. Please enclose an SASE. □

Main Menu

```
* * * MENU * * *
1) CALCULATE POOL SIZE(GALLONS)
2) CALCULATE CHLORINE LEVEL
3) CALCULATE PH LEVEL
4) TO WINTERIZE POOL
5) OPEN POOL(BEGIN SEASON)
6) TO TROUBLE SHOOT
INPUT # DESIRED
? 6
```

Trouble-shooting Menu

```
* * * MENU * * *

1) SLIPPERY POOL WALLS & FLOOR
2) GREEN POOL WATER
3) EYES BURN AFTER SWIMMING
4) BROWN POOL WATER
5) CLOUDY POOL WATER
6) UNPLEASANT SMELL FROM WATER
7) BROWNISH STAINS ON POOL
8) FOAMING
9) SCALE ON POOL SURFACES
```

Sample Run

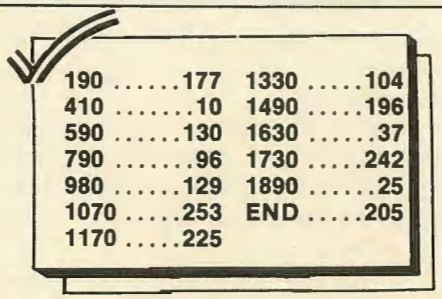
```
NUMBER OF PROBLEM? 3
EYES BURN AFTER SWIMMING

* * * * * CAUSE * * * * *

HIGH PH OR TOO MUCH CHLORINE

* * * * * SOLUTION * * * * *

CHECK PH AND CHLORINE CONTENT
WITH TEST KIT. IF THERE IS TOO
MUCH CHLORINE, STOP CHLORINE
DOSAGE AND CHECK CHLORINE DAILY
UNTIL PROPER LEVEL IS REACHED
```



```
190 ......177   1330 .....104
410 .......10   1490 .....196
590 ......130   1630 ......37
790 .......96   1730 .....242
980 ......129   1890 ......25
1070 .....253   END .....205
1170 .....225
```

The Listing: SWIMPOOL

```
1Ø '****************************
2Ø '*  POOL MAINTENANCE        *
3Ø '*          BY              *
4Ø '*   STEPHEN M. SNIDER      *
5Ø '*   P. O. BOX 234          *
6Ø '*   ENERGY,IL. 62933       *
65 '****************************
7Ø PMODE 1,1
8Ø PCLS
9Ø SCREEN 1,Ø
1ØØ DRAW"BM2Ø,18ØU5ØR15ØD5ØL15ØR
15ØU2ØL3ØU5R3ØD25L8ØU5Ø
11Ø PAINT (6Ø,17Ø),3,4
12Ø PAINT (1ØØ,17Ø),3,4
13Ø DRAW"BM4,19ØU75R19ØD75L19Ø
14Ø PAINT (25,189),2,4
15Ø DRAW"BM2Ø,4ØU2ØR1ØD1ØL1ØBR2Ø
U1ØD2ØR1ØU2ØL1ØR1ØBR1ØD2ØR1ØU2ØL
1ØR1ØBR1ØD2ØR1Ø
16Ø DRAW" BM2Ø,68U2Ø F5E3D2ØBR1Ø
U2ØR1ØD1ØL1ØR1ØD1ØBR1ØR1ØL5U2ØL5
R1ØBR1ØD2ØU2ØF1ØD1ØU2ØBR1ØR1ØL5D
2ØBR15U2ØR1ØL1ØD1ØR5L5D1ØR1ØBR1Ø
U2ØF1ØU1ØD2ØBR1ØU2ØR1ØD1ØL1ØR1ØD
1ØBR1ØU2ØF1ØU1ØD2ØBR1ØR1ØL1ØU2ØR
1ØBR1ØR1ØL1ØD1ØR5L5D1ØR1Ø
17Ø FOR I=1 TO5ØØØ:NEXT
18Ø CLS
19Ø CLS:PRINT @ 4,"* * * MENU *
* *"
2ØØ PRINT"1) CALCULATE POOL SIZE
(GALLONS)"
21Ø PRINT"2) CALCULATE CHLORINE
LEVEL"
22Ø PRINT"3) CALCULATE PH LEVEL"
23Ø PRINT"4) TO WINTERIZE POOL"
24Ø PRINT"5) OPEN POOL(BEGIN SEA
SON)"
25Ø PRINT"6) TO TROUBLE SHOOT"
26Ø PRINT"INPUT # DESIRED"
27Ø INPUT Q: ON Q GOTO 28Ø, 55Ø,
 91Ø, 97Ø, 115Ø, 126Ø
28Ø CLS
29Ø INPUT"POOL IS RECTANGULAR (R
),        CIRCULAR (C) OR OVAL (
O)";P$
3ØØ IF P$="R" GOTO 33Ø
31Ø IF P$="C" GOTO 4ØØ
32Ø IF P$="O" GOTO 46Ø
33Ø INPUT"POOL LENGTH IS";L
34Ø INPUT"POOL WIDTH IS";W
35Ø INPUT"AVERAGE DEPTH IS";D
36Ø G=L*W*D*7.5
37Ø PRINT"YOUR POOL HOLDS ";G;"
GALLONS"
38Ø FOR I = 1 TO 3ØØØ : NEXT
39Ø GOTO 19Ø
4ØØ INPUT"POOL DIAMETER IS";W
41Ø INPUT"AVERAGE DEPTH IS";D
```

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- Un-DISK should be in the library of every serious CoCo user even if you own a disk says Frank J. Esser, independent reviewer for RAINBOW Magazine!

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```
42Ø G=W*W*D*5.9
43Ø PRINT"YOUR POOL HOLDS";G;"GA
LLONS
44Ø FOR I=1 TO 3ØØØ:NEXT
45Ø GOTO 19Ø
46Ø INPUT"POOL LENGTH IS";L
47Ø INPUT"POOL WIDTH IS";W
48Ø INPUT"AVERAGE DEPTH IS";D
49Ø G=L*W*D*5.9
5ØØ PRINT"YOUR POOL HOLDS";G;"GA
LLONS"
51Ø FOR I= 1TO3ØØØ:NEXT
52Ø GOTO 19Ø
53Ø REM THE CALCULATIONS IN THIS
 SECTION ARE FROM CHLORINE MANUF
ACTURERS SPECS.
54Ø REM THEY MAY NEED TO BE ADJU
STED TO INDIVIDUAL CIRCUMSTANCES
55Ø CLS:PRINT"* * * ADJUST CHLOR
INE * * *"
56Ø INPUT"IS YOUR POOL PROPERLY
STABILIZEDAND ARE YOU USING STAB
ILIZED    CHLORINE";S$
57Ø IF S$="NO" OR S$="N" GOTO 74
Ø
58Ø INPUT"AMOUNT OF WATER IN POO
L (GALLONS)";GA
59Ø CL=GA/1ØØØØ*2.5
6ØØ INPUT"AIR TEMPERATURE";A
61Ø INPUT"WATER TEMPERATURE";WA
62Ø INPUT"CHLORINE TEST RESULTS"
;RE
63Ø IF RE <1 THEN GOTO 69Ø
64Ø IF RE>=1 AND RE<1.5 THEN CLS
:PRINT"CHLORINE LEVEL CORRECT"
65Ø IF RE>1.5 THEN CLS:PRINT"CHL
ORINE LEVEL TOO HIGH"
66Ø PRINT"DISCONTINUE CHLORINE M
AINTENANCEAND CHECK LEVEL DAILY
UNTIL     CHLORINE REACHES PROPE
R LEVEL"
67Ø FOR I=1 TO 3ØØØ:NEXT
68Ø GOTO 19Ø
69Ø IF A>=1ØØ OR WA>=85 THEN CL=
CL+1
7ØØ CLS
71Ø PRINT"YOU NEED TO ADD";CL;"O
ZS. OF STABILIZED CHLORINE TO YO
UR POOL."
72Ø FOR I = 1 TO 3ØØØ:NEXT
73Ø GOTO 19Ø
74Ø CLS:INPUT"AMOUNT OF WATER IN
 POOL";W
75Ø INPUT"AIR TEMPERATURE";AI
76Ø INPUT"WATER TEMPERATURE";WT
77Ø INPUT"CHLORINE TEST RESULTS"
;CH
78Ø IF CH<1 THEN GOTO 85Ø:NEXT
79Ø IF CH>=1 AND CH<1.5 THEN CLS
:PRINT"CHLORINE LEVEL CORRECT"
8ØØ FOR I = 1 TO 3ØØØ:NEXT
81Ø GOTO 19Ø
82Ø IF CH>1.5 THEN CLS:PRINT"CHL
ORINE LEVEL TOO HIGH"
83Ø FOR I = 1 TO 3ØØØ:NEXT
84Ø GOTO 19Ø
85Ø CL=W/5ØØØ*3.5
86Ø IF AI>1ØØ THEN CL=CL+1
87Ø IF WT>85 THEN CL=CL+1
88Ø CLS:PRINT"YOU NEED TO ADD";C
L;"OZS. OF       CHLORINE TO YOU
R POOL"
89Ø FOR I = 1 TO 5ØØØ:NEXT
9ØØ GOTO 19Ø
91Ø CLS:INPUT"PH TEST RESULTS:";
PH
92Ø IF PH<7.2 THEN CLS:PRINT"ADD
 ONE POUND OF SODA ASH AND   CHE
CK AGAIN 4 HOURS LATER."
93Ø IF PH>=7.2 AND PH<7.8 THEN C
LS:PRINT"PH LEVEL CORRECT"
94Ø IF PH >7.8 THEN CLS:PRINT"AD
D ONE POUND OF ACID AND CHECK AG
AIN 4 HOURS LATER"
95Ø FOR I = 1 TO 4ØØØ:NEXT
96Ø GOTO 19Ø
97Ø CLS:PRINT@33,"* * * WINTERIZ
E POOL * * *"
98Ø PRINT:PRINT"1) EXAMINE ENTIR
E METAL          FRAMEWORK CAREFU
LLY. ANY SIGNS   OF RUST SHOULD B
E SANDED AND     RE-PAINTED. COAT
 ALL METAL       SURFACES WITH WA
X."
99Ø PRINT:PRINT"2) CHECK FOR LEA
KS. A POOL       EXPOSED TO FREEZ
ING TEMPERATURESMUST NOT LEAK."
1ØØØ PRINT:INPUT"TO CONTINUE HIT
 <ENTER>";E$
1Ø1Ø CLS:PRINT@33,"* * * WINTERI
ZE POOL * * *"
1Ø2Ø PRINT:PRINT"3) REMOVE ALL A
CCESSORIES, PIPESETC. THE SKIMME
R AND OTHER THRU THE WALL FIXTUR
ES MAY REMAIN IF KEPT EMPTY."
1Ø3Ø PRINT:PRINT"4) DROP LEVEL O
F WATER WELL     BELOW SKIMMER O
PENING OR ANY    OTHER THRU THE
WALL FIXTURES."
1Ø4Ø PRINT:INPUT"TO CONTINUE HIT
 <ENTER>";E$
1Ø5Ø CLS:PRINT@33, "* * * WINTER
IZE POOL * * *"
1Ø6Ø PRINT:PRINT"5) TREAT POOL W
ITH ALGAECIDE ANDSUPERCHLORINATE
. ADD CHEMICALS  ACCORDING TO MA
```

```
NUFACTURERS      SPECIFICATIONS.
"
1Ø7Ø PRINT:PRINT"6) DO NOT DISTU
RB POOL AFTER    FREEZING. DISTU
RBING WATER IN   POOL AFTER FREE
ZING COULD RESULTIN MAJOR DAMAGE
 TO SEAMS AND    JOINTS."
1Ø8Ø PRINT:INPUT"TO CONTINUE HIT
 <ENTER>";E$
1Ø9Ø CLS:PRINT@33,"* * * WINTERI
ZE POOL * * *"
11ØØ PRINT:PRINT"OPTIONAL ACCESS
ORIES:"
111Ø PRINT:PRINT"1) POOL COVER T
O KEEP OUT LEAVESAND OTHER DEBRI
S. DO NOT DISTURBIT AFTER IT BEC
OMES FROZEN IN   ICE."
112Ø PRINT:PRINT"2) AIR PILLOWS.
..INSTALLED UNDERCOVER TO RAISE
FOR DRAINAGE."
113Ø PRINT:INPUT"TO CONTINUE HIT
 <ENTER>";E$
114Ø GOTO 19Ø
115Ø CLS:PRINT@33,"* * * OPEN PO
OL * * *"
116Ø PRINT:PRINT"1) FILL POOL WI
TH WATER UP TO   MIDDLE OF SKIMM
ER OPENING."
117Ø PRINT:PRINT"2) CHECK PUMP,
FILTER AND       CIRCULATORY SYS
TEM FOR PROPER   OPERATION."
118Ø PRINT:PRINT"3) ADJUST PH LE
VEL."
119Ø PRINT:INPUT"HIT <ENTER> TO
CONTINUE.";E$
12ØØ CLS:PRINT@33,"* * * OPEN PO
OL * * *"
121Ø PRINT:PRINT"4) ADJUST TOTAL
 ALKALINITY.     CONSULT PROFESS
IONAL."
122Ø PRINT:PRINT"5) SUPERCHLORIN
ATE WITH 5-1Ø    TIMES NORMAL RE
QUIRED CHLORINE."
123Ø PRINT:PRINT"6) STABALIZE. A
LTHOUGH NOT      REQUIRED, IT IS
 BEST TO         STABILIZE YOUR
POOL TO ALLOW    YOUR CHLORINE T
O WORK BETTER."
124Ø PRINT:INPUT"HIT <ENTER> TO
CONTINUE";E$
125Ø GOTO 19Ø
126Ø CLS:PRINT@33,"* * * MENU *
* *"
127Ø PRINT:PRINT"1) SLIPPERY POO
L WALLS & FLOOR"
128Ø PRINT"2) GREEN POOL WATER"
129Ø PRINT"3) EYES BURN AFTER SW
IMMING"
13ØØ PRINT"4) BROWN POOL WATER"
131Ø PRINT"5) CLOUDY POOL WATER"
132Ø PRINT"6) UNPLEASANT SMELL F
ROM WATER"
133Ø PRINT"7) BROWNISH STAINS ON
 POOL"
134Ø PRINT"8) FOAMING"
135Ø PRINT"9) SCALE ON POOL SURF
ACES"
136Ø PRINT:INPUT"NUMBER OF PROBL
EM";N
137Ø ON N GOTO 138Ø, 145Ø, 152Ø,
 159Ø, 166Ø, 173Ø, 18ØØ,187Ø, 19
4Ø
138Ø CLS:PRINT"SLIPPERY POOL WAL
LS AND FLOOR"
139Ø PRINT:PRINT"* * * * * CAUSE
 * * * * *"
14ØØ PRINT:PRINT"ALGAE PRESENT I
N POOL WATER"
141Ø PRINT:PRINT"* * * * * SOLUT
ION * * * * *"
142Ø PRINT:PRINT"USE ALGAECIDE A
CCORDING TO      MANUFACTURERS D
IRECTIONS"
143Ø FOR I=1 TO 1ØØØØ: NEXT
144Ø GOTO 19Ø
145Ø CLS:PRINT"GREEN POOL WATER"
146Ø PRINT:PRINT"* * * * * CAUSE
 * * * * *"
147Ø PRINT:PRINT"USUALLY A RESUL
T OF ABNORMAL    ALGAE GROWTH"
148Ø PRINT:PRINT"* * * * * SOLUT
ION * * * * *"
149Ø PRINT:PRINT"ADD 4 TIMES REG
ULAR AMOUNT OF   ALGAECIDE AND S
UPERCHLORINATE.  TURN ON FILTER.
 IF NOT          SUCCESSFUL,REPE
AT DOSAGE.       BACKWASH FILTER
 IMMEDIATELY."
15ØØ FOR I = 1 TO 1ØØØØ: NEXT
151Ø GOTO 19Ø
152Ø CLS:PRINT"EYES BURN AFTER S
WIMMING"
153Ø PRINT:PRINT"* * * * * CAUSE
 * * * * *"
154Ø PRINT:PRINT"HIGH PH OR TOO
MUCH CHLORINE"
155Ø PRINT:PRINT"* * * * * SOLUT
ION * * * * *"
156Ø PRINT:PRINT"CHECK PH AND CH
LORINE CONTENT   WITH TEST KIT.
IF THERE IS TOO  MUCH CHLORINE,
STOP CHLORINE    DOSAGE AND CHEC
K CHLORINE DAILY UNTIL PROPER LE
VEL IS REACHED"
157Ø FOR I = 1 TO 1ØØØØ: NEXT
158Ø GOTO 19Ø
159Ø CLS:PRINT"BROWN POOL WATER"
16ØØ PRINT:PRINT"* * * * * CAUSE
```

```
 * * * * *"
161Ø PRINT:PRINT"TO MUCH MINERAL
 CONTENT IN WATEROR DEAD ALGAE"
162Ø PRINT:PRINT"* * * * * SOLUT
ION * * * * *"
163Ø PRINT:PRINT"HAVE WATER PROF
ESSIONALLY       ANALYZED. IF PR
OBLEM STEMS FROM DEAD ALGAE, CON
TINUOUS OPERATIONOF FILTER IS NE
CESSARY. BACKWASHFILTER IMMEDIAT
ELY"
164Ø FOR I = 1 TO 12ØØØ: NEXT
165Ø GOTO 19Ø
166Ø CLS:PRINT"CLOUDY POOL WATER
"
167Ø PRINT:PRINT"* * * * * CAUSE
 * * * * *"
168Ø PRINT:PRINT"IMPROPER PH BAL
ANCE, HARD WATER,INSUFFICIENT CH
LORINE CONTENT ORFOREIGN MATTER
IN WATER"
169Ø PRINT:PRINT"* * * * * SOLUT
ION * * * * *"
17ØØ PRINT:PRINT"CHECK PH WITH T
EST KIT AND      ADJUST AS NEEDE
D. CONSULT       PROFESSIONAL ON
 HARD WATER. TESTCHLORINE CONTEN
T WITH TEST KIT  AND ADJUST AS N
EEDED. IF FOREIGNMATTER IS PRESE
NT, CHECK FILTER AND CLEAN IF NE
CESSARY.
171Ø FOR I = 1 TO 15ØØØ: NEXT
172Ø GOTO 19Ø
173Ø CLS:PRINT"UNPLEASANT SMELL
FROM WATER"
174Ø PRINT:PRINT"* * * * * CAUSE
 * * * * *"
175Ø PRINT:PRINT"PROBABLY A LACK
 OF CHLORINE      CONTENT"
176Ø PRINT:PRINT"* * * * * SOLUT
ION * * * * *"
177Ø PRINT:PRINT"TEST FOR PROPER
 CHLORINE CONTENTAND ADJUST AS N
EEDED. IF        CHLORINE TESTS
OK, SUPERCHLORIN-ATE."
178Ø FOR I = 1 TO 1ØØØØ: NEXT
179Ø GOTO 19Ø
18ØØ CLS:PRINT"BROWNISH STAINS O
N POOL"
181Ø PRINT:PRINT"* * * * * CAUSE
 * * * * *"
182Ø PRINT:PRINT"CORROSION OF ME
TAL PARTS DUE TO LOW PH. HIGH AL
KALINITY. DISSOLVED METALS"
183Ø PRINT:PRINT"* * * * * SOLUT
ION * * * * *"
184Ø PRINT:PRINT"CHECK AND ADJUS
T PH. CHECK AND ADJUST ALKALINIT
Y. CHECK WITH DEALER ABOUT DISSO
LVED METALS."
185Ø FOR I = 1 TO 1ØØØØ: NEXT
186Ø GOTO 19Ø
187Ø CLS:PRINT"FOAMING"
188Ø PRINT:PRINT"* * * * * CAUSE
 * * * * *"
189Ø PRINT:PRINT"TOO HIGH A CONC
ENTRATION OF ALGAECIDE"
19ØØ PRINT:PRINT"* * * * * SOLUT
ION * * * * *"
191Ø PRINT:PRINT"READ PRODUCT LA
BELS CAREFULLY. TOO MUCH ALGAECI
DE DOES NOT HARM POOL OR SWIMMER
S"
192Ø FOR I = 1 TO 1ØØØØ: NEXT
193Ø GOTO 19Ø
194Ø CLS:PRINT"SCALE ON POOL SUR
FACES"
195Ø PRINT:PRINT"* * * * * CAUSE
 * * * * *"
196Ø PRINT:PRINT"EXCESSIVELY HAR
D WATER"
197Ø PRINT:PRINT"* * * * * SOLUT
ION * * * * *"
198Ø PRINT:PRINT"ADJUST ALKALINI
TY"
199Ø FOR I = 1 TO 5ØØØ: NEXT
2ØØØ GOTO 19Ø
```


PLUG THIS INTO YOUR COCO

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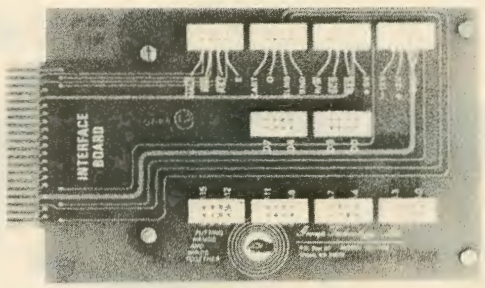
(or at least the electrical signals used to control outside devices and instruments)



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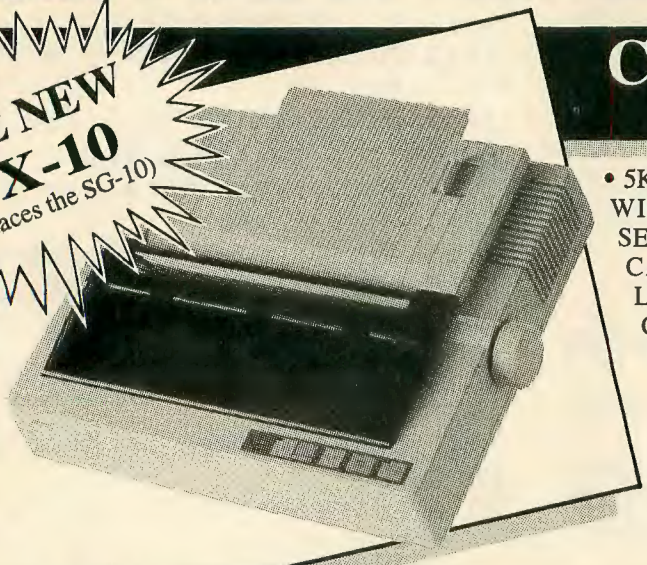

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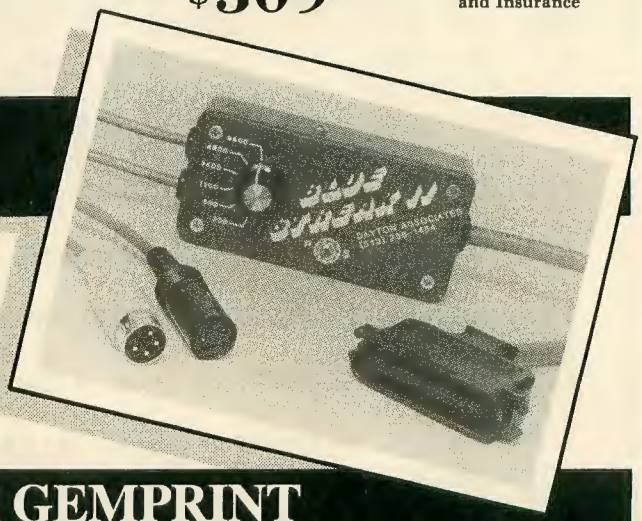

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RECEIVED & CERTIFIED

The following products have recently been received by THE RAINBOW, examined by our magazine staff and approved for the *Rainbow Seal of Certification*, your assurance that we have seen the product and have ascertained that it is what it purports to be.

This month the *Seal of Certification* has been issued to:

Car Dealer Assistant, a financial utility program designed to provide car dealers with an efficient way to figure four "what if" computations for use in negotiating, insurance calculations, rolling of all amortization variables, conversion of annual add-on rate to A.R.P. and two utility programs to change applicable tax rates and/or erase accounts from the disk. *Sylvester Software, 6943 Oleander Avenue, Highland, CA 92346, disks and manual $195*

Digital Memory Oscilloscope, a hardware/software kit requiring a 64K CoCo 2 with Level II RAM to convert a CoCo TV display into an oscilloscope screen for audio range signals and lower. Auto-trigger and storage in 8K buffer allows detailed study of AC and slowly changing DC signals. *D & A Research, 400 Wilson Avenue, Satellite Beach, FL 32937, unit includes all necessary hardware and software, $169*

Plateau of the Past, a 32K graphics Adventure game requiring a disk drive. The scenario places you in the role of explorer accepting the quest for a tycoon's foolhardy brother, lost in a treacherous and unexplored region of the globe. To find and rescue him, you must overcome the hostilities of nature, natives and prehistoric creatures. *Zytek Ltd., P.O. Box 701, Blue Island, IL 60406, disk $26.95 plus $2 S/H*

Inside Information, a book by John Helliwell to give electronic service users a guide to matching online databases to business needs, instruction in database search procedures and a compendium of facts, tips and lists to help maximize return on communication time and money. *New American Library, 1633 Broadway, New York, NY 10019, $19.95*

Casper CoCo Quick Assembler, a 32K programming utility requiring a disk drive that combines the editor, assembler and debugger into one whole. The editor, by looking up symbols and opcodes, saves indexes into tables instead of characters. The debugger is then able to use the assembler to find locations in memory from their position in the editor's source file, which the debugger displays. *Earl W. Casper, 6012 S 14 Pl, Phoenix, AZ 85040, disk $20*

Software Spare Parts, book by Kent Porter consisting of C language routines and utilities covering areas from text processing to matrix algebra, from data conversion to graphics, and including a range of flexible routines that can be plugged into larger programs. *New American Library, 1633 Broadway, New York, NY 10019, $24.95*

Darkmoor Hold, a 64K graphics Adventure requiring a disk drive. The scenario places you and your comrades (a dwarf and an elf) on a perilous exploration of the 10 levels of Darkmoor. Your nemesis is an evil wizard, who will continue to try to thwart your band's every acquisition of treasures with stronger and stronger spells and creepier and wilier monsters. *Prickly-Pear Software, 2640 N. Conestoga Ave., Tucson, AZ 85749, disk $29.95 plus $1.50 S/H*

Eagle, a 32K graphics Simulation requiring joysticks. The scenario places you in the role of pilot breaking out of lunar orbit and attempting a soft landing. Joysticks control thrust and craft altitude and information is continuously displayed on horizontal and vertical velocities, acceleration values, distances from objectives and fuel consumption. *Saguaro Software, P.O. Box 1864, Telluride, CO 81435, cassette $24.95, disk $29.95 plus $1 S/H*

CoCo Valet, a 32K home-based filing system requiring a disk drive. Features include search, edit, mark fields (for selecting fields for printouts), change files, on-screen help and non-destructive cursor. *Derby City Software, 3025 Kozy Kreek Drive, Louisville, KY 40220, disk $21 plus $3 S/H*

A2D Deluxe Joystick, a joystick featuring self-centering as well as free floating operation, mechanical trims on both axes and an eight-foot cable. *Cinsoft, 2235 Losantiville Avenue, Cincinnati, OH 45237, $27.95 each, $49.95 pair*

Best of CoCo-Time '85 (Utilities), a program comprising 18 often-used utilities, most requiring 16K. Among the utilities are: CoCo Disk Zap, 40K BASIC (requires 64K), Banner Creator, DMP Graphics Dump, In Memory Disk Drive (requires 64K), Function Keys, Disk Mailing List (requires 64K), Tape/Disk Encryption and BASIC Program Packer. *Microcom Software, P.O. Box 214, Fairport, NY 14450, cassette or disk $26.95 plus $3 S/H*

U-Buff, a hardware printer buffer designed for user expandability. The U-Buff is available in 16K (P16) and 64K (P64) versions and comes with a handbook detailing installation, operation, upgrades and technical information. *Digital Devices Corporation, 430 Tenth Street, Suite N205, Atlanta, GA 30318, P16 $119.95, P64 $149.95.*

Adventure In Mythology, a 64K graphics Adventure that places you in the roles of various heroes of Greek mythology. You can provide Icarus with a better idea, slay the Minotaur in the labyrinth of Crete, discover the secret of the statue of Galatea and win the hand of the beautiful huntress, Atalanta. *Saguaro Software, P.O. Box 1864, Telluride, CO 81435, cassette $24.95, disk $27.95 plus $1 S/H*

Pumpman, a 32K ML arcade game requiring a joystick. The objective is to destroy the aliens by firing the pump and pumping them into oblivion. Perils include the misuse of your pump resulting in its disappearance, the aliens have only to touch you to kill you and the aliens change form and tactics at ran-

dom. *Saguaro Software, P.O. Box 1864, Telluride, CO 81435, cassette $24.95, disk $27.95 plus $1 S/H*

CoCo Base I, a 32K relational database manager requiring a disk drive and featuring 10 programs. Possible are up to 600 records of up to 1,000 characters, moving specific data around within the program to allow files to update each other, string and numeric operators to allow any user-definable comparison or calculation and compatibility with all CoCo printers. *JTJ Enterprises, P.O. Box 110841, Nashville, TN 37211, disk $49.95 plus $2 S/H*

Temple of the Lost Ark, a 32K Adventure game for the intermediate Adventurer. Features include a help key for guidance through the hazards and pitfalls and a command interpreter that requires only one-word commands. *The Saint John Gallery, P.O. Box 613, Mount Sinai, NY 11766, cassette $7, disk $8*

Hall of the King II: The Inner Chamber, a 64K graphics Adventure on two disks requiring a disk drive but not *Hall of the King I* for play. This game begins another quest for the legendary Earthstone, the foundation of an ancient dwarven civilization. Only by daring the hazards of the inner chambers can you hope to find and learn to use the Earthstone. *Prickly-Pear Software, 2640 N. Conestoga Avenue, Tucson, AZ 85749, disks $39.95 plus $1.50 S/H*

Uninterrupted Power Source (UPS), a hardware accessory to prevent loss of data from power failures for all computers using 5V memories. It consists of a 2.6AH sealed battery, a control circuit, a miniature toggle switch and a light emitting diode. Three connections are necessary: 5 volts, ground and unregulated 9-12 volts. Supplies power to the memories for as long as two hours when commercial power sources fail. *Dynamic Electronics, Inc. P.O. Box 896, Hartselle, AL 35640, $59.95*

Unkill, a 32K disk utility requiring two disk drives, a printer and knowledge of the printer's compressed mode. It is menu driven and does not require knowledge of files and fat tables in order to recover files from a bad disk to a blank one. *Proper Programs, P.O. Box 681, Garner, NC 27529, disk $9.95 plus $2 S/H*

1986 Tax Estimate, a 32K home financial utility requiring a disk drive. Possible is the estimation of federal tax liability based on the laws in effect at the time of publication. *TRY-O-BYTE, 1008 Alton Circle, Florence, SC 29501, disk $5*

GOTHELLO, a 16/32/64K strategic board game for one or two players with three levels of difficulty. *Bangert Software, P. O. Box 21056, Indianapolis, IN 46221, cassette or disk $12.95*

Graphic Echo, a 16/32K graphics screen dump program designed for Radio Shack dot-matrix printers. Sold on cassette, it is compatible with disk systems and offers regular or enlarged images, positive or negative images, with manually set margins or autocentering, and capable of working in all five PMODEs. *Tothian Software, Box 663, Rimersburg, PA 16248, cassette $14.95*

Vegas Game Pak, a 32K arcade game requiring a joystick and containing the following casino favorites: Regular fruit-type slot machine, Bar-bar five-seven-blank slot machine, Multiline pay fruit-type slot machine, Video poker, Video keno and Video blackjack. *Novasoft, 4285 Bradford N.E., Grand Rapids, MI 49506, cassette $24.95, disk $27.95 plus $2 S/H*

CoCo DISKZAP Utility, a disk editor featuring the following commands and functions: Mode, to allow users to specify the disk's sector offset; Zero, allows setting any sector in the disk to Hex 00; Copy; Print; Verify; Format; Display; File Zap, to allow stepping through a file (ML, BASIC or ASCII) to modify any part; and Directory. *Super-Com Associates, 449 Rougemount Drive, Pickering, Ontario, Canada L1W 2B8, manual and disks $39.95 U.S. funds.*

LFAST, Linear-Free-Access-Source-Translation, an assembly utility requiring a disk drive. Possible are the linking of ML programs, insertion of text messages in the object code stream and the ability to point to buffers where text arrays, numeric arrays and ML subroutines are located. *D.J. Leffler, 955 Trinidad Road, Cocoa Beach, FL 32931, $68.50*

KAMELION, an interface operating system (IOS) using the Supercomp 68008 expansion board (produced by Cir-Pac Ltd.). This IOS provides complete co-processing, access and control between a CoCo and the Motorola 68008 microprocessor on the expansion board. CoCo's capabilities are expanded to almost equal the Radio Shack Model 16. Included is the capability to write standard CoCo disk files from the 68008 memory up to full disk capacity for a single file. Also included are complex commands such as CONFIGURE, which can be invoked to configure the 68008 memory with data and machine code files. *D.J. Leffler, 955 Trinidad Road, Cocoa Beach, FL 32931, $78.50*

Code Practice, a 32K instructional aid to help those who would like to learn or improve their skills with International Morse Code. Menu driven, the operator may select listening to random letters, numbers and punctuation or code conversation between Ham Radio operators. Speed at which code is sent can be selected by the operator between two and 90 words a minute. *Sunrise Software, 8901 NW 26 Street, Sunrise, FL 33322, disk $9.95*

The *Seal of Certification* program is open to all manufacturers of products for the Tandy Color Computer, regardless of whether they advertise in THE RAINBOW.

By awarding a *Seal*, the magazine certifies the product does *exist* — that we have examined it and have a sample copy — but this *does not* constitute any guarantee of satisfaction. As soon as possible, these hardware or software items will be forwarded to THE RAINBOW's reviewers for evaluation.

— Monica Dorth

REVIEWING REVIEWS

PLANEGEO & PGCALPRT

Editor:

We found the review of *PLANEGEO* and *PGCALPRT* by John McCormick [April 1986, Page 190] to be just and considerate. In reply, we have a few comments to make about the programs and the review.

PLANEGEO is designed to be strong in educational content and is intended for student use or for refresher use by non-students. If used by students, it should be considered supplemental to, and not substitutive for, formal scholastic training. *PGCALPRT* anticipated more use by professionals. Both programs are for serious use.

We regret the reviewer found bugs. We wish we could guarantee there will be no more but there may be some bugs left in spite of the authors' attempts to eliminate them. We will keep users informed of bugs and fixes. The ones reported in the review have, of course, been corrected.

PGCALPRT is written to send every geometric calculation to the printer. The reviewer pointed out that some systems result in no such optional printing. As a result of his valid suggestion, current releases of *PGCALPRT* contain patches that will enable users to either retain the original concept or to change the main and subprograms to provide optional printing. Also, the patches will be supplied in printed form to prior users.

The *CONVERT* subprograms were included in both programs as sort of a bonus. They were not intended to print on the printer.

Thank you for the review and thanks to John McCormick for his work.

George F. Saunderson
TASC

PIXGEN

Editor:

I would like to comment on the review by Eric Tilenius of *PIXGEN* (RAINBOW, February 1986, Page 208).

I feel that Mr. Tilenius did a fair and accurate review of *PIXGEN* utility, but would like to point out some things he may not have been aware of. Mr. Tilenius mentions in his review that he discovered two places in the program where error handling bugs could be found.

The first of these, which occurred when drawing a line, has been fixed.

The second bug occurred during a "paint" operation. The documentation of *PIXGEN* emphasizes several times that the painting utilities must be used carefully. The reason is that the speed achieved by the *PIXGEN*'s painting routines is accomplished by mathematical algorithms that have few internal error handling routines.

The review states that *PIXGEN* could interest anyone wishing to create graphics Adventures where storing pictures on disk is not a valid option. I disagree. *PIXGEN* makes it possible to store several times as many pictures as could be stored on an entire disk in only about 12K of RAM. With the exception of these items, I feel Eric Tilenius did a remarkable job.

Scott A. Cabit
Author of PIXGEN

Track Events

Editor:

We appreciate the review of *Track Events*, Page 200 of the February 1986 RAINBOW. However, it wasn't mentioned that the game requires 64K, and our updated version of the game requires a joystick. We would also appreciate it if you would inform readers of our new address: 3937 Shady Hill, Dallas, TX 75229.

Baron Products
Dallas, TX

Magazine Index System Disk Pilot

Editor:

Thanks to your reviewers Dan Smith and Larry Goldwasser for their careful reviews of *Magazine Index System* and *Disk Pilot* (December 1985, pages 224 and 233).

Since *Magazine Index System* was submitted for review, a new, updated version has been released (version 1.1). This release corrects minor problems with the original and adds some new features. Files no longer need to be on Drive 0 — any drive on the system can now be accessed by *Magazine Index System*. In addition, the search routines have been rewritten and are now faster than before. The user is no longer limited to nine search terms, nor is the 29 character limit imposed.

Regarding *Disk Pilot*, I'd like to apologize to Mr. Goldwasser. Apparently an addendum sheet was missing from the package he received — this sheet explains the 'S' option, which permits the user to access any of his drives (0 through 3).

Thanks once again for an excellent magazine — keep up the good work, everyone in the CoCo Community appreciates it.

Bob van der Poel
CMD Micro Computer Services Ltd.

CoCo Max II

Editor:

Thank you for the fine review of *CoCo Max II*. We would like to correct, however, a statement that was inaccurate.

Mr. Jackson writes that "*CoCo Max* has no provisions for killing or renaming files." This is not the case. You can leave *CoCo Max* at any time with the "Quit" function, then Kill or Rename any file(s). When finished, simply type RUN. The *CoCo Max* screen will come back exactly where you left off, and you don't lose your art work. We think this ability to switch between *CoCo Max* and BASIC at will is much more powerful than a simple Kill and Rename feature would be.

John Monin
Colorware Inc.

We welcome letters to "Reviewing Reviews" and remind you that they may also be sent to us through the MAIL section of our new Delphi CoCo SIG. From the CoCo SIG> prompt, pick MAIL, then type SEND and address to: EDITORS.

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P. O. Box 14806
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(904) 786-8603

'Shooting Gallery' *Math Mission* Reinforces Skills

Condition red! Prepare for imminent invasion. Protect yourself with intelligence and skill and future generations will honor your courage and knowledge.

Math Mission is an educational game designed to reinforce math skills in addition, subtraction, multiplication and division. It has four levels of difficulty ranging from basic facts to problems with two digits. The program is suitable for first- to fourth-grade students. There is an option that combines all difficulty levels. The game is similar to a shooting gallery and is played with joysticks. Problems are shown with six answers. There is a timer so students must answer the problem promptly, but it is not so fast that it discourages slower students.

It is easy to load and run. If using a disk drive, you are entitled to make two backup copies. With the cassette version, there is an explanation of how to transfer the program to disk.

When running *Math Mission*, you see a title screen and then the main menu. Choose addition, subtraction, multiplication, division and the level of difficulty ranging from basic facts to two digit problems. The game then starts the first of four rounds of play. In each round the student receives 10 problems. The Shot Timer and Power Level Bars with their numerical readouts are in the lower right-hand corner of the screen. When play begins, these are set to the maximum.

The problem is shown at the bottom of the screen with six possible answers at the top. Using the joystick, students move the "gun" under the correct answer and fire. If right, they move on to the next problem and the number of correct responses is shown in the lower left-hand corner. If wrong, the power bar is lowered by 25 percent but they get another chance to answer the problem correctly. If they are correct the second time, the power bar is reset and a right answer is recorded. If wrong again, the correct answer is shown, but a wrong answer is recorded, the power is reduced by 25 percent and they get the next problem.

If four problems are missed in any level, a sad face is displayed and they are told to press the firebutton which returns them to the main menu. A perfect score in any round generates a short song and graphics display. After all four rounds, students receive one of two graphics screens and a musical tune. If they score 100 percent in all four rounds, there is a graphics display showing that they are a "Grand Master of *Math Mission*." For any other score they are shown a screen saying they are a "Master of *Math Mission*."

One distraction though; in the second through fourth rounds, instead of having the graphics on a black screen, they were on a green screen. This made reading some of the numbers hard because I could not see the vertical extension in numbers such as four.

This program would be interesting for elementary students to use. There is plenty of sound, movement and action. I also like how students are given a second chance before getting an answer wrong. When I played, there were times that I knew the right answer, but didn't get the joystick in the right place or pressed the firebutton too fast and it was nice not to be punished for a dexterity mistake.

(Sugar Software, 1719 North 50th Avenue, Hollywood, FL 33021, cassette or disk $24.95 plus $1.50 S/H)

— Thomas E. Nedreberg

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RAINBOW CERTIFICATION SEAL

Hint . . .

Single Disk *COPY*

Here's a feature which can be invaluable for users with a single disk drive. The Radio Shack Disk Manual mentions that use of the COPY Command requires two or more drives. This is not necessarily true. A single drive copy can be made by doing the following:

1) Insert disk with file to be copied into the Drive 0.
2) Type `COPY "FILENAME/ext:0` and press ENTER.
3) There will be one short beep and a notice will appear on the screen instructing the user to insert the destination disk.
4) Insert destination disk and press ENTER.
5) Once completed there will be two copies of the program: one original and one on the destination disk.

This method works for all types of disk files including machine language programs.

CD Editor Provides Invisible Convenience

Using Extended BASIC's line EDIT function to make changes in a block of program lines can, at times, be frustrating. I usually end up listing all the lines in the section of interest and then noting those needing changes or corrections. Each line is then edited one by one. Until now, there has been no easy way of working on programs one screen at a time. *CD Editor* from C & D Computer Products provides some relief from the frustration of program editing. This utility program provides many of the features of a full-screen editor without using one extra byte of memory in a 64K CoCo.

CD Editor requires a 64K CoCo with at least one disk drive and should work on all versions of JDOS or Disk BASIC. The program comes on disk in the form of a short BASIC program that copies the BASIC and Extended BASIC ROMs into the upper 32K of RAM. It then checks for the type of Disk BASIC that is being used and loads in new machine code from disk to the upper RAM locations containing the original line editor. The editor fits in the same amount of space that was taken up by the original EDIT function. If desired, BASIC's standard OK prompt can be changed to anything you want, up to five characters, such as READY. The loader program then clears the screen and erases itself. The copy that I originally received failed to load properly with JDOS BASIC 1.21. A phone call to C & D Computer Products isolated the problem. A short time later I got a new disk that loaded and ran properly with JDOS BASIC 1.21 and Disk BASIC 1.1.

The program is transparent to BASIC and permits BASIC programs to run as if it did not exist. The cursor becomes a blinking black square that turns into a blinking white square when the editor is active. Typing in the command EDIT turns the program on and off.

CD Editor works on any displayed portion of a program that has just been typed in or listed. A movable cursor determines where on the screen any changes are being made. Cursor movement is controlled by the four arrow keys. (The JDOS version uses the shifted up- and down-arrows for vertical motion.)

To delete characters, place the cursor on the first character to be deleted and press the shifted left arrow once for each character that is to be deleted. To add characters, place the cursor at the point of insertion, add blank spaces with the shifted right-arrow key, and then type the new data over the blank spaces. Typing at the current cursor position causes the new text to overwrite the existing text.

None of the changes are actually entered until the cursor is moved to the end of the line being edited and the ENTER key is pressed. Pressing ENTER in the middle of the line causes the last portion of the line to be lost. I had a tendency to forget this and often pressed ENTER immediately after making changes, and not at the end of the line.

The editor also allows two or more program lines to be combined into one. Program lines may also be duplicated by changing the line number of the line that is to be duplicated. I found this last feature quite handy in writing programs that use many lines of nearly identical code. I just duplicated the lines as many times as required and then went back and made the unique changes to each line.

Another program on the disk lets you save the modified BASIC and Extended BASIC into EPROMs to make the screen editor and new prompt a permanent part of the CoCo. I could not try this because I do not own an EPROM programmer. However, I did try the EPROMs loaned to me by C & D Computer Products and had no problems.

The disk comes with a three-page instruction sheet which covers loading and using the program. A copy of the instruction manual is on the disk in the form of a BASIC program. The disk also contains a catalog of other programs from C & D. None of the programs are copy protected so backups can be made. The programs, however, are copyrighted.

(C & D Computer Products, 1706 Seabrook Avenue, Cary, NC 27511, disk $19.95 plus $2 S/H)

— Chuck Wozniak

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Super RAMDisk Provides Mega-memory

"More memory!" they cried. "Give us mega-memory like the competition!" Well, CoCo users, now you have it. Spectrum Projects is distributing a 256/512K memory expansion from DISTO.

To use the DISTO Super RAMDisk you need a 64K CoCo and a Multi-Pak Interface. Why the Multi-Pak? It enables the DISTO upgrade to be used with the CoCo 2, something that has been hindering previous upgrade kits. The unit is housed in an attractive white metal case and plugs into slot number 2 of the Multi-Pak. Software for both Disk BASIC and OS-9 is provided on disks to use the memory upgrade as a RAM disk. With OS-9, up to three RAM disks can be connected at one time.

What is a RAM disk and do I need one? At present, the only software that exists for the Super RAMDisk is drivers that make the memory expansion act as another disk drive. It's not a normal disk drive, though. First, it is super fast. The total time to read or write a sector is less than 5/1,000 of a second. One of the uses could be storage of graphics pages for fast recall during games. Can you write longer programs? Not with the present software. The problem is not with the memory expansion, but with the software. As you are probably aware, Disk BASIC only recognizes 32K of user memory.

To write longer programs, you could split them into small ones, but you can do the same thing with a regular disk drive. You will have to find a way to pass parameters (variables) between programs if necessary. A suggestion is to store them in a file and recall them when necessary. Remember, we are talking about a quiet, fast disk drive that consists of RAM.

The use of a RAM disk with OS-9 is another story. Regarding longer programs, as long as modular programming concepts are used, BASIC09 already has the facility to pass parameters between programs. Considering the disk intensive nature of OS-9, it's a welcome relief to transfer the commands directory to the RAM disk and watch it fly. Commands execute almost instantaneously. No noise either.

There are still memory constraints inherent to OS-9 Level I, but a RAM disk seems to speed up things quite a bit.

Brian Lantz has licensed both the Disk BASIC and OS-9 RAM disk drivers to DISTO. The Disk BASIC version is on a separate disk.

After entering `LOADM"RAMPAK":EXEC`, you are prompted for the default RAM disk drive number and Multi-Pak slot number. Then, you are asked whether to clear the RAM disk.

After these prompts, the RAM disk is formatted and available for use as another disk drive. You are in the 64K RAM mode and the driver is located at $FD00. This is why you are asked whether to clear the RAM disk. If you have to use the Reset button, the data on the RAM disk is not lost, but you have to re-initialize the driver before it can be recovered.

The DISTO Super RAMDisk OS-9 Driver by Brian Lantz is virtually the same driver software used for other memory expansions. The module is named RAMDisk and, after loading this module, you must link the driver "R0" to the system. You must then format the RAM disk. The default format is 40 tracks, single-sided, but the device descriptor can be changed to take full advantage of the spare memory.

The only drawback to doing this is backing up the RAM disk. The use of a utility by Computerware named *Dircopy* makes it easier.

The DISTO unit is compatible with all CoCos. Previous units reviewed would not work with the CoCo 2. The cost of using it is the price of a Multi-Pak. The unit is well-constructed and functions as advertised.

I do see some shortcomings with the Disk BASIC software and documentation. I sometimes wonder how to take advantage of all of this extra memory. The only documentation for Disk BASIC is a typewritten page explaining how to boot the driver. No information is given about the hardware aspects of the unit. The user should have the page addresses and a description of the hardware for experimentation purposes.

The OS-9 software documentation is just adequate. It explains all of the initialization steps and procedure files, but again it lacks any information about the hardware. This is not so bad for OS-9, due to the nature of the system, but I'd like to see it.

In comparison to other units I've seen, this unit is adequate from a hardware standpoint, and doesn't require soldering, wiring or opening the computer. We will have to wait and see if any software other than the RAM disk applications develops.

(Spectrum Projects, Inc., P.O. Box 21272, 93-13 86th Drive, Woodhaven, NY 11421, 256K version $129.95, 512K version $169.96, distributed in Canada by CRC Computers, 10802 Lajeunesse, Montreal, Quebec, Canada H3L 2E8)

— Dan Downard

Two-Liner Contest Winner . . .

Type in *Babbler* and RUN it. See if you can make out what the CoCo Man is trying to say. This would make a cute subroutine.

The listing:

```
Ø PCLS:PMODE4,1:SCREEN1,1:CIRCLE
(128,96),5Ø:CIRCLE(112,8Ø),1Ø:CI
RCLE(144,8Ø),1Ø:CIRCLE(112,8Ø),5
:CIRCLE(144,8Ø),5:PAINT(1Ø5,8Ø),
5,1:PAINT(137,8Ø),5,1:CIRCLE(128
,96),7:PAINT(129,96),5,1
1 CIRCLE(128,116),1Ø,1:SOUNDRND(
255),RND(1Ø):CIRCLE(128,116),1Ø,
Ø:DRAW"C1;BM118,116R2Ø":FORA=1TO
RND(2ØØ):NEXT:DRAW"CØ;BM118,116R
2Ø":GOTO1
```

Brett Bauer
South Bend, Indiana

(For this winning two-liner contest entry, the author has been sent copies of both *The Second Rainbow Book of Simulations* and its companion *The Second Rainbow Simulations Tape.*)

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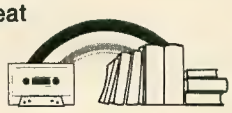

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SemiGraphics Support Utility Unleashes 'Hidden' Abilities

The *SemiGraphics Support Utility*, available for 16K ECB CoCos on either disk or cassette, expands Extended Color BASIC to allow direct access to the semigraphics modes.

What's a semigraphics mode? You can go through Tandy's *Color BASIC, Extended Color BASIC,* and *Disk System* manuals and still not know a thing about semigraphics. Why? Because four of these five semigraphics modes are not supported by any version of CoCo BASIC. So how do you find out about them? The RAINBOW is a source, and so is William Barden's book, *Color Computer Graphics.*

What you'll find is that these semigraphics modes are built into a chip in the CoCo called a Video Display Generator. One of the modes (SG 4) is accessed by Color BASIC as the Lo-Res graphics through the SET, RESET and POINT commands. The remaining four modes (SG 6, SG 8, SG 12 and SG 24) are called the forgotten modes. When the various versions of CoCo BASIC were developed, these capabilities were, for one reason or another, not supported. Without BASIC support, these modes are cumbersome to use. Various numbers must be POKEd into memory locations to select color, or set or reset the various picture elements. A pain, to say the least.

The advantage of the semigraphics modes over the true graphics modes is that all eight colors can be used on one screen with a fairly fine resolution of 64 by 192. The semigraphics modes also lend themselves to intermixing text and graphics on the same screen.

Are these advantages worth the hassle involved in figuring out all of those POKEs? To the average programmer, probably not. Not, that is, without *SemiGraphics Support Utility.*

SemiGraphics Support Utility becomes part of ECB, adding 18 commands and four functions to the programming language. These new commands and functions can be freely intermixed with all of the ones you're already used to. The graphics require allocation of video pages, much like ECB graphics. Various semigraphics modes can be assigned to various sets of pages. Any element (based on X and Y coordinates) can be set to any color. *The SemiGraphics Support Utility* commands, similar to their ECB counterparts, allow the user to draw lines (solid, dotted or dashed), boxes, circles, ellipses or arcs. Figures thus created can be filled with any color using the command parallel to ECB's PAINT.

The figures can be redrawn at other coordinates, or moved to other parts of the screen or even to other screens not currently displayed. These features should be of interest to anyone creating animation. As the demo program displays, smooth and rapid movement of screen figures can be produced. Figures produced in the highest resolution mode can be "scaled down" to lower resolution modes without altering X/Y coordinates. Video pages can also be copied from one location in RAM to another.

Since the alphanumeric mode is one of those accessible by *SemiGraphics Support Utility*, text and graphics can be mixed on a single screen. In addition to the graphics capabilities, the utility allows the generation of either one-bit or six-bit sounds. The user supplies what is called a "frequency delay" and an "envelope delay" for these sound-producing commands. Neither of these terms is defined in the documentation, so expect to do a little experimenting. The six-bit version allows control of the sound volume. With practice, you can produce some pretty bizarre sounds.

The user is able to print his graphics creations to a dot-matrix printer. I was unable to review this aspect of the utility because the only kinds of printers supported are the Gemini-10X and Epson. Pictures included in the documentation indicate that the various screen colors are represented on the printout by shades or patterns of gray. I would like to see this utility with support for more printers.

The documentation consists of 61 pages. I have already pointed out what I feel to be a shortcoming in documentation for the sound commands. The remainder of the documentation shares this shortcoming: brevity. To give credit where credit is due, however, *SemiGraphics Support Utility* is a very complex system and would not be easy to document. Don't expect to sit down and immediately produce stupendous semigraphics: This system takes some work. I would compare learning it to learning ECB's graphics capabilities. Included in the documentation are short programming examples, illustrating all the features. On the disk (or tape) with the utility is a demo program in which *SemiGraphics Support Utility* struts its stuff. The listing of this demo is provided. I strongly urge the user to type in the example programs, run the demo and go over the listing as a learning experience.

One of the first applications I thought of for this program was the creation of title screens and the like for my programs. Remember though, *SemiGraphics Support Utility* must be in place on the computer running the program, which could cause exportation problems.

Extended Color BASIC is great for graphics. Have you ever found yourself wishing you could use more than four colors? Or have graphics and text on the same screen? Then I would definitely recommend the *SemiGraphics Support Utility.* Check the price — I consider it a bargain few graphics programmers should pass up.

(Micro Computer Systems, 1404 Sunset Dr., Friendswood, TX 77546, cassette $14.95, disk $17.95)

— Stanley Townsend

Hint . . .

Upside-Down Loading

If you've been having problems with I/O Errors when loading programs from cassette, try reloading with the cassette recorder placed upside down. It may not be technically refined, and it may not work, but when faced with the dreaded I/O it's worth a try. Besides, Rick Bullon, who suggested this method, says it works for him 90 percent of the time.

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The CoCo Health Consultant: *Health Programs*

Interested in knowing whether your diet is providing the proper amounts of vitamins, minerals and protein? How about suggestions for supplements for certain physical ailments? Or maybe you just want to check your biorhythm for the next few weeks. These are all part of a package from Health Software called *Health Programs*. The package includes; "Deficiency Symptoms and Food Sources for 21 Different Nutrients," "Nutritional Therapy for 30 Different Ailments," "Pmode 4 Graph for 3-Week Biorhythm," "Text Mode Graph for 4-Week Biorhythm," and "Hypoglycemia Symptoms, Tests and Diet Recommendations."

The largest part requiring a 32K system, is the Diet program. To quote the introductory display, "Select from a list of 181 foods and see how much protein, calories, 11 vitamins and nine minerals are contained in your selections. The totals are individually compared to your RDAs if under age 19, or your MDRs if over age 18. It has 14 different RDA and MDR categories and adjusts for pregnant or lactating women 18 to 45 years old."

The package includes a two-page list of food items with codes and units of measure. To use the Diet program, enter age, weight, sex, and, if female, whether pregnant or not. The user is then asked if he/she uses vitamin supplements and, if so, the quantities of each. Then, using the list supplied, the user enters the quantities of food consumed for a full day up to 30 items. The program then displays the previously mentioned analysis of protein, vitamins and minerals.

The programs are well-written and perform as claimed. They are written in BASIC and come on tape or disk. In the tape version, the long Diet program is loaded using the high speed POKE to speed up the loading — even at that it takes about one and a half minutes to load. This program is too large to use with a disk even if the disk PCLEAR 0 is used. However, there is another copy of the Diet program on the 'B' side of the tape which can be loaded onto a disk.

Although the programs are easy to use, there are a few suggestions that could result in an even friendlier package. Some of the programs move to another screen simply by pressing ENTER while others require the entry of a specific number. Sometimes the choice is 1 or 2 and other times it's 5 or 6. There should be more consistency here. An improvement my wife would like to see would be the ability to enter three days' worth of diet instead of one to give a more representative average. The analysis takes four full screens to display and it would be nice to be able to direct this to a printer. Finally, the food list supplied with the package should also be included as a file so that if the original is lost or worn, a new one can be printed.

Is it worth buying? If you're interested in meeting your MDRs, the analysis can be very useful and the other programs in the package provide interesting information. The $10 price is certainly quite fair for what you get.

(Health Software, 1521 Lancelot, Borger, TX 79007, cassette or disk $10)

— James G. Kriz

Line Editor Works Well with Compilers

Line Editor is a full-screen editor for Assembly and PASCAL source code. It edits text files that can then be used with Assembly or PASCAL compilers. It requires at least 16K Extended BASIC and uses the Hi-Res graphics to display a 51 by 24-column screen with true upper- and lowercase characters. The program features auto-repeating keys, fast screen routines, and built-in help screens to remind you of the different commands. Although it is sold on cassette, *Line Editor* works with both cassette and disk. The editor is in machine code, but has a BASIC loader which allows the user to make some modifications. All input and output is in ASCII so as to be compatible with other programs.

Line Editor is not compatible with *EDTASM+* type assemblers nor is it designed to edit BASIC programs.

At first, I couldn't get it to work. After following the instructions without success, I discovered there was a simple error in Line 0 of the BASIC loader. After fixing that line the program runs fine.

The editing capabilities of *Line Editor* compare well with other text editors with similar command options.

The manual is eight pages long and covers all the commands and operations of the program with suggestions for use and modifications. Unfortunately, the manual contains typos and mistakes and the help screens in the program also contain errors.

Commands sometimes work erratically with lines of text that contain only one or two characters. Editing is done primarily in an overstrike mode and inserting text is awkward. A line of text is restricted to 51 characters. If you exceed this limit, not only is anything past the 51st character hidden, but the commands sometimes act unpredictably.

There is no way to send files to a printer; a major shortcoming. Though you might be able to overcome this by modifying the BASIC loader, you cannot break out of the editor, modify the loader and then rerun the program. The text is lost if the program is re-entered with the RUN command. There is no way to re-enter the editor after performing a write to disk or cassette. The program simply ends. This makes it difficult to make saves periodically as you type in a long text file. Although you can append stored files to the text in memory, there is no way to save only a portion of the text in memory.

This program works well for its intended purpose but is of somewhat limited use. It is only for those with an assembley or PASCAL Compiler but no text editor to create files to use with them. Although it has a very reasonable price, *Line Editor* should have been debugged with more care. If you need such a program, *Line Editor* is for you.

(CMD Micro Computer Sevices Ltd., 10447 124 Street, Edmonton, Alberta, T5N 1R7, distributed in the U.S. by Saguaro Software, P.O. Box 1864, Telluride, CO 81435, cassette $17.95 plus $2 S/H)

— James Ventling

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Software Review

Super Tutor — A Typing Tutor for Young Children

Super Tutor is designed to teach letter and number recognition to children ages 2 to 6. With the aid of parents, *Super Tutor* can be expanded to teach spelling.

The program arrived on disk. Actually there are four versions of *Super Tutor* on the disk. *Super Tutor* is divided into three learning levels. Each learning level has its own program. In addition, there is a main program that runs all three levels. The main program allows you to quickly switch between learning levels.

Level one teaches letter and number recognition. Each time a letter or number key is pressed the letter or number is drawn on the screen in large block form. The letters and numbers are drawn on a black background and colored white. Up to five rows of eight characters each can be displayed at one time. When a key is pressed the parent should tell the child the name of the letter or number. After a letter or number is displayed a short melody is played, which is usually a couple of notes designed to get the child's attention.

Level two teaches the child to recognize a letter or number on the keyboard. A random character is displayed and the child presses the appropriate key to cause the character to be displayed again. Nothing happens to the display until the proper character is pressed. When the child gives the proper response, the character is echoed to the screen and a short tune is played. In level two you can select training on letters or numbers only, or both letters and numbers.

Level three can be used to teach spelling. At the start of level three, enter the largest word length to be displayed, which can be from one to eight letters. In level three, words are displayed on the screen. The child must press each letter of the word in the proper order. When a correct letter is pressed the letter is displayed. When a word is entered properly an ear-catching melody is played. The parent must work along with the program to teach the child word pronunciation and spelling.

The *Super Tutor* package includes two pages of operating instructions. The instructions are straightforward and easy to understand. Included with the operating instructions is information on modifying and adding words to level three. The *Super Tutor* programs are written in BASIC. Words used in level three are located in lines 7000 and above. Up to 250 words can easily be placed in the data dictionary. *Super Tutor* comes with 50 words in the dictionary. You must know how DATA statements are written to modify or add words to the dictionary.

Super Tutor is easy to operate and performs exactly as described in the instructions. The author's telephone number is included in the instructions. Parents need to participate in the training in order for *Super Tutor* to work effectively. If you are looking for a program to teach young children the alphabet, numbers and early vocabulary, *Super Tutor* may fit the bill.

(Challenger Software, 42 Forth St., Pennsburg, PA 18073, 32K ECB, tape or disk $24 includes S/H)

— Gabriel Weaver

Educational *Biosphere* is Fun and Challenging

Imagine cruising in a spaceship, as captain of *Arkworld*, and learning about a dying planet below. This is much more than a game. In *Biosphere*, the challenge is to save doomed alien life-forms as you fly about the galaxy. You must remember that your decisions will affect the ecology of the planet. It can be a very educational experience and is not for those who wish a shoot-'em-up action game.

Biosphere is a complex ecological Simulation that lets you decide how to populate the dying colony of each planet you land on. Your ship is filled with 100 plants and 100 animals, each with their own characteristics. You can choose from these or experiment with genetic engineering to compose as many as 10 new life-forms. You must examine the planet's environment, and then determine what combination of plants and animals to beam down.

Educators will marvel over the detail of the ecological system, and the glossary page. The manual is well-written and provides helpful insights into a successful Simulation.

The program is also well-written and user friendly. It employs eight icons to display the main actions. The left- and right-arrow keys select the icon/functions. The up- and down-arrow keys scan through the information. A display area between the icons uses words and pictures to depict the information. The bottom half of the screen simulates the control panels, computers and ship holding cells.

Each *Biosphere* Simulation is different since the native Colony is randomly generated. When the first icon flashes, information about the colony is displayed. The number of inhabitants varies depending upon your success in providing the correct balance of necessary ingredients.

Using the Environmental icon, information about the planet's temperature, humidity, wind direction and gasses present on the surface is displayed. During the Simulation, these factors change as the balance of nature is affected.

The Animal Manifest is next. Use the up and down arrows to scroll through each of the 100 animals in the ship's hold. Biological information is shown: Animal Name (listed one at a time, in alphabetical order), Order (what it eats), Intake/Expel (gasses breathed), Weight range, Temperature and Humidity range it can live in and Quantity. The Quantity is the only random factor from game to game (all other characteristics remain constant). As each animal is displayed, determine how many (if any) you want to send to the planet. By studying the current environment, and that which will support the native life form, you are better prepared to save the dying planet.

The next icon, the Plant Manifest, works the same way as the Animal Manifest.

Genetic Engineering is next. If you choose to create an animal or plant, scroll through the Plant/Animal manifest lists. When you have chosen the two animals or plants you want to draw from, they appear in two boxes, and between them, your mutation: The Genetic1 lifeform appears! Five plants and five animals can be created this way.

The Window View is the view of the planet. You see a parade of animal life and growing plants. The author claims, "The beautiful sight of that teeming lifescape is the thrill that makes you glad you chose to be an ecologist." However, the view seems to start from the beginning each time, rather than continue from where it left off.

The Time Control icon displays the number of days the Simulation has been running, as well as the modes: normal, accelerated or hyper. In normal time, you make the choices and set up the Simulation. Printouts can also be made. In Accelerated time, one planetary day passes every 20 seconds. You can test the selections and make adjustments. Hyper time runs the Simulation at one day per second. Once in hyper time, the Simulation must run its course until all native animals have perished, or the ecology created proves to be stable by supporting the colony for 65,000 days. (This could take up to 18 hours to complete. But, until your decision-making skills are finely honed, the game is usually much shorter.)

The final icon is Archives. You can save a current Simulation, retrieve an already-created Simulation, or list the directory of previously saved Simulations. This allows saving choices before going into hyper time, and allows replaying the Simulation after loading and changing the quantities to better your performance. It is recommended to save a record when beginning the simulation and several more times before entering hyper time. By looking at the environmental changes and observing the native colony's head count, you can monitor the effects of your actions.

Playing the game is easy. However, winning is another story entirely! The tips the author suggests are timely. A good strategy is to print out the entire animal and plant manifests so that you can learn about and refer to the wide range of possible combinations. In a school setting (or two-computer family), the use of a database on another computer would be a great way to choose the best life-forms to fit the needs of the simulation.

There is no suggested age range for this program. However, I would recommend it for middle-school age and older. Those who work with this Simulation will gain insight into the ecological principles that govern our own relationship to the planet Earth.

Required is 64K Color Computer, (color TV recommended) and one drive. *Biosphere* loads with the DOS command, or the BASIC program provided to start OS-9 on a Color Computer with a BASIC ROM prior to 1.1.

(Tandy Corp., available in Radio Shack stores nationwide, Cat. No. 26-3280, disk $29.95)

— Dale Shell

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French Package Sharpens Language Skills

It's been quite a while since I wrassled with French irregular verbs in high school and in college. The verbs won. Always. Every match. Although I never passed a French exam in my scholastic life, I always merited a 'C' because I tried so hard. I just never mastered the art of thinking in another language.

Here at THE RAINBOW, letters from our French-speaking readers land on my desk for translation. I still try as hard as I can and I'm still earning a 'C'. Perhaps if I had had a tool like *French Package* by David M. Compton to study with, I wouldn't have to live with the memory of my professor's parting words to me, "Monique, you sound like a child. You guess too much. It is amazing how much you guess right, but you *must learn.*"

French Package requires 32K and comes on a non-protected disk so that backups for the user's convenience can be made. This program does not teach French; it is designed to help students reinforce material already studied. The documentation is three pages long and describes the programs within *French Package.*

From the menu, students may choose a quiz on the verbs aller, avoir, boire, s'asseoir and devoir, and from within each verb choose any of the 11 tenses or moods. The declensions are shown and the student responds with the correct verb form. Next are three categories of regular and irregular verbs along with their tenses and moods (including my personal boogeyboo, the subjunctive). Past participles, future and conditional are among the choices. The student is presented with the infinitive and asked for the correct form.

There are quizzes on both relative pronouns and object pronouns. This was my second favorite part. I always knew the difference between "que" and "qui" (I just never placed them correctly in the sentence, so no credit). Vocabulary is tested and stumped me royally when "fertile" was rejected as the response to "fecond." There is a multiple choice test in English on French civilization and a multiple choice test in French on French history. That was my favorite part along with the quiz on the comparative and superlative forms of adjectives and adverbs — they were the only rounds in which I earned perfect scores on the first tries.

There are quizzes and reviews on "si" clauses, forms of "quel" and "lequel," interrogative pronouns and a test on the student's knowledge of imparfait versus passe compose (in which I proved once again, I really am an animal and can live and deal only with now). There are quizzes on regular verbs in the present tense and I was able to salvage some of my pride on those and the quizzes on numbers from one to 100.

Mr. Compton has included instructions to modify *French Package* so it can match different textbooks more closely. I believe if I had had a CoCo and *French Package* when I was in school, I could have spared my classmates all those dumb puppet shows I wrote and performed and probably could have passed my courses in the regular manner. All in all, *French Package* is a worthy learning aid and delighted me with how much I can still guess right.

(David M. Compton, 252 N. Main Street, Suffield, CT 06078, requires 32K, disk $39.95 plus $3 S/H)

— Monica Dorth

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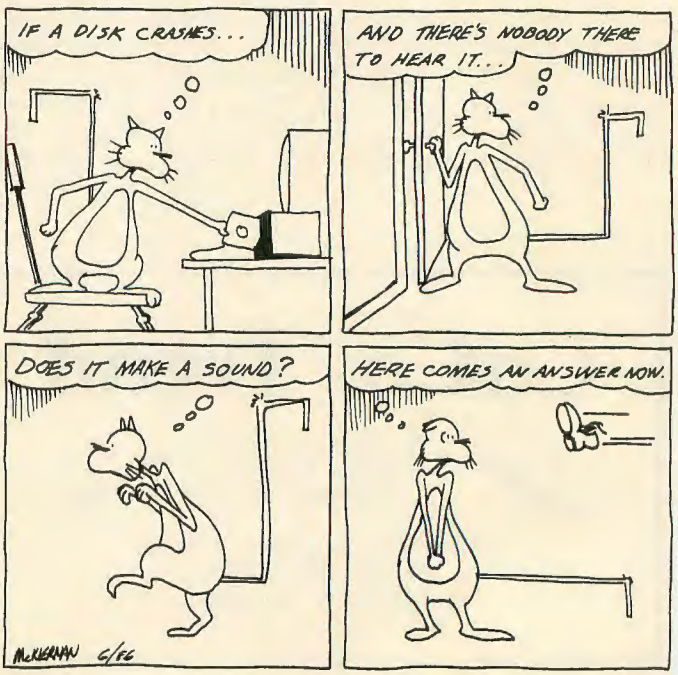

XSCREEN Gives High Resolution for OS-9

Have you ever wanted something besides the 32 characters per line on a green screen for your OS-9 system? Unhappy with inverse video instead of lowercase letters? Well here it is, and at an affordable price.

XSCREEN is a high resolution screen package for the OS-9 operating system of the Color Computer. Choose from 51, 64 or 85 characters per line. The display can be white or green characters on a black background, or black characters on a white or green background. All of these combinations have 24 lines per page. *XSCREEN* also has real lowercase letters.

The 85 characters per line is nearly impossible to read on a television. However, it is readable on a monitor. The 64 characters per line is available in two character sizes; wide and narrow. The wide characters seemed easier for me to read, but judge this for yourself. At 64 characters per line with either the wide or narrow characters, my eyes got tired after 15 minutes of work on the television. The 51 characters per line was easy to work with for long periods of time on a television or a monitor.

After *XSCREEN* is copied to the command directory, activate it by typing XSCREEN. You are presented with a menu for selecting the characters per line, and the foreground and background colors. It then returns to OS-9. If you need to change to a different style screen or want to quit *XSCREEN*, return to the menu by pressing the CLEAR and BREAK keys at the same time. If you quit *XSCREEN* and want the high resolution screen back again, reboot the system before executing *XSCREEN* again. This is stated in the manual in large bold letters.

XSCREEN uses about 12K bytes of user memory. This leaves about 28K bytes of memory for applications. If using BASIC09, you will have about 7,000 bytes of memory for your application program. With the OS-9 editor you will have just over 24K bytes of memory for the text you are editing.

All of the OS-9 display functions are supported by *XSCREEN*. In fact, *XSCREEN* has additional display functions which make it much easier to write screen editing routines. These codes allow erasing to end of line, turning the cursor on or off, scrolling down and erasing to end of screen. There are also several codes to change the foreground and background colors of the display and change the number of characters per line. To get these additional display codes, *XSCREEN* uses some of the OS-9 graphics display codes. This may sound like a problem if you have existing programs that make use of these codes. It is not, and here is why. *XSCREEN* does not use the standard output /TERM. Instead it uses a driver called /HI. To perform the standard OS-9 graphics display functions, direct the display command to /TERM. OS-9 will process the display code the same as if *XSCREEN* was not present.

I tried *XSCREEN* with OS-9 version 2.0.0. It did not operate predictably. I hope the makers of *XSCREEN* will make the necessary changes so it will work properly with version 2.0.0.

XSCREEN is well worth the price. It is nice to be able to get more than the 32 characters per line. If you cannot afford 80-column hardware, *XSCREEN* is the way to go.

(Microtech Consultants Inc., 1906 Jerrold Ave., St. Paul, MN 55112, disk $19.95)

— Mike Piotrowski

Hint . . .

Data Finder

Have you ever gone through your tapes or disks and found a data file that you couldn't identify? Well, I have, and it's a pain when you can't load it without the program and you can't find out what program it came from. Here is a program to solve your problems. Simply type in and run the program, and when it finds the file it will put it on the screen or on paper if you have a printer.

```
20 CLS:INPUT"WHAT IS THE NAME OF THE
DATA FILE";DF$
30 OPEN "I",#1,DF$
40 INPUT#1,D$
50 PRINT D$
60 IF D$="EOF" OR D$=""THEN 80
70 GOTO 40
80 CLOSE #1
```

If you want to load a data file from tape, change *#1* to *#-1* in lines 30, 40 and 80. If you want to print out the data, change line 50 to *PRINT#-2, D4.*

Chris Stevenson
Crocker, MO

"XPNDR2 and SuperGuide - an Ideal Expansion Card Set"

— RAINBOW 2/86 HARDWARE REVIEW

RAINBOW

XPNDR2 $39.95 each or **2/$76**
This prototype card features a 40 pin connector for projects requiring an on-line disk system or ROM paks. The CoCo signals are brought out to wire-wrap pins. Special gold plated spring clips provide reliable and noisefree disk operation plus solid support for vertical mounting of the controller. The entire 4.3×7 inch card is drilled for ICs. Assembled, tested and ready to run.

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"The CBASIC Compiler"

Now anyone can create fast efficient Machine Language Programs Easily and Quickly without having to use an Editor/Assembler

CBASIC is a fully integrated, easy to use Basic program Editor and Compiler package. CBASIC is 99% syntax compatible with Disk Extended Color Basic programs, so most Basic programs can be loaded and compiled by CBASIC with little or no changes required. The compiler is an optomizing two-pass integer Basic compiler that can convert programs written in Disk Extended Color Basic into 100% pure 6809 Machine Language programs which are written directly to disk in a LOADM compatible format.

The programs generated by the compiler can be run as complete stand alone programs. A built-in linker/editor will automatically select one and only one copy of each subroutine that is required from the internal run-time library and insert them directly in the program. This eliminates the need for cumbersome, often wasteful separate "run-time" packages.

CBASIC WAS DESIGNED FOR BOTH BEGINNING & ADVANCED USERS

CBASIC is a Powerful tool for the Beginner or Novice programmer as well as the Advanced Basic or Machine Language programmer. The Beginner or Novice programmer can write and compile programs without having to worry about Stack Pointers, DP registers, memory allocation, and so on, because CBASIC will handle it for you automatically. All they have to do is write their programs using the standard Basic statements and syntax. For the advanced Basic and Machine Language programmers, CBASIC will let you take command and control every aspect of your program, even generating machine code directly in a program for specialized routines or functions.

CBASIC adds many features not found in Color Basic, like Interrupt, Reset, and On Error handling. It also has advanced programming features that allow machine level control of the Stack and Direct Page registers, variable allocation, automatic 64K RAM control, program origin and even multiple origins. It can even have machine language code generated within a program that executes just like any other Basic program line.

FULL COMMAND SUPPORT & SPEED

CBASIC features well over 100 Basic Commands and Functions that fully support Disk, Tape, Printer and Screen I/O. It also supports ALL the High and Low Resolution Graphics, Sound, Play and String Operations available in Extended Color Basic, and all with 99.9% syntax compatibility.

CBASIC is FAST. Not only will CBASIC compiled programs execute 10 to 1000 times faster than Basic, but the time it takes to develop a CBASIC program versus writing a machine language program is much, much shorter. A machine language program that might take several months to write and debug could be created using CBASIC in a matter of days or hours, even for a well experienced machine language programmer. We had a report from a CBASIC user that claimed "a Basic program that used to take 3 hours to run, now runs in 7 to 8 minutes". Another user reported a program that took 1 to 1½ hours to run in Basic, now runs in 5 to 6 minutes!!!

MORE THAN JUST A COMPILER

CBASIC has its own completely integrated Basic Program Editor. The Editor contained in CBASIC is used to Create and/or Edit programs for the compiler. It is a full featured editor with fur.ctions designed specifically for writing and editing Basic programs. It has built-in block Move and Copy functions with automatic program renumbering. Complete, easy to use inserting, deleting, extending and overtyping of existing program lines. It is also used for Loading, Saving, Appending (merging), Killing disk files and displaying a Disk Directory. It also has automatic line number generation for use when creating programs or inserting sequencial lines between existing lines. You can set the printer baud rate and direct normal or compiled listings to the printer for hard copy. The built-in editor makes program corrections and changes as easy as "falling off a log". If CBASIC finds an error when compiling, it points to the place in the program line where the error occurred. All you have to do is tell the editor what line you want to start editing and when it is displayed, move the cursor with the arrow keys to the place where the error is and correct it. Just like that, it's simple.

HI-RES & 80 COLUMN DISPLAYS

CBASIC is the only Color Basic Compiler that includes its own Hi-Resolution 51, 64 or 85 by 24 line display. It is also the only compiler that supports both the PBJ "Word-Pak" and the Double Density 80 column cards. All of these display formats are part of the standard CBASIC compiler package. Not only can these display formats be used for normal program editing and compiling, but CBASIC will also include them in your compiled programs! If you want CBASIC to include the display driver in your program, all you have to do is use a single CBASIC command "HIRES". The run-time display driver that CBASIC includes in your program is not just a simple display, but a full-featured display package. With the Hi-Resolution display package you can mix text & graphics, change characters per line, underline, character highlight, erase to end of line or screen, home cursor, home & clear screen, protect screen lines, and much more. All commands are compatible with our HI-RES II Screen Commander so you can easily develop screen layouts using HI-RES and Color Basic before you compile your program. The same applies to using the 80 column card drivers. What other Basic compiler offers you this kind of flexibility?

64K RAM SUPPORT

CBASIC makes full use of the power and flexibility of the 6883 SAM (Synchronous Address Multiplexer) in the Color Computer. It will fully utilize the 96K of address space available in the Color Computer (64K installed) during program Creation, Editing and Compilation. CBASIC has a special command for automatic 64K RAM control. When used in a program, it allows the user to use the upper 32K of RAM space automatically for variables or even program storage at run-time. It will automatically switch the ROMs in and out when needed. There are also two other commands that allow you to control the upper 32K of RAM manually, under program control. No other Color Basic compiler directly supports the use of 64K RAM like CBASIC.

ALL MACHINE LANGUAGE

CBASIC is completely written in fast efficient Machine Language, not Basic, like some other Color Basic compilers. Because of this, CBASIC can edit and compile very large programs. Even using the Hi-Resolution 51 by 24 line display, it can work with about a 34K program, and the 80 column card versions can handle almost 40K of program. Some of the other Basic compilers can only work with 16K or about 200 lines. Even working with large programs, CBASIC compiles programs with lightning fast speed. It will compile a 24K program to disk in less than 2 minutes! That's without a listing being generated. We've heard stories about some other compilers that take almost 10 minutes to compile a simple 2-3K program. You might inquire about this when you look at some of the other compilers available.

THE FINISHED PRODUCT

Since CBASIC contains statements to support ALL of the I/O devices (Disk, Tape, Screen & Printer), Hi-Res Graphics, Sound, and Enhanced Screen displays, it is well suited for a wide range of programming applications. It generates a complete, Ready to Run machine language program. The finished product or program does not have to be interfaced to a Basic program to perform some of its functions or commands. This may seem obvious to you, but some of the other Color Basic compilers don't necessarily work this way. Some of their compiler commands need a separate Basic program in order for them to work. In some cases, require that a separate Basic program be interfaced to the compiled program to perform I/O functions, like INPUT, PRINT and so on. CBASIC doesn't do this. ALL of its commands are compiled into a single machine language program that does not require any kind of Basic program to make it work.

COMPATIBILITY

You may be wondering about those statements we made earlier concerning 99% or 99.9% syntax compatibility. What does that other 1% consist of? The biggest part of that 1% has to do with string arrays and variables. CBASIC does not use a "String Pool" like Color Basic. It uses absolute memory addresses to locate string variables and arrays. This is why CBASIC's string processing is so fast, it also eliminates the time consuming "Garbage Collection" problem. When CBASIC allocates space for strings, it must know how much space to use for each string. When you Dimension a string variable in CBASIC, you must tell it how much space you want to save for each element. To Dimension an array of 40 strings, 64 characters each, you would DIM DA$(40,64). If a string is not dimensioned, CBASIC will automatically allocate 32 bytes for it. If you want a single string to have enough room for 200 characters you would DIM AX$(200). For string arrays, you would still access the element you want, the same as Color Basic, to get string #30 from the array DA$, you would still use DA$(30), the only real change is in the DIM statement. For undeclared string arrays of 10 elements or less, CBASIC will automatically reserve space for 10 (0-9) strings of 32 characters. In some other Color Basic compilers, you have to declare EVERY string variable used in the progrm in a DIM statement. And, to create an array of 40 strings with 64 characters each, you would have to DIM AD$(2560), and then to access string #30, you would have to multiply 30 × 64 and use a special variable name format or access it one character at a time. Not very compatible or convenient to use, and difficult at best.

CBASIC REQUIREMENTS

CBASIC requires a minimum of 32K RAM and at least one Disk drive. We strongly recommend that you have 64K. CBASIC is compatible with all versions of Color & Extended Basic and both Disk Basic V1.0 and V1.1. Programs compiled on either system will run on systems with different ROMs. CBASIC is NOT compatible with JDOS.

DOCUMENTATION

The Documentation provided with any program is very important to the user. This is especially true when you talk about a program as complete and complex as CBASIC. Even though CBASIC was designed to be the most User Friendly compiler on the market, we went to great lengths to provide a manual that is not only easy to use and understand, but comprehensive and complete enough for even the most sophisticated user. The manual included with CBASIC consists of approximately 120 pages of real information, not like some manuals that put just one or two short paragraphs on a page. If we did it that way, we could have easily created a three or four hundred page manual. The manual index breaks down each section of the manual and gives a 3 or 4 word description of each section and its items along with page numbers. The manual has three sections, the Editor, Compiler and Appendix. Each of these is divided into subsections, with Section and Subsection titles printed at the top of each page. If you want to, you could find the information you are looking for by simply flipping through the pages and scanning the Section titles on the top of the pages. The Manual itself is an 8½ by 11 Spiral Bound book with durable leather textured covers. Some of the reports we have had from CBASIC users describe the manual as being the Best program manual they have ever used.

COMPARE THE DIFFERENCE

CBASIC is not just another Color Basic Compiler. It is the only complete Basic Compiler System for the Color Computer. Compare CBASIC's features to what other compilers offer and you'll see the difference. When comparing CBASIC to other compilers, you might want to keep some of these questions in mind. Does it support I/O functions? You can't write much of a program without PRINT, INPUT and so on. What about complex string statements, or string statements at all? How large of a program can you write? Can you compile a complex string like: MID$(RIGHT$(DA$(VAL(IN$),LEN(LE$)),3,3)? Can you use two character variable names for string & numeric variables, like Basic. Does it support all the Hi-Res graphics statements including PLAY, DRAW, GET and PUT, using the same syntax as Basic? Do you ever have to use a separate Basic program? Can you take complete Basic programs and compile them without extensive changes? Will they work? How do you edit a program when it has errors compiling?

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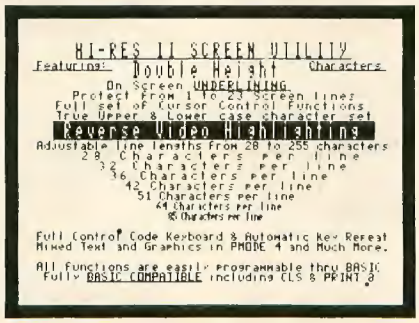

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Upper/Lower case characters	Yes	Yes	Yes
Mixed Text and Graphics	Yes	Yes	Yes
Separate Text & Graphics	Yes	Yes	No
Print @ fully implemented	Yes	Yes	Yes
Print @ on all line lengths	Yes	Yes	51 only
Different line lengths	28 to 255 (9)	28 to 255 (9)	51 only (1)
Automatic Key Repeat	Yes	Yes	Yes
Adjustable Key Repeat	Yes	No	No
Auto Repeat Disable	Yes	No	No
Erase to end of line/screen	Yes	Yes	Yes
Home Cursor	Yes	Yes	Yes
Solid or Blinking Cursor	Yes	No	Yes
CLS command supported	Buff/Black	Buff/Black	Buff/Black
X,Y Coordinate Cursor Positioning	Yes	Yes	No
Double Size Characters	Yes	Yes	No
Individual/Continuous Highlighting	Yes	Yes	No
On Screen Underlining	Yes	Yes	No
Clear Key functional	Clear/L keys	Clear key	No
16,32 & 64K Supported	Yes	Yes	Yes
Green or Black Background Color	Yes	No	No
Dual Character sets for Enhanced 64 and 85 Characters per line display	Yes	No	No
Protected Screen Lines (programmable)	1 to 23	No	No
Full Control Code Keyboard for Screen control directly from the keyboard	Yes	No	No
Programmable Tab Character Spacing	Yes	No	No
Full Screen Reverse Function	Yes	Yes	No
Switch to & from the Standard 16 by 32 Screen for full compatability	Yes	No	No
On Error Goto Function	No	No	Yes
Extended Basic Required	No	Yes	Yes
All Machine Language Program	Yes	Yes	Yes
RAM Required in addition to Screen RAM	2K	2K	2K
Program Price (Tape)	$24.95	$19.95	$29.95

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Money Math Teaches Children Coin Values

If you have a young child who is excited about using money but confused about its values, *Money Math* may be a useful addition to your home or school library. *Money Math* is an educational program targeted for first- through third-grade children (and useful for remedial tutoring for upper grades). It uses high resolution graphics and a voice synthesizer (optional) to teach children the value of common U.S. coins and the dollar, how to count various combinations of coins and even how to spell them.

Money Math comes in two versions, a 32K program and a 64K version. The programs are identical except the 64K program offers voice prompts, help and encouragement by utilizing The Voice speech synthesizer from Speech Systems.

After the initial Hi-Res title page, which includes a display of the coins and dollar, the program displays a menu of 15 options comprising six categories. The categories are: Coin Values, Spelling, Count to $1.00 with . . ., Count Coins, Mixed Coins and Choose Coins.

Selection from the menu is highlighted and made through movement of the up or down arrows and ENTER key. Large graphics coins are used throughout all options. (The quarter is one and one-half inches on a 13-inch screen; the rest of the coins are proportionally presented and easy to read.)

The first category, Coin Values, randomly shows the child the four basic coins (penny, nickel, dime, quarter) and the dollar along with the name of the currency. The child has to enter the value of the currency in either decimal or cents notation. The second category reinforces the correct spelling of the appropriate coins and dollar.

The next three sections (10 options) drill the child in counting coins, and offer the choice of counting to one dollar using a particular coin or of counting a variety of groups of coins. The easier counting categories require input in cents notation. The most difficult category, Mixed Coins, requires decimal notation when working with sums greater than one dollar. (The child is required to place the dollar sign and decimal point in the correct places in order to get credit for the problem.)

In the final category, Choose Coins, the student is shown a monetary value on the bottom of the screen and he must place an appropriate combination of coins on the screen to equal that value. This is accomplished by depressing the 'P', 'N', 'D' or 'Q' keys for pennies, nickels, dimes, or quarters. The selection of coins can be in any order and erased one coin at a time if desired.

Choosing Coins does not have the option of choosing a dollar bill, even if you are working with values greater than one dollar. My third-grade son wanted to use dollar bills and I thought about that idea myself. It might be a possible addition to the program. However, I can see many disadvantages to that approach. For example, dollars and dimes both begin with 'D', dollars take up considerably more space on the screen, and counting money problems become much more simplified and too easy to solve if dollars are used instead of coins to produce a dollar's worth of currency on the screen. Perhaps it might be best to leave this routine as is.

There are several additional features that should be noted. The 'C' key is used to change the color of the penny to its copper color if it should be blue initially.

Normally, the child makes a selection from the menu and is drilled through a total of 10 problems before he is given a random musical and graphics reward and returned to the menu. The child may quit, however, at any time by pressing the CLEAR key, and return to the menu. Needless to say, there is no reward in such an action. The rewards are brief and entertaining, and have a positive influence on the kids. If using the 64K talking version, the child is also rewarded with verbal phrases like "congratulations," "super," "outstanding" and a surprising "supercalifragilisticexpialidocious."

The student can receive help at any time by pressing the space bar. Help is available in all levels at any time and always shows the child the correct answer or one of the possible solutions. Additionally, in the Mixed Coins category, the computer provides a step-by-step counting of each coin, accumulating the sum of each value at the bottom of the screen and highlighting the coins counted as each is added. The 64K version provides a verbal counting of the coins in addition to the visual presentation.

The right arrow is used to erase answers throughout all drills. It seems more natural for children who have used the CoCo to associate the left arrow with erasing. Perhaps it would be desirable to leave the right arrow in the program, but add one line of code to accept the left arrow erase as well.

I had a problem with trying to run the 64K program. My computer has always been able to handle the speedup poke (`POKE 65495,0`), until now. For some reason the placement of the poke within the program caused peculiar screen problems. After several attempts at various solutions, I took a close look at the software and discovered that removal of the speedup poke solved the problem. Therefore, if *Money Math* seems to load OK, but you have unusual effects or problems running the program, try replacing the `POKE 65495,0` with `POKE 65494,0` in lines 13 and 1000. You'll have to load the program *MONEYT* by itself, without following the normal instructions for loading, in order to edit that program. The author has been notified of the situation and a note probably will be added to the documentation. If you know that your computer can not use the speedup poke, be sure to mention it with your order. The documentation, by the way, is quite clear and easy to read.

Money Math, along with several educational programs by CY-BURNET-ICS, is tested and used in elementary school systems in Tennessee and is quite student friendly. It is available for Network use as well as individual family environment use.

Kindergartners seemed to need more help, but enjoyed using the program. Older, early-elementary kids loved it and enjoyed counting and manipulating money on the TV. I think *Money Math* shed a new light on some of the things they had been working with on paper at school. I highly recommend *Money Math*.

(CY-BURNET-ICS, 5705 Chesswood Dr., Knoxville, TN 37912, 32K ECB, cassette $29.95, disk $32.95)

— Kenneth D. Peters

Options Galore with *CGP-220 Screen Dump Package*

The *CGP-220 Screen Dump Package* consists of six separate programs. Basically, they accomplish two things. Three of the programs create four-color pictures while the other three produce monochrome results. The package includes versions that run on 16K and 32K Color Computers. Two of the programs allow the user to print the two-screen images produced by *CoCo Max*. Memory limitations, however, require the user to be using at least a 32K machine.

The package is well-written and organized. Pretty menus were sacrificed for ease of use and efficiency of programming. The programs are easily transferred to disk for those who have disk drives.

Several printing options are provided in this package. When printing color images, the user can alter the printed colors as related to those shown on the screen. One can also select normal or double-sized images. When printing mono images, the options include printing in any of eight colors and the ability to print the negative of the image. These capabilities allow the creation of attractive, as well as weird, results. Imagine . . . purple people and blue pets.

Although the documentation explains all options, one thing needs to be clarified. The user is asked to CLEAR some memory before loading one of the programs. My gripe with this is that it doesn't tell the user how much memory to clear. Because of my past experience I was able to allow enough memory. However, a new CoCo user might not be so lucky. Also, the loading instructions should be organized in an itemized "step" fashion. These changes would be relatively simple.

All in all, *CGP-220 Screen Dump Package* is an excellent buy for $14.95. Aside from those problems in the documentation, it surpasses products you might find elsewhere.

(CMD Micro Computer Services, Ltd., 10447 124th Street, Edmonton, Alberta, Canada T5N 1R7. Distributed in the U.S. by Saguaro Software, P.O. Box 1864, Telluride, CO 81435, cassette $14.95 plus $2 S/H)

— Cray Augsburg

Hall of the King Challenges Avid Adventurers

If you like Adventure games, and enjoy programs that show how far Color Computer programming has advanced in recent years, you should experience *Hall of the King* to see how good it gets.

Available from Prickly-Pear Software, *Hall of the King* is one of the best Adventure programs I have experienced to date. I wish I could report my victory but thus far I have been unable to solve the game. *Hall of the King* is a challenge for even the most avid Adventure player.

The opening credits are impressive and make you feel as though you're watching a show on television because the special effects are special. Next, you receive an in-depth background on the situation you're becoming involved in. You can review the scenario a page at a time at your own speed. The authors have taken time to research the topic while remaining imaginative so you're primed when the Adventure begins.

Hall of the King consists of two disks, and gives you a lot more playing time that you might need when an Adventure is so complex and challenging. Although there are two disks, only one disk drive is required, but you need to have 64K.

The graphics are many and well-done. *Hall of the King* is 100 percent high resolution graphics in detailed color. I enjoyed wandering through the *Hall of the King* admiring the programmer who spent so much time polishing all the fine details.

The response time to commands is almost immediate, except for a brief wait between commands while new graphics are drawn, which I didn't mind at all. There are SAVE and LOAD commands that make it possible for you to resume where you left off between games with ease. The packaging of the program is a vinyl container making it handy to grab and load. The documentation is thorough and well-done.

Good Adventures like *Hall of the King* keep the Color Computer's future bright.

(Prickly-Pear Software, 2640 N. Conestoga Avenue, Tucson, AZ, 85749, two disks $39.95 plus $1.50 S/H)

— Barbara Combes

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Advanced Utilities — Five OS-9 Goodies

I was once asked, "What do you buy for the computer when you already have a word processor, a spreadsheet and a database?" I told the questioner to buy utilities. Utilities are those wonderful little programs that exist only to make the computer do more for us in an easier way. To this end, Computerware has released a set of five OS-9 utilities packaged together as *Advanced Utilites*.

The five utilities included in the package are *Kshell*, a direct, more powerful replacement for Shell; *Cpy*, a more powerful version of Copy; *Archive*, a backup utility to back up hard disks to floppies; *Flink*, a program to define what file to use as the boot file on the next reboot; and *Unload*, used to remove a program from memory by recursively unlinking it. The five utilities come on one disk, which is unprotected. Also included is a nine-page manual that explains the utilities and has examples for each. The explanation for *Kshell* is wonderful and covers all aspects of this utility. The other utilities seem to suffer a little, though.

Kshell is the showpiece of the package. This program takes the place of the shell to give a more powerful command interpreter. Its most powerful feature is its automatic wild card extensions. Any place on an OS-9 command line you would place a filename, you can use a wild card. Use it to match any file in the directory that corresponds to a pattern. The '*' character matches any set of zero or more characters. The '?' character matches any single character. For example, the command "del *.bas" deletes all files in the current directory that end with ".bas." The command "del file?.txt" deletes files such as "file1.txt," "file2.txt," "filez.txt" and any other file that fits the pattern. This works with all OS-9 commands that let you give a list of filenames on the command line. It does not work on OS-9 commands that only use the first filename found on the command line. For example, the ident command only reports the first file no matter how many are stated. Thus, a wild card used with ident still only gives one report.

Another feature of *Kshell* is its PATH variable. You may assign a value to PATH to tell OS-9 where to look for commands. The command PATH="/d0/cmds:/h0/cmds" tells OS-9 to look for a command first in /d0/cmds and then in /h0/cmds. You can give it as many paths to search as wanted. Although not stated in the manual, I am sure there is some limit on the number of characters the PATH can have.

In addition to the PATH variable, *Kshell* gives four user-defined variables or macros. These are called *$1* through $4. You may give them any value and substitute them anywhere in an OS-9 command line. If you set $1 equal to /d1/docs/reviews/advutil.txt, all you have to do to edit that file is enter edit $1. In addition to saving repetitive typing, macros can be passed to procedure files. The command `proc $2="program"` sets $2 to the string "program" for the duration of the procedure `proc`. In the procedure file you would use $2 in any place you would normally use a filename.

Kshell has also borrowed some ideas from the UNIX operating system. One of these is the use of the single opening quotation mark (') character. If a command is placed within single opening quotes, its first line of output is substituted at that point. For example the command echo Current directory is 'pwd' generates this: Current directory is /d1/docs/reviews. You can mix this with the macros. $1='pxd' sets $1 equal to the current execution directory.

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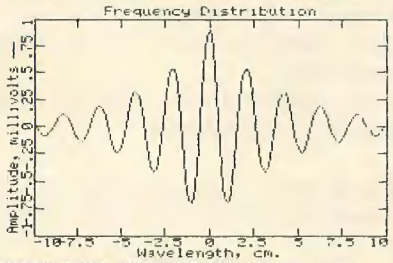

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Goin' Steady On BBS

Here is a short program to demonstrate how someone may get their messages to print evenly on a BBS.

```
1 REM RICHARD BECK
2 REM KISSIMMEE,FL
10 CLS:CLEAR 1000
20 LINEINPUTA$:CLS
30 GOSUB50
40 IFINKEY$=""THEN40ELSE20
50 FORP=1TOLEN(A$):PRINTMID$(A$,P,1);
60 X=X+1:IFX>26ANDMID$(A$,P,1)=""THEN
PRINT:X=0
70 IF X=30 THENPRINT"-":X=0
80 NEXT:X=0:PRINT:RETURN
```

Richard Beck, IV
Kissimmee, FL

Also from UNIX, *Kshell* accepts either the standard CHD and CHX commands or the aliases of CD and CX. Comment lines under *Kshell* may begin with either an '*' as in the normal shell or with an '#' as in UNIX.

The *Kshell* has a few other features. The command prompt can be set to whatever is wanted. The command -"p="Ksh>" would replace the OS9: prompt with Ksh>. Error reporting can be turned on or off. The command "-e" turns on full error messages like PRINTERR does. The difference is that a -ne command turns off error reporting. You can also specify what file to take the error messages from if you want to use something other than the system default. *Kshell* has improved upon the standard shell's redirection capability. The output of a command may be redirected to a file, to append to an existing file, or to overwrite an existing file.

To get all these extra features, you must give up something; what you give up is memory. *Kshell* reduces available memory by about 3.5K. This may be a problem if memory is tight. Using *Kshell* and a Hi-Res screen utility only left enough room for me to edit an 8K document with my word processor, as opposed to a 12K document under the standard shell. Those using the standard 32 by 16 screen or an 80-column hardware card may not miss that 4K as much.

If it seems that the other four commands are getting the short end of the stick here, you're right. They also get short-changed in the manual. While *Kshell* is covered in full detail with several examples for each command, the rest of the utilities are covered in less detail.

The *Cpy* utility is an improvement upon the Copy command. In addition to the standard Copy features, it can copy multiple files to a directory. Used with *Kshell*'s wild cards it can be very useful. The command "Cpy /d1/source *.bas" copies all BASIC programs in the current directory to /d1/source. *Cpy* is a little confusing though. To copy one file to another, the syntax is "Cpy source destination," while to copy multiple files it is "Cpy Destdir source1 source2 source3 . . . ." I have no idea why the author used two separate syntaxes on the same program.

The *Archive* utility is used to back up hard disks or large floppies to smaller media. It allows copying these large media to several smaller ones without splitting files over two different smaller medias. This command worked exactly as the documentation said it would and without any problems.

The *Unload* utility is a recursive version of Unlink. *Unload* removes a module from memory by repetitively unlinking it until it disappears from memory. This also worked as described.

The final utility, *Flink*, is an interesting one. It allows you to state what file the system is to boot from on the next reboot. Thus, you could have two or more boot configurations on a disk and choose which to use. This also seemed to work just as it is described.

What you get with *Advanced Utilities* is a very good replacement shell and four good utilties. The *Kshell* itself is worth the price. All five utilities were tested under both OS-9 Version 1.01 and Version 2.0 without any problems.

(Computerware, 4403 Manchester Ave., Suite 102, Box 668, Encinitas, CA 92024, $29.95, requires OS-9 operating system)

— Mark Sunderlin

Software Review

Vegas Game Pak — CoCo Goes Casinoing

If you're having the gang over for a party soon, you'll be doing them and yourself a favor if you have the *Vegas Game Pak* on hand. It has six games, count 'em, and if your friends enjoy gambling, this is the next best thing to being in Nevada.

The selections include: Poker — Everybody's favorite card game, complete with graphics face cards and the ability to enter as high a credit line as you choose before the game gets under way. You may bet as much as five dollars per hand; Keno — The screen displays a series of 80 numbers. The challenge is to pick the 10 numbers you believe the computer will select. Your numbers are indicated by a blue checkmark until replaced by red checkmarks — should the computer choose one of your numbers. The game includes the capability of changing numbers if you want to change your selection before the action begins; Blackjack — Nice graphics cards with some handy options, including splits, doubles and insurance that allow you to increase your earnings fairly quickly, if you're lucky; Three different slot machine games, including Riteleft, Bar5 and 3Line. These are variations on the theme of spinning wheels, fruits and numbers.

All six games are written in machine language and are very responsive to user input. Betting is easy, the action is smooth, running totals of earnings are available and suspense is ever present.

Vegas Game Pak is fun. It is a good bargain because almost every one of these games would be a nice draw if sold separately.

(NovaSoft, 4285 Bradford N.E., Grand Rapids, MI 49506, tape $29.95, disk $27.95 plus $2 S/H)

— Barbara Combes

Hint . . .

Color Computer 2 Warning

If you are upgrading your new CoCo 2 to 64K, remember that the 16K chips you are taking out are *not* the same as the 16K chips (type 4116) that earlier CoCos used. They are type 2118, which use a different power supply (+5 volts only) and *will not* work in earlier units, and could cause damage. (If you intend to do a 32K "piggyback" expansion on your CoCo 2, use another set of 2118s, *not* 4116s that came out of an older computer.)

NumberJack — An Auxiliary Keyboard Input Device

HJL has now provided the Color Computer with the long-missing Numeric Key Pad Area by introducing a device it calls NumberJack.

Initial reaction by many of you will be, "I have number keys already; what do I need another gadget for?" Well, I felt that way too, but my preference for HJL products (I own several) led me to try NumberJack. I do enough calculation and spreadsheet work to make reasonable use of the device. The question in my mind was whether spreadsheet use of it alone could justify its hefty price.

I am now convinced that NumberJack justifies its cost not just as a spreadsheet convenience, but as an auxiliary input device in the fullest sense of the word.

The unit is approximately six or seven inches on a side, and a few inches thick. The numeric keypad is attached to the computer by a length of ribbon cable that projects about two feet from the underside of the computer case on whichever side you choose. On the top are 24 keys, including the 10 digit keys (zero through nine), four arrow keys, four primary math operations (add, subtract, multiply and divide), two relational operators (< and >), and four computer control keys (@, CLEAR, SHIFT and ENTER).

A competent technician could install NumberJack in under three minutes, but the average owner may take closer to 15 minutes. The installation involves opening the case, removing the keyboard, and then connecting both the keyboard and the numeric key pad to a small T-shaped adapter board. This is then replugged into the keyboard connection receptacle. (The specimen I received included T-connectors for all versions of the CoCo; the shipping documents imply that you might receive only the adapter appropriate to your model.) In no case is soldering needed. For some CoCo 2 installations, an additional grounding pigtail is needed and supplied, and the method of attaching that is simple and well-planned. The computer case must be cut to let the ribbon cable out, and the ribbon cable must be attached to a ventilation slot to provide strain-relief on the cable. The other end of the ribbon cable is then plugged into a receptacle on NumberJack.

The directions warn that erroneous characters on the screen mean the cable is plugged in backwards. The best solution for that is to reopen the case and turn the ribbon the other way in the T-connector. Expecting that the average user may be reluctant to open his case, HJL advocates simply turning the cable over and plugging it into the NumberJack the other way. That will work also, but gives a less professional appearance.

Here I must fault HJL for a few minor shortcomings. The instructions do not mention that other sources of erroneous characters are stuck keys! I spent two hours trying to get the unit to work properly before I discovered that a small burr of plastic where the ENTER key rubbed on the edge of the cover was causing such anomalies as double characters when SHIFT-8 (the open parenthesis) was pushed, inoperative ENTER from the keypad but correct operation of ENTER from the main keyboard, and similar problems. I called HJL about the problem. They said mine was the only case of this problem so far reported and had me return the unit for warranty re-work. I shipped it to them, and received a fully repaired unit in exactly eight days.

I can attest to the fact that customer support has been excellent; my own experience has been that questions normally receive return phone calls with adequate answers in under four hours. This is the first time I have had to return hardware to HJL, and a check with two local CoCo Clubs and a few local dealers indicated that hardware returns are rare for HJL, and that their service is consistent with the excellent phone support I experienced.

However, I feel strongly that the receptacle on the side of NumberJack and the connector inside the computer should both have been made idiot-proof, rather than simply suggesting reversing the plug in the receptacle. I say this because an upside-down plug on the unit looks bad, and I could very easily connect the cable to the unit with pins misaligned.

Once my unit was working, I tried some calculations and spreadsheets. Naturally, the unit worked as advertised, and I found the "phone dial" approach to number crunching significantly less tiring than the use of my normal keyboard. But then my kids interrupted. I have a three-year-old who is into Sesame Street educational software. I never realized how intimidated she had felt by the large keyboard when doing her simple preschool math. She grabbed NumberJack and wouldn't give it (or my CoCo) back! Her comprehension and speed rose dramatically, and I concluded that the more convenient arrangement of number keys can make a big difference in educational uses.

Next, my nine-year-old took over the CoCo to play a video game. He prefers to play *Frogger* with arrow keys rather than joysticks. Again, NumberJack was preferred to the normal keyboard input. Then, I tried modeming, and found that having a spare CTRL (alias CLEAR) key, or another ALT (alias '@') key was something to be appreciated.

My CoCo is stationed in the den, with a monochrome monitor facing one wall. The family TV is on another wall and serves as our color display. I often get backaches twisting to watch both displays when using software with color capability. Since 80 percent of my usage is word processing, I cannot justify replacing the monochrome monitor with a color one. Suddenly my swivel chair and the two feet of ribbon cable became the solution to the problem. A number of my programs were readily modified to accept punctuation or number responses in place of, and in addition to, the use of single letter responses to some prompts. Thus, I could turn in the chair with NumberJack on my lap and comfortably view the color display while retaining full control of the computer.

NumberJack is not just a spreadsheet convenience, but rather a true auxiliary keyboard input device. It may soon be viewed not as a luxury, but as a normal upgrade for the CoCo.

(HJL Products, a division of Touchstone Technology, Inc., 955 Buffalo Road, P.O. Box 24954, Rochester, NY 14624, $89.95)

— H. Larry Elman

Become a King in *Wizard's Tower*

Before he died, the Wizard King hid three magic talismen in the dungeon under his tower and protected them with monsters. Your quest is to find the three talismen and become king.

There is nothing I like better than a great Adventure game, but this is not really an Adventure game so much as it is a Dungeons and Dragons simulation.

Play takes place on three Lo-Res text graphics screens. The first screen shows the countryside with various terrain and monsters. After buying supplies in town (food, magic spells, weapons, armor), make your way across the screen to the tower. Upon entering, go to the Dungeon screen. It shows the corridors, treasure chests and evil creatures of the dungeon. The idea is to steal treasure chests while killing or avoiding the evil creatures. A treasure chest may contain gold or may have one of the magic talismen. The third screen is a smaller, simpler version of the second screen.

When you find the three talismen and return them to the village, you win. Before achieving that goal, however, you will have to return to the village for more food rations or better armor and weapons.

Unfortunately, the creatures (goblins, wizards, dragons, balrogs) are less than intelligent. Represented by text letters, they wander around on the screen. No matter how many you kill there are always the same number of them on the screen. Everytime you move, all of the creatures make a move.

The game is easy to learn and takes about a half hour to play. The graphics are not high resolution and the action can be slow and repetitive. The program is written in BASIC. If you enjoy programming you might like to modify it to correct for the slowness.

This game is a good choice for the price.

(Mitchell Software, P.O. Box 194, Tomahawk, WI 54487, $9.95)

— James Ventling

Telewriter-64 Character Set Editor Makes Modifications Easy

One of my most frequently used and favorite programs is *Telewriter-64*. This latest offering from CMD Micro makes this popular word processing program even more appealing.

The *Telewriter-64 Character Set Editor* provides an easy way to modify the character set used by *Telewriter-64*. Three new fonts are included with the program that demonstrate the capability of the software. "Descend" provides real honest-to-goodness descenders on the screen and "French" adds French characters to the vocabulary.

Modification of characters is simple. With the aid of cross hairs, arrow keys, and an eight-times larger-than-normal character, you can edit any character and make it look as you want it to. While you see real descenders, you will not be able to print them unless your printer has true descenders as well. You can modify characters to your heart's content, and the printout is not affected. However, if you have a printer that allows downloading character sets, you could use this program to create unique characters.

The program is menu driven and easy to use. The documentation is adequate, consisting of six pages of detailed instructions on the program's application and use. All modified fonts can be saved to tape or disk. The software is supplied on tape but can easily be transferred to disk. It works on all versions of *Telewriter-64* and is not copy protected, so backup copies can be made. I liked this program. It did what it is was advertised to do and won't leave an empty spot in your wallet.

(CMD Micro, Computer Services Ltd., 10447 124 St., Edmonton, Alberta, Canada T5N 1R7. Distributed in the U.S. by Saguaro Software, P.O. Box 1864, Telluride, CO 81435, cassette $14.95, plus $2 S/H)

— Jerry Semones

ASSEMBLY LANGUAGE PROGRAMMING for the TRS-80 COLOR COMPUTER

At last - The book exclusively for you and your CoCo !! You've learned BASIC and are now ready to learn assembly language programming. This hands-on guide begins with the basics and progresses to the expert level; revealing programming conventions and techniques and all the internal capabilities of the TDP-100, CoCo 1 and 2. At every step of the way are illustrations, sample programs, and plain English explanations. All sample programs are shown as assembled with Radio Shack's EDTASM+ cartridge. Plus, a complete chapter explains how to use all EDTASM+ capabilities. This book describes how to write subroutines, interrupt handlers, programs that control the graphics display modes, cassette, disk, keyboard, sound, joysticks, serial I/O, interrupts, and use of ROM resident subroutines. Not only is the MC6809E microprocessor described, but also the video display generator (VDG), peripheral interface adapters (PIA), and how they all work together. This book is suitable as a high school or college textbook.

CHAPTERS: The Binary Number System - Memory and Data Representation - Introduction to MC6809E Microprocessor - Addressing Modes of the MC6809E - MC6809E Instruction Set - Assembly Language Programming with EDTASM+ - Assembly Language Programming - Assembly Language and Extended Color BASIC - Internal Control and Graphics - Technical Details.

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Modest Packaging Can't Hide *SCRDMP10*'s Usefulness

Let's get the negative thing out at the beginning. *SCRDMP10* comes modestly packaged on an average quality commercial cassette. The documentation accompanying the cassette is two paragraphs that very briefly describes what the program does and how to get it up and running.

But don't be discouraged and don't be fooled. Once it's fired up, you discover that behind those humble trappings is one slick screen dump program that reproduces a PMODE 3 or 4 screen through a DMP printer with a minimum of fuss and bother.

SCRDMP10 comes on a cassette in the form of a BASIC driver. When the program is run, you are provided with a pair of prompts. The first is for your printer's graphics control codes (ENTER defaults to those of the DMP-100, which worked fine with my DMP-110). The second prompt asks for a loading address, and here you may run into a snag, since the documentation is neither clear nor helpful (hint: Begin the routine from a cold start — `POKE 113,0:EXEC40999`, and if you have a DMP-100 or one of its cousins, try entering 14848). The actual ML program is poked in and you are given the choice of saving it to tape or disk.

Now you're home free. After loading or drawing the graphics screen, simply enter EXEC. You are prompted for the choice of background color (to reverse the printout) and the Baud rate for the printer. Position the paper at the top of the head, push ENTER, and away you go! It's as easy as that.

As soon as the print is finished, you are offered the choice of rerunning (again with the option of reversing the colors) or returning to BASIC to draw or enter another graphics screen and repeat the cycle.

The finished format is six and a half by seven inches sideways, and, as might be expected, there is a degree of distortion in the printout, relative to what is on the screen. I also discovered that I could not copy the ML program between drives. So, unless you are luckier than I, you'll have to use the Backup routine and then copy whatever else you might want on the disk with it. I'm not into drawing with my CoCo, but I did try the program as a tool for printing out graphs generated by Tom Mix's *Teachers Data Base* and billboards of some other pieces of software in my library. I had no problems at all.

The main problem with this software is its poor documentation. If you can get by that and the modest packaging, you have a quick and easy, black-and-white screen dump.

(Neat-O Software, Rt. #3, Box 205, Kingsport, TN 27664, cassette $10 plus $2 S/H)

— John Ogasapian

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Algebra Simplifies and Solves Equations

Algebra, to the best of my knowledge, is the only program that solves equations as *equations*, rather than numerically, although it sometimes says zero is one solution to a particular equation, even while it continues to complete the solution algebraically.

It is somewhat difficult to describe just what it does but a few examples may help make it clear.

If you enter `(X^2-6X)^2-2(X^2-6X)=35`, *Algebra* displays `X^4-12X^3+34X^2+12X-35`. Enter `3-X^2=2X^2+1`, and you get `3X^2-2=0`.

`5X-2X^2=2` produces `-2X^2+5X-2`; ready to substitute into the standard binomial solution (very hard to write in a recognizable form here, but which goes like this: -B plus or minus the square root of B squared, minus 4AC, all divided by 2A; a formula that stirs memories).

Here is an equation generated by the computer (the previous ones came from a math text): `(F+A-(C-E)-B)*E*A=0`; one solution is `A=0` and the general solution is `A=B-E-F+C`.

Here is one last equation, this one also generated by the computer, which I did not verify: `C/(C+F*B/((F+E-C)/(C+D)))=0` and the solution is `C=0` and `C=E+F`. I spent about 10 minutes on this one and gave up!

Briefly put, *Algebra* simplifies or solves certain equations for any specified variable.

The only changes the user must make to his input equation is to specify every number as a letter, e.g., 23X-3Y must be written as AX-BY because the program treats everything, numbers included, as string variables.

If you don't change all numbers to letters, you often get incorrect-appearing solutions because the answer is written as "ABX" or something similar and, if 'A' and 'B' are left as numbers, you could get something like "12X" when the correct answer is "2X" (1 times 2X).

By specifying the numbers as letters, it is always obvious that the numbers are to be multiplied in the final answer.

This is not made clear in the documentation and led to my initial conclusion that there was something wrong with the program (there wasn't).

When starting the program you select three different speeds which turn out to be our old friends, the CoCo speed pokes. These pokes don't work with all CoCos but will work with most and really speed up the operation of this program.

On normal speed I could always solve the equation faster than the computer, and I even kept up with it at high speed, but I am certain my accuracy would suffer if I solved several equations in a row, a problem the computer doesn't have.

The program's author is currently translating this program into machine language, which should greatly speed up execution, although it is now faster than many people who are inexperienced with this sort of problem.

The new version should be sent to the purchasers of the BASIC version when completed.

After selecting the speed the computer can handle, you either enter an equation to solve and then specify which variable to solve for, or you have the computer generate random equations and solve them as a demonstration.

Don't run the auto equation generator on the fastest speed. If you do, you won't be able to tell what is happening. If you get "stuck" in the fastest speed (where the display is garbage during calculations), press the BREAK key and rerun the program. Even though the screen is scrambled, this restarts the program without using the Reset button. When running your own equation in the fastest speed, the program stops at the end of a solution.

I found no bugs in this program and am impressed with the idea behind it.

I have seen better documentation but I can't remember ever seeing worse. The bad grammar, poor spelling, lack of information and generally sloppy appearance of the brief documentation that comes with this fine program are discouraging but shouldn't prevent you from purchasing the product because the program itself is very easy to use.

This is a very interesting program, probably unique in its function, that deserves attention. With some changes to the documentation this would be a fine program for anyone who has the need to solve linear equations or convert higher order equations to a form that can then be looked up in various tables.

It is a bargain and so easy to use that most people will find the instructions more of a minor annoyance than an obstacle. This program isn't flashy or complicated to use; it just sits there and lets your CoCo perform a task it has never been able to do before.

Algebra is the answer to many students' prayers for a program that would "really solve" some of those jumbled masses of numbers and letters that teachers always assign as homework.

The copy of *Algebra* that I received was not copy-protected and after starting the review I was informed that the price had been reduced to $19.95, a giveaway price for this innovative piece of software. At this price I urge anyone with an interest in programming, or any use for this sort of program to buy a copy.

(M F Estes Softhead Co., P.O. Box 335, Elba, NY 14058, requires 32K, cassette or disk $19.95 plus $2.50 S/H)

— John McCormick

Hint . . .

Heads or Tails?

Have you ever wanted to devise a simple "odds/even" or "heads/tails" utility program? If so, this might help:

```
10 RND(2)-1              (YIELDS 0 OR 1)
20 RND(2)>1              (YIELDS 0 OR -1)
30 ((RND(2)>1)*2+1       (YIELDS 1 OR -1)
```

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Programs from Our Past June Issues:

June 1985 (Sound/Music Issue) — *Piano Note Tutor*, a tutorial on the notes of the piano keyboard; *Minute Waltz*, a music program that brings classical composer, Frederick Chopin up to date; *Name That Song*, a game to test music and memory skills; *Multo of Mars*, a graphics game to learn multiplication; *Chopper Assault*, an arcade game of action; *Analog-To-Digital*, a sound synthesis program to put your voice into memory; *Simplifying the SOUND Command*, a tutorial on saving keystrokes and memory; *Animatic*, a demonstration program to ease the writing of animated graphics; *CoCo Chronograph*, a hardware/software project to add a real-time clock to CoCo; *Hi-Q*, a challenging puzzle peg game of skill; *Super Disk Charger*, a utility to put the "turbo" in your drives; plus 17 additional programs.

June 1984 (Music Issue) — *Tone Row*, a tutorial on 12 note/12 pitch composing; *Music+*, a music synthesis program for composing in four part harmony; *Room Layout*, a home utility to help rearrange furniture; *Election Tabulation*, a vote tallying utility; *Music 1812*, an entertainment program that produces some grand overtures; *Doodler*, a graphics program for CoCo Picassos; *CoCo Classics*, a music program to get a 'Handel' on 'Bach'; *Connect 4*, a game to test your skill; *Guitar Chords*, an aid in producing string music; plus 16 more programs.

Super Duper Utilities Packs a Punch

Utilities are some of the most popular pursuits of the CoCo hobbyist. Human nature drives us to seek new ways of doing things quicker and easier. Our computers provide the opportunity. The new offering from Microcom Software definitely does some new things quicker. *Super Duper Utilities* is supplied on an unprotected disk and is written for a 32K ECB system. The author, Kishore M. Santwani of *500 Pokes Peeks & Execs* fame, has done a good job. He has used his expertise to make CoCo do some pretty handy tasks, which I have listed here:

40K Disk Basic — A utility that gives 64K disk users 40K instead of the usual 32K of memory. Remember, Disk BASIC needs 2K for its own use, so there is only 38K to work with. Two versions are available, one for Disk BASIC 1.0 and one for version 1.1.

Alphadir — This utility reads the disk directory, then sorts and rewrites it in alphabetical order. This is handy for locating program names as your disk library grows larger.

Basic Search — Enables you to find all BASIC lines where a specified string is located. Very handy to find all those high speed pokes, as an example.

Banner Creator — Lets you create a large banner with seven-inch letters. Baud rate is selectable from the menu, ranging from 600 to 9600.

Disk Encryption — Provides password protection for BASIC programs on disk and keeps unauthorized people from accessing them.

EZ Disk Master — Lets you copy, kill and rename disk files, and to determine the starting, ending and executing addresses for ML programs. You can also run and execute programs directly from the menu.

Function Keys — Allows you to program any numeric keys (0-9) with strings of up to 250 characters each. This can be a very helpful feature during programming. For example, you could press a key and automatically insert "print #-2" in the BASIC line.

Graphics Zoom — This utility is very impressive and easy to use. A menu allows you to look at the picture in memory and to select the area to be magnified four times. You can then modify the magnified area using arrow keys to move the cursor and the space bar for turning the cursor on or off and for modifying the picture.

Large Screen Dump — This program dumps PMODE 3 or 4 screen images to your DMP printer. The printout runs sideways and is twice the size of the graphics screen.

List/Dir Pause — I really liked this one! By pressing SHIFT/CLEAR, you can make the list pause in full screens instead of flashing by. A second SHIFT/CLEAR returns to the normal mode.

Mailing List — A handy mailing list right where you need it. You can delete or modify the records and sort by ZIP code. It prints to either screen or printer.

Program Packer — Removes all spaces and REM statements from BASIC programs. Reduces the memory requirements of BASIC programs.

Super Input/Line Input — This is a very useful utility and one which most programmers will love. It modifies the keyboard input routine to allow editing without having to access the EDIT command each time. Load it in and edit directly with a combination of arrow and CLEAR keys.

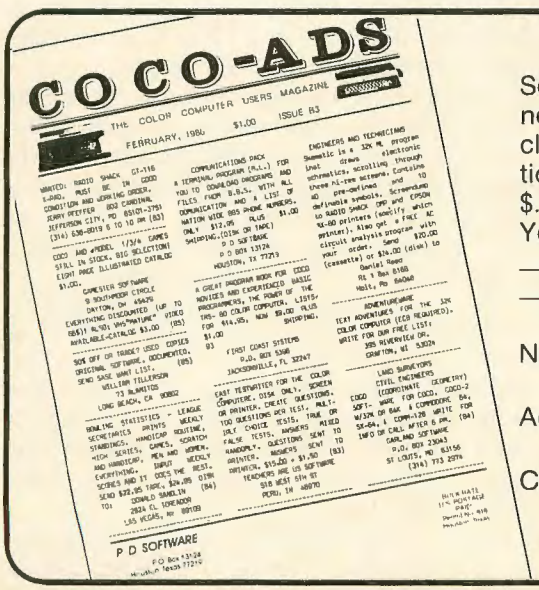
Disk Zapper — This utility allows you to change the data on the disk and recover most of the data in case of a crashed disk.

These utilities are useful and the fact that they are all on one disk makes this program even more appealing. However, in most cases, the user must type in a short BASIC line before actually using the utility.

But, they all work fine and the software is worthy of consideration. It offers helpful utilities at a reasonable price.

(Spectrum Projects, Inc., P.O. Box 21272, 93-15 86th Drive, Woodhaven, NY 11421, $29.95 plus $3 S/H)

— Jerry Semones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Converting ASCII text from MS-DOS disks to CoCo disks

The Great Transformation

By Marty Goodman

Much as we love the CoCo, the fact is the IBM PC (and its clones) running Microsoft Disk Operating System (MS-DOS) is by far the most commonly used personal microcomputer for business. Many of you may use one at work, or have friends who use them.

This article is intended to provide you with a means of converting ASCII text files on a disk created using an MS-DOS computer into ASCII text files on a Color Computer-type disk. Next month, a companion article will provide you with the means of creating an MS-DOS-type disk on your Color Computer and the means to write CoCo text files to such a disk.

System Requirements

A 64K Color Computer with Disk Extended BASIC (versions 1.0 or 1.1) and two disk drives are required for these programs. Two drives are needed to allow the file conversions to occur at a reasonable rate of speed. That is why no attempt was made to write this utility for single-drive systems.

The disk drives must be capable of fully accessing 40 tracks. There is no way around this; MS-DOS uses all 40 tracks. Most disk drives sold by third-party suppliers will access 40 tracks, as do most Tandy disk drives manufactured over the last couple of years. Most of the full-height drives Tandy sold in white cabinets will access 40 tracks. All of the half-height drives Tandy has been selling are capable of 40-track operation.

The Problem of File Conversion

The Color Computer differs widely from the IBM PC. The CoCo uses disks formatted with 35 tracks and 18 256-byte sectors per track; the PC uses 40 tracks with nine 512-byte sectors per track. The CoCo uses single-sided disk drives; the PC uses double-sided disk drives. The CoCo uses a Western Digital or Fujitsu brand disk controller chip; the IBM PC uses a NEC disk controller chip. The CoCo uses the Radio Shack Disk BASIC operating system; the PC uses MS-DOS. All of these differences cause problems.

The fact that many IBM PC word processors store files in a form that is not exactly ASCII text causes further complications. You simply have to make sure the files you wish to read on the IBM PC-type disk are pure ASCII text. Most programs that do not normally use pure ASCII for text storage provide, as an option or separate conversion program, the means of turning their file format into pure ASCII.

Working in our favor is the fact that both computers use the same size disk, that Microsoft wrote the code for both MS-DOS and Disk BASIC, and that the Western Digital (or Fujitsu) disk controller chip can read or write anything written by the NEC controller chip. (Oddly, the NEC chip cannot read everything written by the Western Digital chip. In converting CoCo material to an MS-DOS disk, one has to take the special limitations of the NEC chip into account when formatting a disk for it using the Western Digital chip.)

I have added one feature to my MS-DOS-to-CoCo conversion program. It pokes a little routine into memory that sets the high order bit of all characters in the MS-DOS file to zero before converting them to CoCo disk format. It also strips out line feeds from the MS-DOS file.

Most MS-DOS ASCII and other text files end lines with a carrige return character (Hex $0D), followed by a line

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator on CompuServe and Delphi. Among his numerous hardware and software designs, production and marketing projects, he introduced Graphicom *and* WEFAX *to the CoCo world. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.*

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feed character (Hex $0A). But CoCo word processors are accustomed to seeing lines ended *only* by the carriage return. Some CoCo word processors automatically remove any line feeds they may find in a file. *Telewriter-64* is one example. However, some CoCo editors (i.e. the editor for Macro 80C) choke on a file if it contains line feeds. In general, when converting text from an MS-DOS system to a CoCo Disk BASIC system, it is useful, sometimes mandatory, to strip off line feeds. The resetting of the high-order bit to zero should help convert *WordStar* and some other type files into ASCII for compatibility with CoCo word processors and editors.

The "filter" routine that does the line feed and high-order bit stripping is executed in Line 5050. If you want to have the file converted without this filter, just delete Line 5050: load the converter program, then before running the program, type 5050 and press ENTER. This deletes Line 5050 and disables the filter. You may want to save the program with that line deleted.

Program Limitations and Idiosyncrasies

There are several limitations with this file conversion program. First, it can only read single-sided disks (because so few CoCo owners use double-sided disk drives). Virtually all MS-DOS users use double-sided disks. However, originally MS-DOS used single-sided disks, and to maintain backwards compatibility, the current versions of MS-DOS have the ability to read and write single-sided versions of MS-DOS disks. In order to create an MS-DOS disk that can be read by a CoCo with single-sided drives, the user must first format a single-sided disk on the MS-DOS machine. Under MS-DOS, do this with Drive B and give the command FORMAT B: /1.

After prompting you to put a blank disk in Drive B, the computer formats a single-sided MS-DOS disk. You must transfer any files you want converted to that disk. Only MS-DOS disks prepared in this manner can be read by this MS-DOS-to-CoCo conversion program. (It is possible to write a conversion utility to read double-sided [normal] MS-DOS disks on the CoCo, but double-sided drives are required.)

MS-DOS supports volume labels and subdirectories. To keep the conversion program simple, I elected not to write code that took either into account. Therefore, the files you wish to transfer *must* be put in the Root directory of the single-sided MS-DOS disk. This program ignores volume labels, subdirectories and killed files, but I do suggest not having any of these things on the disk you are preparing for file conversion.

Files can be of any length, but the computer reads and writes data a sector at a time. To keep the code simple, I made it convert files a sector at a time and let the last sector in each file be fully converted, even if the file is supposed to include only part of that last sector. The result is that it adds some trash at the end of files it converts, although all of the file does get converted. This extra trash often shows up as part of the original file itself. Indeed, that trash will very often be material from just before the end of the file. But if you look a little farther back, you'll see the true end of the file, followed by up to 255 characters of text, which is a repeat of stuff near the end of the file. The extra trash can be edited out with a word processor.

One note for *Telewriter* users: *Telewriter* does weird things when it encounters a caret sign in incoming text. The caret itself is not displayed, and the character following it is lost or altered. I suggest you make sure there are no caret signs in the text you convert. If need be, first edit the text using an MS-DOS-based word processor on your MS-DOS machine.

"I made it convert files a sector at a time . . ."

Users of *VIP Writer* will need to do a little extra work to prepare their files for loading into the word processor. Unfortunately, *VIP* is set up to interpret a null as an end-of-file marker. This MS-DOS-to-CoCo conversion routine doesn't actually remove the line feeds; it converts them into nulls. Because of this, *VIP* loads only the first line of the converted text. The rest is ignored as the null at the end of the line tells *VIP* it has reached the end-of-the-file.

To correct this, *VIP* users need to delete Line 5050 in the main program. This tells the converter not to strip the line feeds. Then, after the conversion is complete, you can do one of two things: 1) Leave the file as is and edit out the line feeds (the hard way), or 2) Run the file through the program in Listing 2 and answer the prompts. This listing strips the line feeds right out of the file.

Using the Program

First, make up your MS-DOS single-sided disk with MS-DOS ASCII text files you want to convert. Be sure to put all files in the Root directory. Be sure the disk does not have a volume label, subdirectories or a killed file. Put that disk in your CoCo's Drive 1. Put a disk with this conversion program *(MS2COCO.BAS)* in Drive 0. Type LOAD "MS2COCO" and RUN. Upon seeing the title page, make sure your specially prepared MS-DOS disk is in Drive 1, then press ENTER. Follow the prompts to view all entries on the root directory of the MS-DOS disk. Select the entry you want to convert by typing its number, then pressing ENTER when asked to confirm that selection.

Be sure you have adequate blank space on the Disk BASIC disk in Drive 0. That disk must be formatted in ordinary format — just follow the prompts. After selecting the file on the MS-DOS disk you wish to convert, you are asked to choose a filename for it as it will appear on the CoCo disk. Note that you are only to enter an eight-letter filename; the program automatically assigns the extension "/TXT."

The speed of file conversion is roughly 2400 Baud. This is accomplished by a sneaky programming trick, the "VARPTR trick." You might wish to examine the code between 5000 and 5200 to see how the VARPTR statement is used to help create a 256-character long string in one fell swoop.

During file conversion some curious numbers appear on the bottom of the screen. These numbers were put there mostly to help debug the program. Going from left to right, they represent the cluster number, track and sector number on the MS-DOS disk that is currently being acted on.

On the right bottom part of the screen you will see a display of the number of bytes that remain to be converted. As the file is converted, that number decreases to zero. The number gives an idea how far along the program is in the process of file conversion. When the program is done converting a file, it prompts with a beep and asks if you are done or if you want to convert another file.

Special thanks go to Don Hutchison (user name DONHUTCHISON on Delphi) for his beta testing of this utility and his help in dealing with line feeds, including the program in Listing 2. Also to Art Flexser (ARTFLEXSER on Delphi), author of ADOS, for his help in suggesting the VARPTR trick and for providing a routine from which Don

derived the line feed-stripper program. Thanks to Cray Augsburg (RAINBOWMAG on Delphi) for his beta testing that revealed the problems to be encountered by users of *VIP Writer*. Extra special thanks go to Fred Cisin, author of *Xenocopy*, who spent hours patiently teaching me about MS-DOS disk file structure.

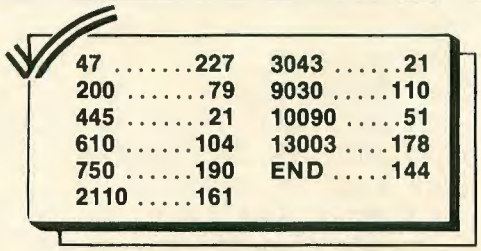
Next month we'll present the other half of this package: a group of programs that allow you to format an MS-DOS-type disk on the CoCo and to write Disk BASIC text files onto that MS-DOS disk using the CoCo. A short simple BASIC program will be included that inserts line feeds into CoCo ASCII files after the carriage return, making such files more palatable to MS-DOS-type text handling programs.

For those with other file conversion needs, please take note of the following:

Mark Data Products makes a program called *CoCo Util* that converts to and from Disk BASIC on an MS-DOS-type machine. (Note that this is an MS-DOS program and runs only on MS-DOS machines.) It does, of course, support double-sided MS-DOS disks. Mark Data Products, 24001 Alicia Parkway, No. 207, Mission Viejo, CA 92691, (714) 768-1551.

D.P. Johnson makes conversion utilities to handle file conversions between OS-9 and MS-DOS disks. These utilities run on the Color Computer under OS-9 and support double-sided disk drives. D.P. Johnson, 7655 S.W. Cedarcrest Street, Portland, OR 97223, (503) 244-8152.

For those with an IBM PC or other MS-DOS machine who wish the ultimate in file conversion utilities, let me recommend *XENOCOPY II*. It runs on nearly all MS-DOS machines, and reads from, writes to and formats over 250 different disk formats. This includes OS-9, Color Computer and hundreds of CP/M variant formats. If you obtain special hardware, this conversion program also supports a number of eight-inch and 3½-inch disk formats. *Xenocopy II* is available from Xenosoft, 1454 6th Street, Berkeley, CA 94710, (415) 525-3113. □



Listing 1: MS2COCO

```
1 CLEAR 512,&H5DFF
2 PCLEAR 4
3 DIM LKS(8)
5 DIM NTRYLC(8)
2Ø IS=&H6Ø:ID=&H6ØØØ 'MS DOS DAT
A SECTOR BUFFER
25 FS=&H62:FD=&H62ØØ 'FAT BUFFER
3Ø DS=&H66:DD=&H66ØØ 'MS DOS DIR
ECTORY BUFFER
35 DEND=&H71FF 'END OF DIRECTORY
4Ø POKE &H7EØØ,&H8E:POKE &H7EØ1,
&H6Ø:POKE &H7EØ2,Ø 'LDX #$6ØØØ
41 POKE &H7EØ3,&HA6:POKE &H7EØ4,
&H84 'LDA Ø,X
42 POKE &H7EØ5,&H81:POKE &H7EØ6,
&HØA 'CMPA #$ØA
43 POKE &H7EØ7,&H26:POKE &H7EØ8,
&HØ3:POKE &H7EØ9,&H4F 'BNE $7EØC
  CLRA
44 POKE &H7EØA,&H2Ø:POKE &H7EØB,
&HØ2:POKE &H7EØC,&H84:POKE &H7EØ
D,&H7F  'BRA $7EØE  ANDA #$7F
45 POKE &H7EØE, &HA7:POKE &H7EØF
,&H8Ø  'STA ,X+
46 POKE &H7E1Ø,&H8C:POKE &H7E11,
&H62:POKE &H7E12,&HØØ  'CMPX #$6
2ØØ
47 POKE &H7E13,&H25:POKE &H7E14,
&HEE:POKE &H7E15,&H39 'BCS $7EØ3
  RTS
49 REM DELETE STEP 5Ø5Ø TO KILL
THE FILTER.
6Ø H=PEEK(&HCØØ4):L=PEEK(&HCØØ5)
:DKON=256*H+L
1ØØ CLS:PRINT@32," MS DOS TO COC
O TEXT FILE XFER"
1Ø5 PRINT" FOR SINGLE SIDED MS D
OS DISKS"
11Ø PRINT:PRINT" (C) MARTY GOODM
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```
AN JAN 1, 1986":PRINT
115 PRINT"FOR EITHER 8 OR 9 SEC
/ TRK."
12Ø PRINT"ONLY ROOT DIRECTORY FI
LES CAN"
125 PRINT"BE CONVERTED.  FORMAT
THE DISK"
13Ø PRINT"YOU WILL PUT THE MS DO
S FIES"
135 PRINT"ON USING THE COMMMAND:
":PRINT
14Ø PRINT" FORMAT B: /1"
145 PRINT:PRINT" PLACE SINGLE SI
DED MS DOS DISK"
15Ø PRINT"   IN DRIVE 1 AND TAP
ENTER";
19Ø IF INKEY$ <> CHR$(13) THEN G
OTO 19Ø
2ØØ REM READ IN FIRST SECTOR OF
FAT
21Ø POKE &HEA,2:POKE &HEB,1:POKE
 &HEC,Ø:POKE &HED,2:POKE &HEE,FS
:POKE &HEF,Ø
22Ø EXEC DKON
23Ø IF PEEK(&HFØ)<>Ø THEN GOTO 9
ØØØ
3ØØ REM CHECK FOR 8 VS 9 SECTOR
PER TRACK
31Ø GN=Ø:GOSUB 15ØØØ:T=CV AND 15
32Ø TS=Ø
33Ø IF T=&HE THEN TS=8
34Ø IF T=&HC THEN TS=9
35Ø IF TS=8 THEN GOTO 4ØØ
36Ø IF TS=9 THEN GOTO 45Ø
37Ø CLS:PRINT@256-29,"WRONG KIND
 OF MS DOS DISK"
38Ø PRINT" TAP ENTER TO RESTART
PROGRAM"
39Ø IF INKEY$<>CHR$(13)GOTO 39Ø
395 GOTO 1ØØ
4ØØ REM INPUT 8 SEC /TRK DIRECTO
RY
41Ø FOR N=4 TO 7
42Ø POKE &HED,N
43Ø POKE &HEE,DS+(2*N)-8
435 EXEC DKON
44Ø IF PEEK(&HFØ)<>Ø THEN GOTO 9
ØØØ
445 NEXT N
447 GOTO 5ØØ
45Ø REM INPUT SECOND FAT SECTOR
AND ALL OF DIRECTORY
455 FOR N= 5 TO 9
46Ø POKE &HED,N
465 POKE &HEE,DS+(2*N)-12
47Ø EXEC DKON
```


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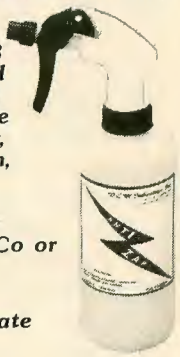

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```
475 IF PEEK(&HFØ)<>Ø THEN GOTO 9
ØØØ
48Ø NEXT N
49Ø GOTO 5ØØ
5ØØ REM PUT DIR ON SCREEN
51Ø K=Ø:LKS(Ø)=Ø:Z=Ø
515 REM LOOP
52Ø CLS:PRINT@8,"DIRECTORY LISTI
NG"
53Ø PRINT@64,"   FILENAME.EXT
  SIZE"
54Ø GOSUB 13ØØØ
55Ø IF FE=Ø THEN GOTO 7ØØ
555 IF Z=Ø THEN GOTO 75Ø
56Ø F$="M" 'MIDDLE OF DIR
57Ø PRINT@512-96,"   ENTER CHOIC
E NUMBER OR"
58Ø PRINT"   UP OR DOWN ARROW TO
 SEE"
59Ø PRINT"   PREVIOUS OR NEXT CH
OICES";
595 F$="M"
6ØØ Z=Z+1:LKS(Z)=K
61Ø A$=INKEY$
615 IF A$="" THEN GOTO 61Ø
62Ø IF A$=CHR$(1Ø) THEN GOTO 68Ø
625 IF A$=CHR$(94) THEN GOTO 66Ø
627 IF VAL(A$)=Ø THEN GOTO 61Ø
63Ø IF VAL(A$)>Q THEN GOTO 61Ø
635 CLS:VV=VAL(A$)-1:GOSUB 16ØØØ
:GOSUB 17ØØØ
64Ø PRINT@32,"YOU HAVE CHOSEN:"
645 PRINT:PRINT NAM$,FZ
65Ø PRINT:PRINT"HIT ENTER TO PRO
CEED, OR"
652 PRINT"ANY OTHER KEY TO RETUR
N TO MENU."
656 A$=INKEY$:IF A$="" GOTO 656
657 IF A$=CHR$(13) THEN GOTO 2ØØ
Ø
659 Z=Z-1:K=LKS(Z):GOTO 515
66Ø IF FE=Ø THEN GOTO 61Ø
662 K=LKS(Z):GOTO 515
68Ø IF Z=1 THEN GOTO 61Ø
682 Z=Z-2:K=LKS(Z): GOTO 515
7ØØ PRINT@512-96,"   END OF DIRE
CTORY"
71Ø PRINT"   ENTER SELECTION OR
DOWN ARROW"
72Ø PRINT"   TO SEE PREVIOUS PAG
E";
73Ø GOTO 6ØØ
75Ø PRINT@512-96,"   TOP OF DIRE
CTORY"
76Ø PRINT"   ENTER SELECTION OR
UP ARROW";
```

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"I LOVE ADOS! . . . A GENUINELY FIRST RATE PRODUCT." Color Micro Journal, February 1985

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```
78Ø PRINT"   TO SEE MORE ENTRIES
";
79Ø GOTO 6ØØ
2ØØØ REM FILE TRANSFER SECTION
2Ø2Ø HCLU=4Ø*TS
2Ø3Ø CLS:PRINT@32,"PUT COCO DISK
 IN DRIVE Ø"
2Ø4Ø PRINT"AND INPUT A FILE NAME
"
2Ø45 PRINT"USE UP TO 8 LETTERS A
ND"
2Ø5Ø PRINT"DO NOT USE AN EXTENTI
ON!"
2Ø6Ø PRINT:INPUT CFN$
2Ø7Ø IF CFN$="" THEN GOTO 2Ø3Ø
2Ø75 IF LEN(CFN$)>8 THEN GOTO 2Ø
3Ø
2Ø8Ø OPEN "O",1,CFN$+"/TXT:Ø"
2Ø9Ø CURCLU=BC
2Ø92 IF TS=8 THEN QQ=5
2Ø93 IF TS=9 THEN QQ=7
2Ø95 ZCLU=INT (FZ/512)+1
2Ø97 CLS:PRINT@256-32,"   NOW TR
ANSFERRING THE FILE"
2Ø98 PRINT@512-96,"CLUSTER TRACK
 SECTOR #BYTES"
21ØØ FOR M=1 TO ZCLU
211Ø IF CURCLU>HCLU THEN M=M+1:G
OTO 226Ø
212Ø X=CURCLU+QQ:T=INT(X/TS):S=X
```


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```
-TS*T+1
213Ø PRINT@48Ø+2,CURCLU;:PRINT@4
8Ø+2Ø,FZ-(512*(M-1));
214Ø GN=CURCLU:GOSUB 15ØØØ:CURCL
U=CV
22ØØ GOSUB 5ØØØ
221Ø IF CURCLU=Ø THEN GOTO 19Ø
222Ø IF CURCLU>HCLU THEN GOTO 22
5Ø
223Ø NEXT M
224Ø GOTO 3ØØØ
225Ø IF CURCLU=&HFFF THEN M=M+1
226Ø NEXT
227Ø GOTO 3ØØØ
3ØØØ PRINT #1,CHR$(&HØD);
3ØØ5 PRINT#1,CHR$(&H1A);
3Ø1Ø CLOSE
3Ø15 PRINT@48Ø+2Ø,"     ";:PRINT
@48Ø+2Ø,LB;
3Ø2Ø SOUND 1ØØ,1Ø
3Ø3Ø PRINT@256-32,"          TRAN
SFER DONE          "
3Ø4Ø PRINT" TAP ENTER TO TRANSFE
R MORE  "
3Ø43 PRINT" TAP ANY OTHER KEY TO
 EXIT"
3Ø45 A$=INKEY$
3Ø5Ø IF A$="" THEN GOTO 3Ø45
3Ø6Ø IF A$=CHR$(13) THEN GOTO 1Ø
Ø
3Ø7Ø CLS:END
5ØØØ REM INPUT SECTOR TO BUFFER
5Ø1Ø PRINT@48Ø+9,T;:PRINT@48Ø+15
,S;
5Ø2Ø POKE &HEA,2:POKE &HEB,1:POK
E &HEC,T:POKE &HED,S:POKE &HEE,I
S:POKE &HEF,Ø
5Ø3Ø EXEC DKON
5Ø4Ø IF PEEK(&HFØ)<>Ø THEN GOTO
9ØØØ
5Ø5Ø EXEC &H7EØØ
5Ø6Ø A$=""
5Ø65 P=VARPTR(A$)
5Ø7Ø POKE P,128
5Ø75 FOR Y=Ø TO 3
5Ø8Ø Z=ID+Y*128
5Ø85 GOSUB 52ØØ
5Ø9Ø POKE P+2,MSB:POKE P+3,LSB
51ØØ PRINT#1,A$;
511Ø NEXT Y
513Ø RETURN
52ØØ MSB=INT(Z/256)
521Ø LSB=Z-MSB*256
522Ø RETURN
9ØØØ REM PRINT DISK I/O ERROR
9Ø2Ø CLS:PRINT@256-32,"      DIS
K ERROR ... SORRY!"
9Ø3Ø PRINT" TAP ENTER TO RESTART
 PROGRAM"
9Ø4Ø IF INKEY$<>CHR$(13) GOTO 9Ø
4Ø
9Ø5Ø GOTO 1ØØ
1ØØØØ REM GET INFO FROM DIR
1ØØØ1 REM NT IS ENTRY NUMBER
1ØØØ2 REM NAM$=FILENAME ON EXIT
1ØØØ3 REM F1=7 IF INVALID ENTRY
1ØØØ4 REM F1=Ø IF VALID ENTRY
1ØØØ5 REM F1=1 IF SUBDIR
1ØØØ6 REM F1=2 IF KILLED FILE
1ØØØ7 REM F1=3 IF FREE (END  OF
DIR)
1ØØØ8 REM F1=4 IF ENTRY POINTS
BEYOND THE BUFFER SPACE.
1ØØØ9 REM BUFFER SPACE IS FROM
$66ØØ THRU $71FF (6 SECTORS)
1ØØ1Ø REM OR 96 TOTAL ENTRIES.
1ØØ11 RE A=ATTRIBUTE BYTE
1ØØ15 ZZZ$=CHR$(&HE5)+STRING$(7,
CHR$(&HF6))
1ØØ2Ø DLOC=DD+32*NT
1ØØ3Ø IF DLOC>&H71FF THEN F1=4:R
ETURN
1ØØ4Ø FB=PEEK(DLOC)
1ØØ6Ø IF FB=Ø THEN F1=3:RETURN
1ØØ7Ø NAM$=""
1ØØ8Ø FOR N=Ø TO 7
1ØØ9Ø NAM$=NAM$+CHR$(PEEK(DLOC+N
))
1Ø1ØØ NEXT N
1Ø1Ø4 IF NAM$=ZZZ$ THEN F1=3:RET
URN
1Ø1Ø5 IF FB=&HE5 THEN F1=2 :RETU
RN
1Ø11Ø NAM$=NAM$+"."
1Ø12Ø FOR N=8 TO 1Ø
1Ø13Ø NAM$=NAM$ +CHR$(PEEK(DLOC+
N))
1Ø14Ø NEXT N
1Ø145 F1=Ø
1Ø15Ø A=PEEK(DLOC+11)
1Ø155 T=A AND &H1Ø:IF T<>Ø THEN
F1=1
1Ø16Ø T=A AND &HØ8:IF T<>Ø THEN
F1=7
1Ø2ØØ RETURN
11ØØØ REM FOR GIVEN ENTRY NUMBER
11ØØ1 REM GET FILE SIZE (FZ)
11ØØ2 REM AND BEGIN CLSTR (BC)
11Ø1Ø DLOC=DD+NT*32
11Ø2Ø FZ=PEEK(DLOC+28)+PEEK(DLOC
+29)*256+PEEK(DLOC+3Ø)*65536+PEE
K(DLOC+31)*65536*256
11Ø3Ø BC =PEEK(DLOC+26)+PEEK(DLO
C+27)*256
11Ø4Ø RETURN
13ØØØ REM GET 8 DIR ENTRIES
```

```
13ØØ2 REM Q=VALID ENTRY COUNT
13ØØ3 REM K=KOUNT OF ALL ENTRIES
13ØØ4 REM FE=255 IF MORE NTRIES
13Ø1Ø Q=Ø:FE=255
13Ø13 SCST=128
13Ø15 REM LOOP
13Ø3Ø NT=K
13Ø4Ø GOSUB 1ØØØØ:GOSUB 11ØØØ
13Ø5Ø IF F1<>Ø GOTO 132ØØ
131ØØ NTRYLC(Q)=DLOC
131Ø7 PRINT@SCST+32*Q,Q+1
1311Ø PRINT@SCST+3+Q*32,NAM$
13115 PRINT@SCST+19+Q*32,FZ
1312Ø Q=Q+1
132ØØ K=K+1
1321Ø IF F1=3 THEN FE=Ø:RETURN
1322Ø IF DB+32*K>DEND THEN FE=Ø:
RETURN
1323Ø IF Q>7 THEN RETURN
1324Ø GOTO 13Ø15
15ØØØ REM READ FAT
15ØØ1 REM GN =CLUSTER ENTRY#
15ØØ2 REM GN=Ø TO 44Ø
15ØØ3 REM CV = CONTENTS OF THE
CLUSTER NUMBER REQUESTED
15Ø1Ø GIN=INT(GN/2)
15Ø2Ø GCN=3*GIN
15Ø3Ø GF=GN-2*GIN
15Ø4Ø B1=PEEK(FS*256+GCN)
15Ø5Ø B2=PEEK(FS*256+GCN+1)
15Ø55 B3=PEEK(FS*256+GCN+2)
15Ø6Ø N1=(B1 AND &HFØ)/16
15Ø7Ø N3=(B2 AND &HFØ)/16
15Ø8Ø N5=(B3 AND &HFØ)/16
15Ø9Ø N2=B1 AND &HF
151ØØ N4=B2 AND &HF
1511Ø N6=B3 AND &HF
1512Ø IF GF=Ø GOTO 152ØØ
1515Ø CV=N3+N6*16+N5*256:RETURN
152ØØ CV=N2+N1*16+N4*256:RETURN
16ØØØ DLOC=NTRYLC(VV):GOTO 1ØØ3Ø
17ØØØ DLOC=NTRYLC(VV):GOTO 11Ø2Ø
```


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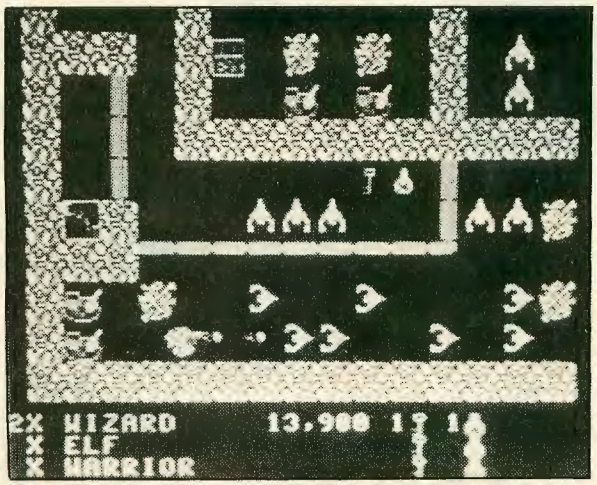
All of these programs carry the Rainbow Seal.

Listing 2: STRIPLF

```
1Ø 'LINEFEED STRIPPER
2Ø 'BY DON HUTCHISON [7Ø425,1225
]
3Ø 'ADAPTED FROM A PROGRAM BY AR
T FLEXSER, MARCH 1986
4Ø '
5Ø 'MODIFIES ASCII FILES BY DELE
TING THE LINEFEEDS
6Ø '
7Ø CLEAR 2ØØ,&H7DFF
8Ø FOR I=&H7EØØ TO &H7E29: READ
P$:POKE I,VAL("&H"+P$): NEXT
9Ø DATA 8D,A,8D,1D,81,A,27,F8,8D
,9,2Ø,F4,C6,1,D7,6F,7E,C5,97
1ØØ DATA C6,2,D7,6F,AD,9F,AØ,2,F
,6F,6E,9F,AØ,2,D,7Ø,27,4,F,6F
11Ø DATA 32,62,39
12Ø IF PEEK(&HCØØ4)<>&HD6 THEN P
OKE &H7E12,&HC4 'For 1.1 ROM
13Ø CLS: PRINT: PRINT: PRINTTAB(
8)"LINEFEED STRIPPER": PRINT
14Ø LINEINPUT "NAME OF INPUT FIL
E: ";I$
15Ø LINEINPUT "NAME OF OUTPUT FI
LE: ";O$
16Ø OPEN "I",#1,I$
17Ø OPEN "O",#2,O$
18Ø EXEC &H7EØØ
19Ø CLOSE #2: CLOSE #1
2ØØ END
```

DIECOM PRODUCTS

GANTELET

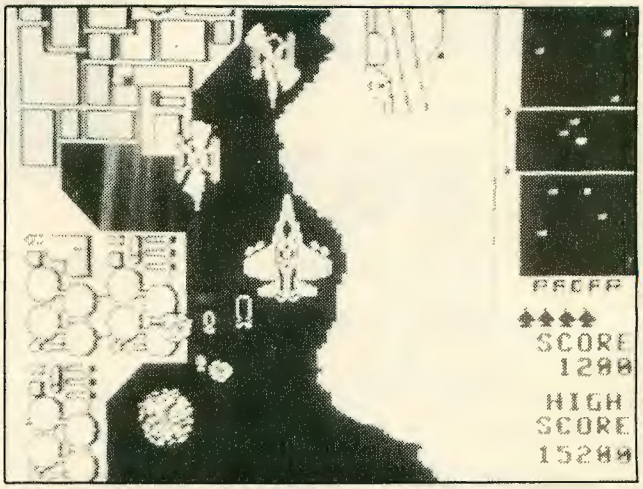


One, two or even three people can play Gantelet at the same time. You and your friends travel through the many levels in search of an exit to the next level. Avoid the Ghosts and other creatures that are out to stop you in your quest. Collect keys to open doors, treasures and magic potions to aid you in your battle. Watch out for hidden traps as you frantically search for the exit to the next level.

64 k required
tape or disk

$28.95 U.S.
$38.95 Can.

Mission: F-16 ASSAULT

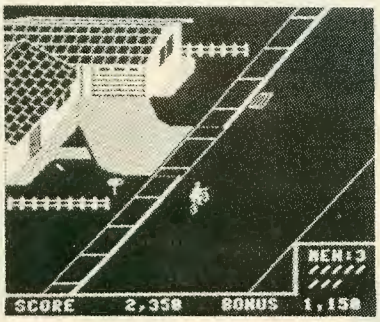


Fly your plane over land and water while avoiding enemy missiles, planes and helicopters attacking from the top and bottom of the screen. Use your radar to track objects as they approach the main screen. Bomb oil refineries, airports and destroy planes before they can take off from the airports. Watch out for missiles fired from hidden missile silos on the ground. Dozens of screens of detailed terrain plus increasing difficulty make this a great game for everyone.

64 k and joystick required
tape or disk

$28.95 U.S.
$38.95 Can.

PAPER ROUTE



As a paper boy, you ride your bike along your route delivering papers to your customers. Break customers' windows or damage their property and they will cancel their subscriptions! Earn bonus points by damaging non-subscribers' property. Avoid pedestrians, cars, and maybe even a mad dog in your attempt to deliver all of your papers! Detailed graphics and lots of surprises make this game a real challenge for everyone.

64 k
joystick required
tape or disk

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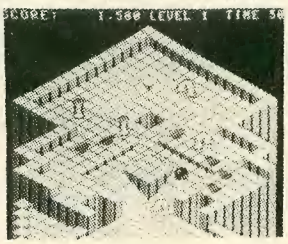
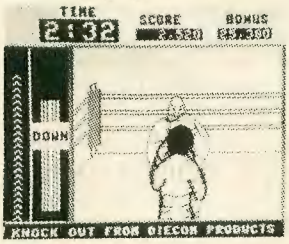
MARBLE MAZE



Move your marble around the mazes in your search for the finish line! Avoid marble eaters, acid puddles and other creatures that inhabit the mazes. Eight different levels and great graphics make this game a must for your collection.

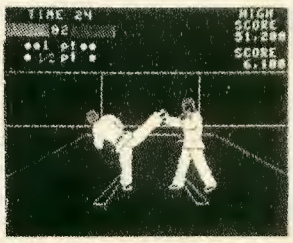
joystick required

KNOCK OUT



Fight against five different boxers in this great boxing game! At first the boxers are easy to knock out, but beware, it gets harder as you move on. The boxers are out to stop you in your quest to become champion of the world. Outstanding graphics make this a must for your collection!

KARATE



Challenge the computer, or a friend to a Karate match! Use various Karate punches and kicks to knock your opponent down and earn points to win the match. When challenging the computer, your opponent's Karate skills increase as you win matches. This game is a challenge for even the expert game player.

joystick required

64 k required **tape or disk** **$28.95** U.S. **$38.95** Can.

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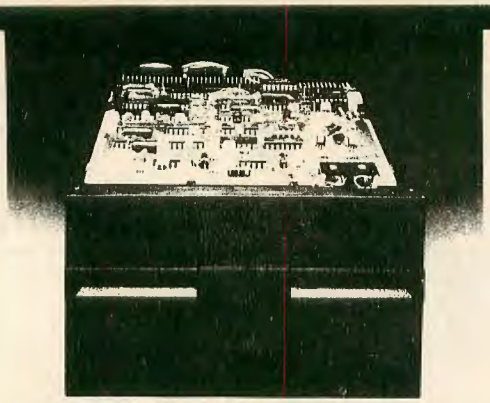

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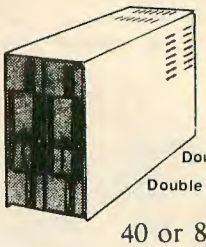

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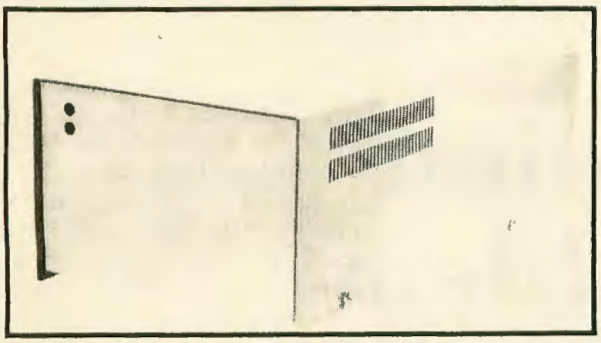

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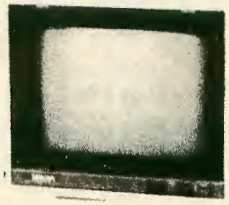

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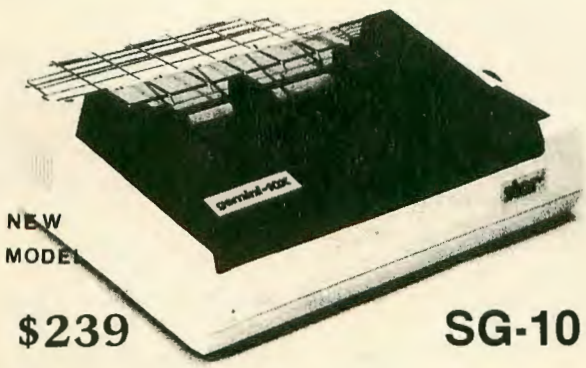

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By Dan Downard
Rainbow Technical Editor

• *I have two questions. My system consists of a CoCo 2 64K, a CoCo 1 NC board upgraded to 64K with dual Radio Shack disk drives (white cases) and their controller, a CMP-130 printer, a Modem I and a Radio Shack cassette recorder.*

1) When I move the disk drives from my CoCo 2 to my CoCo 1, the disk directories display garbage and none of the programs will run, yet when I move the drives back to the CoCo 2 everything works fine. Could this have something to do with the clock speeds of the two CoCos?

2) Is there any way to transfer the Radio Shack Disk BASIC *1.1 ROM to RAM, then automatically print out all the memory locations to my printer? I have the Radio Shack* EDTASM+ *cartridge on disk using Roger Schrag's patch.*

Dean Pace
St. Peters, MO

Dan Downard is an electrical engineer and has been involved in electronics for 26 years through ham radio (K4KWT). His interest in computers began about seven years ago and he has built several 68XX systems.

Most of the people who write, Dean, have just the opposite problem with their disk drives. The older disk controllers will not work with the CoCo 2s due to the lack of 12 volts on the expansion port. As far as your problem is concerned, I suggest replacing the 6809E on your CoCo 1. I had the same problem once and replacing the microprocessor cured it.

As a sidelight, we have been informed that the new disk controllers from Tandy are not capable of reading single-density tracks. FLEX and some protection schemes read and write single-density data on Track 0. The new controllers will not work with this software.

To disassemble Disk BASIC all you need to do is return to the 32K mode by entering Z-BUG and changing memory location $FFDE. This disables the 64K mode and you should be able to read the data directly from ROM. Use the Z-BUG command THC000 DF58. Make sure you are in the Hex input mode first by typing I16.

A Hard Disk is Hard to Find

• *I have Version 02.00.00 of OS-9. It is compatible with either 15-megabyte or 35-megabyte hard disk drives. When I found out this information, I became interested in buying a hard disk drive. I searched through magazines and catalogs trying to find one and came up with nothing.*

Could you please give me any information as to where I could find a 15M or 35M hard disk drive?

Andy Ellinor
Odessa, FL

Andy, it just so happens that Tandy also sells 35-Meg hard drives. Maybe that's why the drivers are set up for these odd values. I'm sure that changing these parameters in the device descriptors will be addressed by one of our OS-9 advocates very shortly.

Mixing Software and Memory Expansion

• *I am considering installing more memory in my CoCo — 128K or 256K. There are several suppliers of these upgrades and I am concerned about their compatibility with software, that I believe, will eventually be available to use this memory. If I install one*

of these upgrades will I be able to use software written for this amount of memory or will I have to have a certain "brand" of memory expansion?

What do you know of the progress being made on this software, such as spreadsheets, word processors or database managers?

David Kincaid
Greenville, SC

David, you hit the crux of memory expansion when you bring up software. So far, I have seen no efforts in the fields you mention. Most memory upgrades come with RAM disk software. All this does is allow the increased memory to act as a super-fast disk drive.

Thunder RAM from Spectrum Projects comes with a built-in ROM using a system of machine language commands/entry points. It's called TDOS and it's a step in the right direction, but still does not easily facilitate the use of longer programs.

Personally, I can't envision a program too large to run on the CoCo if modular programming is used. Maybe the data will not fit in memory now; that is where a RAM disk helps. Just store all of your data in disk files that have fast access.

Terminal Adjustment for OS-9?

• *I have an older 'D' board that was "piggybacked" up to 32K. How do I go about installing 64K so it can be used as a terminal in my OS-9 system? I can remove the 74LS02 and 138 and install sockets if that is necessary.*

Bernie Besherse
Ketchikan, AK

I assume you want a smart terminal, Bernie, since 32K is more than enough for a dumb terminal; 32K is more than enough for a smart terminal, as long as you don't mind a small buffer. What I am getting at is the fact that your terminal program does not have to operate under OS-9 to use it as a remote terminal for OS-9. There are several excellent terminal packages written for Disk BASIC that will do the job.

To modify a 'D' board I suggest obtaining a copy of the May 1984 RAINBOW. There is an article entitled "RAM/ROM Upgrade Roundup" by Ed Ellers [Page 49] that gives instructions for upgrading several types of boards, up to the earlier CoCo 2s.

If you buy your 64K chips from one of our advertisers, they will usually provide installation instructions with your order if requested. Be sure to mention the type of board you have.

No Hope for this Marriage

• *Recently, I experimented with one of my programs. I made a BASIC program that requires the use of a predrawn graphics screen. Every time I work with this program, I first have to load the BASIC program and then* LOADM *the graphics screen. I want only one program to load! I tried to* SAVEM *the program and graphics screen like this:*

```
SAVEM"GRAPHS",1536,30000,1536
```

When I loaded the program, I made a listing perfectly, but when I ran the program, the computer stopped and the listing became lines of garbage. What can I do to SAVEM *and* LOADM *my BASIC program and graphics screen together?*

Eric Bernatchez
Quebec, Canada

Eric, loading a BASIC program also sets pointers in low RAM to tell CoCo where the program starts and stops. There are several methods of packing graphics into a BASIC program, but I would not advise them for extensive graphics usage. Just grin and bear it when you hear your drives purr.

The Secret of Cables and Pins

• *I have a gray CoCo with two vertical disk drives. I also have acquired two additional Drive 0s I would like to use as Drives 2 and 3.*

One of the best kept CoCo secrets seems to be the cable and pin function assignments and the disk drive addressing methods used by Radio Shack for the vertical drives. The local Radio Shack Service Center claims it cannot provide this information.

John NcNeirney
Madison, WI

John, the different drives are selected by a separate pin for each drive. The functions of all of the active pins between the controller and drives are as follows:

Pin	Signal
8	Index/sector
10	Drive select 1
12	Drive select 2
14	Drive select 3
16	Motor on
18	Direction select
20	Step
22	Write data
24	Write gate
26	Track 00
28	Write protect
30	Read data
32	Drive select 4

April Fresh CoCo

• *I read in another magazine that if you combine fabric softener and water in a spray bottle and spray it on the rug around your computer it will stop static electricity. Is this true or not?*

Chris Romance
Massapequa Park, NY

Chris, I heard a rumor to that effect, too, but I'm not a chemist. Maybe one of our readers can confirm this suggestion. It certainly works on your clothes!

Read My Memory

• *I upgraded to 64K, added disk and* Telewriter-64. *Everything worked. I then prefixed* ROMRAM *to a program expecting more memory from* MEM, *but CoCo seemed stuck in 32K. How can I determine the true memory remaining in 64K regime? Is there a* POKE? *Or am I misusing* ROMRAM?

R. Telford
Surrey, British Columbia

Mike, there have been several articles written on this subject, but you are correct — just simply running *ROMRAM* does not give more memory. It just relocates your BASIC ROMs to RAM where they can be changed, moved, etc. I do think you have a bigger buffer with *Telewriter-64* in 64K.

Prompt Printing

• *I have a Radio Shack DMP-100 printer and I print out graphics pictures quite often. But, even when I print them out at 1200 Baud, it still takes a while for a complete picture to print out. Is there any way I can print at a faster speed? I've heard of a serial-to-parallel interface, but what does it do?*

Matthew Coenen
Norwalk, IA

Matthew, the only thing a serial-to-parallel converter does is speed up the data from your CoCo to the printer; it does not allow the printer to print any faster. Instead of sending data at 1200 Baud, you are able to send it at 9600 Baud.

Your technical questions are welcomed. Please address them to: Downloads, THE RAINBOW, P.O. Box 385, Prospect, KY 40059. We reserve the right to publish only questions of general interest and to edit for space and clarity. Due to the large volume of mail we receive, we are unable to answer letters individually.

Your technical questions may also be sent to us through the MAIL section of our new Delphi CoCo SIG. From the CoCo SIG> prompt, pick DELPHI MAIL, then type SEND and address TO: DANDOWNARD.

BARDEN'S BUFFER

The Meaning of Life

By William Barden, Jr.
Rainbow Contributing Editor

The game I'm about to describe is more than a frivolous pastime. For some, it's a challenge in assembly language. For others, the key to unlocking the secrets of evolution. And for yet others, it's a way of generating interesting patterns. It's called "Life," and is an ancient computer game dating back at least 15 years.

Actually, it's not a game in the sense of a person versus computer confrontation. It's more a challenge of finding out how the game works and what the limits are, if any.

The Rules of Life

The rules were laid out by the game's inventor, mathematician John Horton Conway. Martin Gardner, of *Scientific American*'s "Mathematical Games" fame, introduced it in his October 1970 column and provided periodic updates for several years thereafter. For the most part, the descriptions I'm providing come from the *Scientific American* columns. There's a recently published book on "Life" and other topics, called *The Recursive Universe* (William Poundstone, William Morrow and Company, 1985) that makes interesting reading.

Bill Barden has written 27 books and over 100 magazine articles on various computer topics. His 20 years experience in the industry covers a wide background: programming, systems analyzing and managing projects ranging from mainframes to microcomputers.

The rules are deceptively simple. Start with a square matrix like a checkerboard. Each square of the checkerboard is called a cell. The checkerboard can be any width and any height, although something on the order of a CoCo screen (128 by 96) is a good size to start with. Put a pattern on the checkerboard by generating random points or entering points via a BASIC PSET command. The pattern defined is the starting generation.

Now consider each cell in the 128 by 96 matrix defined by the CoCo's screen. If a cell is on, it's considered to be living. Whether or not a cell survives until the next generation is dependent on its immediate neighbors, the eight cells adjacent to the living cell, as shown in Figure 1. We'll call the neighbors A, B, C, D, F, G, H and I.

If the living cell has no neighbors or one neighbor, it dies from loneliness and disappears in the next generation. If the cell has two or three neighbors, it survives until the next generation. If the cell has more than three neighbors, it dies from overcrowding.

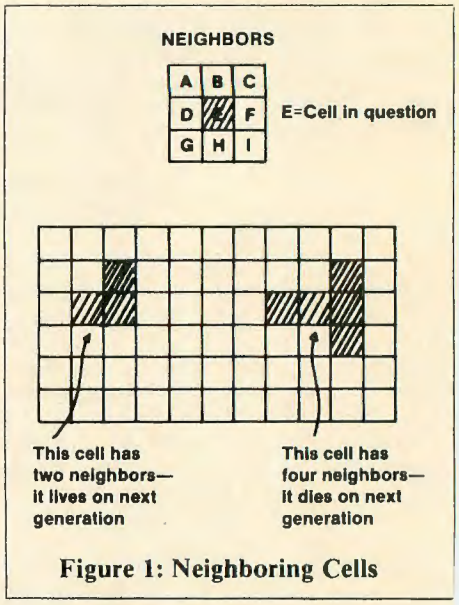

Figure 1: Neighboring Cells

Not only can cells die, but new cells can be born. If an empty cell has three neighbors, the neighbors produce a new cell in the next generation. This only happens if an empty cell exists and there are three of the possible neighbors A, B, C, D, F, G, H and I.

Each generation is produced using these simple rules and there are an unlimited number of generations.

Here's an example. Start with a simple pattern such as the three cells in a straight line, as shown in Figure 2. The

result in generation one is a straight line of three cells at right angles to the first line. This pattern flips back and forth, oscillating in a style reminiscent of a blinker. To "Life" devotees, the pattern is called a blinker.

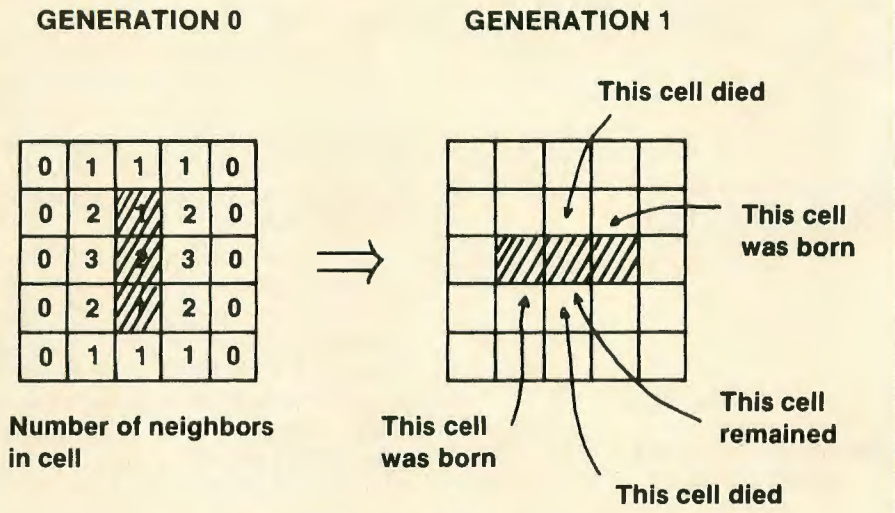

Figure 2: Computing the Next Generation

The Appeal of Life

The interesting thing about "Life" is the unpredictability of the patterns produced. Start with a completely random pattern generated by:

```
1ØØ PMODE 4,1
11Ø SCREEN 1,Ø
12Ø FOR I=1 TO 14ØØ
13Ø PSET(RND(256),RND(192))
14Ø NEXTI
```

and apply the rules of "Life." You'll wind up with a situation analogous to life oozing up out of the primordial slime — a random pattern that produces some organisms that stay around forever and others that produce beautiful designs but die off after a dozen generations or so. Figure 3 shows the tenth generation of a "Life" game generated from 1,400 initial random points, grouped towards the screen center.

The rules of "Life" pose some interesting questions and they had programmers, computer scientists and mathematicians spending millions of dollars of computer time investigating "Life's" patterns. Are there patterns that move? Are there patterns that reproduce without limit? The answer to both of these questions is yes, but it's not immediately obvious to those watching the game for the first time.

A High-Speed Life Generator

To study "Life," programmers and computer scientists use large mainframe computers and displays. One display allows 4,096 by 4,096 cells to be displayed at one time. As a matter of fact, a dedicated system has been built to run "Life" at high-speed so the patterns can be observed and cataloged. Bear in mind this is not a project that is a profound breakthrough in artificial intelligence — it is primarily a fun thing that has some interesting implications. Still, "Life" has a large following.

Figure 3: Sample of Life Generation

A BASIC Life

Listing 1 shows "Life" implemented in BASIC. This BASIC program uses only a 14 by 20 element portion of the screen since BASIC is decidedly slow in producing the next generation. To use this program, enter a number for 'X' from zero to 19 and a number for 'Y' from zero to 13 to define the pattern, and watch the computation. It takes about 52 seconds to produce the next generation. The blinker pattern is defined by entering:

```
10,6
10,7
10,8
-1,-1
```

The two "-1" values terminate the entry and start "Life" processing.

An Assembly Language Life

A 14 by 20 matrix is really not big enough to see the interaction of the different patterns. The point of this column is a full-blown CoCo assembly language program to generate a 128 by 96 single-color version of "Life" on the CoCo (see Listing 2). Using the assembly language program, each generation of "Life" takes about 6.7 seconds. Still slow, but fast enough so you can easily watch the progress from generation to generation. I decided to use the lower resolution PMODE 0, instead of the maximum resolution PMODE 4, which requires four times the computation because there are four times the number of pixels.

The Program Algorithm

Having been through several versions of "Life" on different systems, I knew the program could never be fast enough. For that reason, I gave a lot of thought as to how the program should be implemented.

The first design consideration was the graphics screen. The graphics screen in Disk BASIC starts at location $E00, as shown in Figure 4. If PMODE 0 is used, the resolution of the screen is 128 pixels wide by 96 pixels high. In PMODE 0 and in every single-color graphics mode, one

bit is used to store the color for each pixel. A '1' in the bit means the foreground color is used; a '0' bit means the background color is used. Therefore, in PMODE 0 there's a total of 128 pixels/row x 96 rows = 12,288 pixels = 12,288 bits.

Of course, there are eight bits in a byte, so 12,288 bits/(8 bits/byte) = 1,536 bytes used to store each graphics screen.

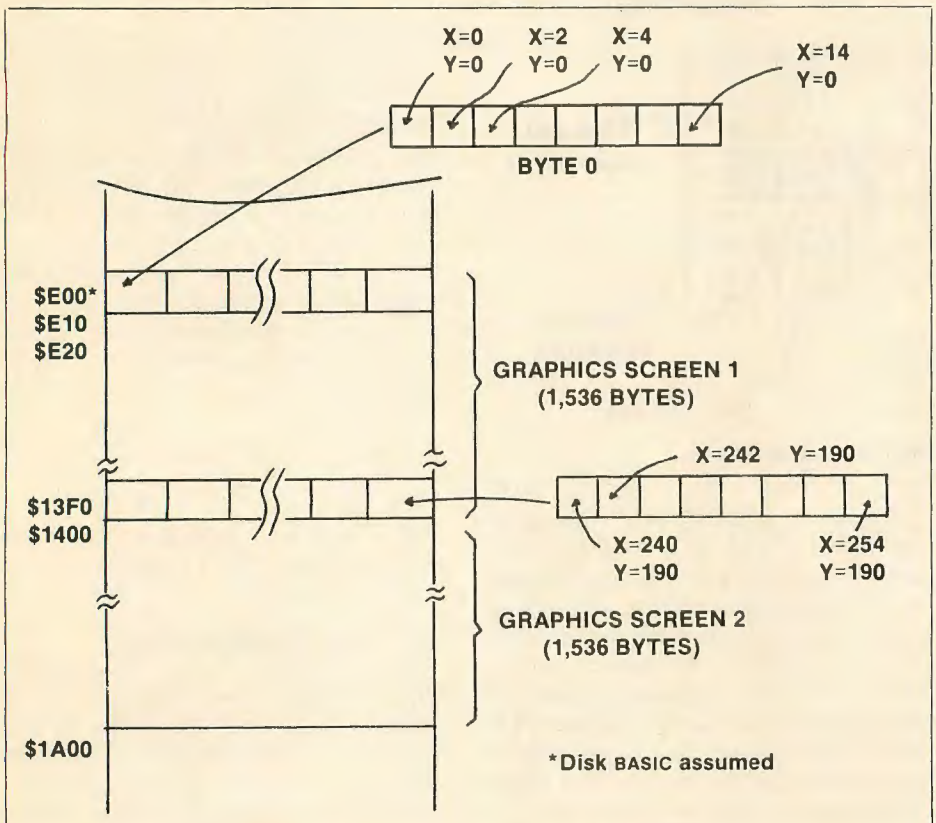

Figure 4: Memory Layout for PMODE 0

The plan I use is to keep the PMODE 0,1 screen as the current screen and update a second screen, the PMODE 0,2 screen. (In the PMODE command, the second parameter specifies the page number, in this case '1' or '2'.)

To do this, I have it scan the current screen one cell (pixel) at a time. For each cell, a count of the neighbors is made, with the corresponding cell in the new screen set or reset according to the rules of "Life." The scan proceeds from right to left across each row, starting at the last row and ending on the first row, as shown in Figure 5.

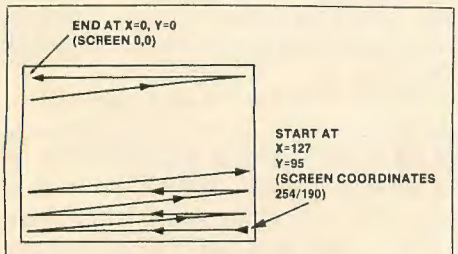

Figure 5: Scanning the Current Page

One other screen design consideration was what is to be done on the screen boundaries. There are two approaches to handling boundary conditions. One approach lets the living cells disappear beyond the screen edges. A second approach treats the whole screen as a "toroid" — a closed universe — as shown in Figure 6. The second approach is followed here. Patterns going off the right reappear on the left, patterns going off the top reappear on the bottom, and so forth.

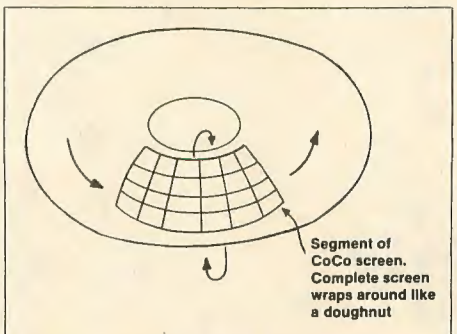

Figure 6: The Closed Universe of the Screen

After each screen scan of 12,288 cells, the second screen is written to the first screen by a quick assembly language subroutine. This makes the update appear almost immediately, avoiding a slow, partial screen update.

The program is divided into three parts: a main loop, a Count Neighbors subroutine and a Get Address subroutine.

Main Loop

The main loop scans through the first screen as shown in Figure 5, starting with the last cell in Row 95 of Column 127. Rows are called 'Y' and are numbered from zero through 95. Columns are called 'X' and are numbered from zero through 127.

The current location is held in variable XY. Note that this is a two-byte variable. The first byte holds 'X' and the second byte holds 'Y'. This variable is initialized with X=127 and Y=95. The loop from MAN005 through the fifth instruction after MAN080 is the main loop of the program, done 128*96 times to process each of the 12,288 cells. Each time through the loop, subroutine GETADD is called to calculate the addresses for the current XY. This is followed by a call to subroutine COUNTN to count the neighbors of the current cell.

After the call to COUNTN, a check is made of the current cell's on/off status. The byte location of the current cell is held in ELOC, a 16-bit pointer set by GETADD. The bit position of the cell within the byte is held by EBIT, an eight-bit variable set by GETADD. A branch is made to MAN040 if the cell is empty.

If the cell is empty, a check of variable COUNT (set by COUNTN) is made. If COUNT=three, the code at MAN010 is called for the "birth." If COUNT<> three, nothing is done.

If the current cell is not empty, a check is made of the number of neighbors. If COUNT=two or three, the corresponding cell in the second screen is set, otherwise the cell is reset. Again, pointer ELOC holds the address of the current cell, while EBIT holds the bit position of the cell within the byte retrieved. Variable EBITI is the inverted bit of the cell, set by GETADD. For example, if the current bit is represented by 0010000, EBITI holds 1101111. This makes it easy to reset the bit.

At the end of the birth/death checks, the code at MAN080 decrements 'X' by one. If 'X' does not equal 11111111 (off the left edge of the screen), the next cell is considered. If 'X' is 11111111, 127 is stored in the first byte of XY for the 'X' value, and 'Y' is decremented by one. If

'Y' is not equal to 11111111, the next row above is considered.

When the 'Y' value is decremented down to 11111111, the last row has been processed and the new cells are in the second screen. The data in screen two is moved to screen one by the short move code starting near MAN085. This code is so fast the entire screen appears to change, even though the movement is done from top to bottom, a row at a time.

Count Neighbors Subroutine

This subroutine counts the eight neighbors of the current cell. The result is COUNT, which holds a value of zero through eight and is used in the main loop to determine whether the cell lives or dies. The subroutine uses two tables. One of the tables starts at ALOC and is the byte location table. This table is established by the GETADD subroutine and holds the byte address of each of the neighbors of the current cell, the neighbors being the cell up and to the left, directly above, up and to the right, the cell directly left, and so forth.

The second table starts at ABIT and holds the bit configuration that defines the neighbor bit within the byte pointed to by the ALOC table. For example, if the current cell is defined by 00010000, the neighbor to the left is defined by 0010000 and the neighbor to the right by 00001000.

The Count Neighbors subroutine goes down through both tables, using the ALOC table entry to point to the byte containing the cell and the ABIT table entry to strip off the proper bit, which is counted if it is a one. The current cell is defined by ELOC and EBIT, and is beyond the end of both tables so that the subroutine only counts neighbors.

Get Address Subroutine

Most of the work in the program is done by the Get Address subroutine. It establishes the addresses in the ALOC table and the bit positions in the ABIT table. The graphics data for all 128 by 96 bits, remember, is represented by one bit somewhere within the 1,536 bytes of screen one. The first byte represents Y=0 and X's of 0, 1, 2, 3, 4, 5, 6 and 7; the next byte represents Y=0 and X's of 8, 9, 10, 11, 12, 13, 14 and 15, and so on.

The subroutine locates the byte containing the current X,Y by multiplying the 'Y' value by 16, as there are 16 bytes per row. The 'X' value is then divided by eight and added to the Y*16 value. Eight is used as a divisor because there are eight cells per byte. The division is done by three consecutive shifts — it's equivalent to a BASIC INT function. The actual address in screen one is then computed by adding $E00 to Y*16+INT(X/8). This byte address is stored in DLOC, ELOC and FLOC the table locations for the current X,Y and its two neighbors on the same row.

The ALOC, BLOC, and CLOC locations in the preceding row can be found by subtracting 16 from the locations for the current row. The result is put into the three table entries. Similarly, the GLOC, HLOC and ILOC locations are found by adding 16 to the current row locations.

These table entries are valid providing one of the three rows isn't off the top or bottom (or another condition, which we'll discuss shortly). Checks are made for this, and 1,536 is either added or subtracted from the row to point to the wrap-around row from the other side of the screen, which gives the toroidal effect.

The code from location GET022 is used to compute and store the bit position within the byte to be accessed by the ALOC entry. This location is determined by the three least significant bytes of 'X'. If X=XXXXX000, for example, the bit position is 10000000; if X=XXXXX001, the bit position is 01000000, and so forth, up to X=XXXXX111, where the bit position is 00000001.

The cell mask values are contained within a cell mask table at location MASK. The entries in ABIT are initialized such that the current 'Y' values (B, E and H) get the mask table value, the 'Y' locations to the left get the bit position values with the bit shifted left one bit, and the Y locations to the right get the bit position values with the bit shifted right one bit. If the bit position for the current cell is 00010000, for example, ABIT, DBIT and GBIT get 00100000, and CBIT, FBIT and IBIT get 00001000.

The last part of the GETADD subroutine adjusts the ALOC table for the boundary conditions in cases where either the current 'Y' involves two bytes or the edge of the screen (left or right) has been encountered. If the current 'Y' is at the left bit of a byte, for example, the bit mask is 10000000. The left neighbor's bit mask is 00000001 in this case (the right neighbor's bit mask is 01000000).

This means the left neighbor's byte location should be one less than the location stored. This check is made and the byte location adjusted in the two cases where the current 'Y' is at either end of the byte. A check is also made for the left and right edges, and 15 is added or subtracted to get the proper wrap-around byte in this case.

To avoid computing addresses for every X,Y, the byte address calculation is done only for X's that represent a bit at either the left or right end of the byte. These are the only cases where two bytes are involved. If the bit is in bit position one (01000000) through five (00000 101), the prior ALOC addresses apply, and the address portion of GETADD is skipped at the beginning of the subroutine. The effect is to speed up the subroutine for two-thirds of the cells, knocking about 14 percent off the screen update rate.

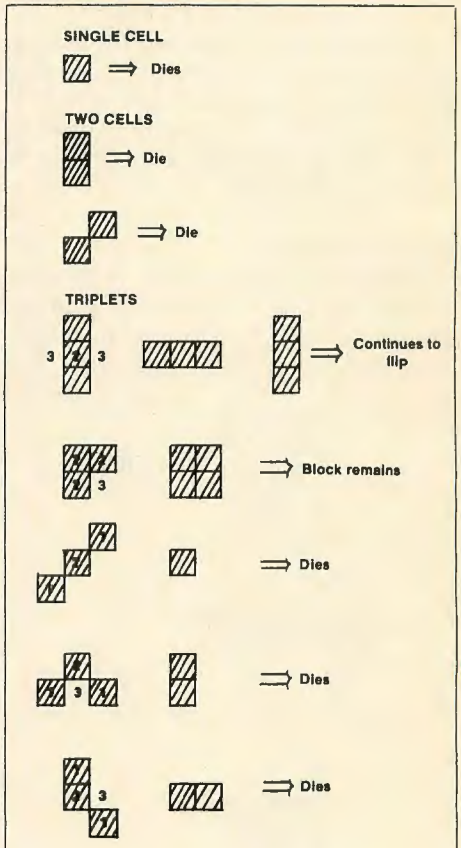

Figure 7: One-, Two- and Three-Cell Patterns

A BASIC Driver

Listing 3 shows the BASIC driver program that implements the assembly language "Life" program. It has the assembly language machine language code embedded in it as a series of DATA values. The DATA values are relocated to the &H3E00 area by a POKE loop before the program is executed.

The BASIC driver has provision for either entering a set of points for the initial "Life" pattern, or for generating a number of random points at the screen center. To enter a set of points, enter 'S' after the USER PNTS (S) OR RANDOM (R)? prompt message.

The program then asks for the X,Y position of the point: X,Y? Enter as many X,Y values as you want, and enter `-1,-1` to terminate the entry. The X,Y points *must* be even numbers due to the half resolution of `PMODE 0`. For example, adjacent points are 100/100, 100/102 and 100/104.

To use a set of random points, enter `R` after the Set/Random message. The program asks for the number of points to use: NUMBER OF POINTS?

Too few points here, and the second generation virtually disappears, leaving only a few points that disappear on the next generation. If the entire screen is filled with points, the next generation disappears entirely.

Sample Patterns

You could systematically investigate all patterns and their succeeding generations in "Life," — much work has already been done in this area. The simplest pattern is a single cell (Figure 7), which dies in the next generation from loneliness. The next simplest patterns are two adjacent cells, either horizontally, vertically or diagonally. These also die in the next generation.

The next set of patterns are triplets. There are five ways in which three cells can be combined, as shown in Figure 7. Since the L-shape cells have two neighbors, they endure until the next generation. In addition, the cell in the nook of the 'L' is born. The resulting block is a stable life form — what Conway calls a still life — it never changes. We've seen the three cells in a straight line before; they change to a line at right angles on the next generation, a so-called blinker. The blinker flips back and forth from generation to generation. The other configurations die after one generation.

The next set of cells are made of four cells connected together. The game's jargon for these patterns is "tetromino," tetra meaning four. There are five ways that four cells can be connected, as shown in Figure 8. The block configuration is stable, as we've seen. The 'T' tetromino looks as if it will grow larger and larger, but stabilizes after nine generations into a "traffic light," a series of four blinkers.

The straight line tetromino turns into a block of six cells on the next generation, which in turn creates a "beehive," another unchanging pattern. The two remaining tetrominoes also produce beehives.

So far, "Life" isn't too exciting, but we've only considered four sets of patterns. There is an infinite number to go!

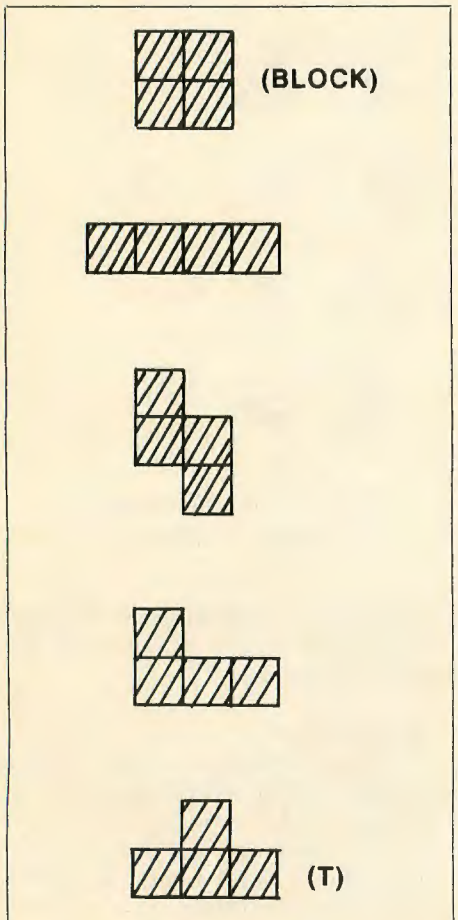

Figure 8: The Five Tetrominoes

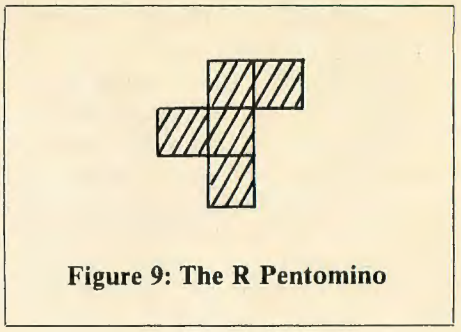

Figure 9: The R Pentomino

The next set of patterns is formed by connecting five cells, "pentomino" shapes. One of the most interesting of these is the 'R' pentomino, shown in Figure 9. The 'R' pentomino seems to grow without bound, scattering debris all over the screen. However, after dozens of generations in our toroidal universe, the life forms settle down to simple patterns that are either still life or blinkers. An intermediate screen is shown in Figure 10.

Ah, Sweet Mystery of Life

Is there any configuration of cells that grows without bound, forever? Experimentation in this area produces a shape known as a glider. It glides across the screen (Figure 11). The glider can be generated by a glider gun, a complex arrangement of patterns that goes on producing gliders forever. (It's also seen in the 'R' pentomino patterns.) There are other patterns that replicate themselves as well.

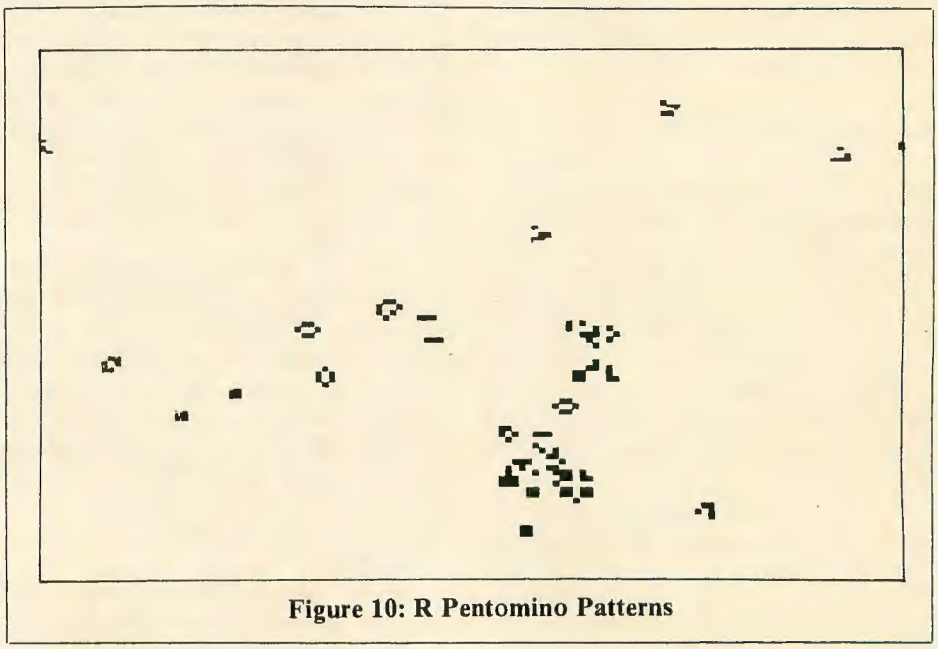

Figure 10: R Pentomino Patterns

It's a lot of fun to start with a pattern of your own design (you can do this by slightly altering the BASIC program) and watch what happens. At the very least, you'll see generations of interesting "Life" forms.

For more reading on this, get Poundstone's book or try to get the original *Scientific American* articles. For help, contact me at P.O. Box 3568, Mission Viejo, CA 92692.

Next month I'll be back with more assembly language topics. In the meantime, keep assembling! □

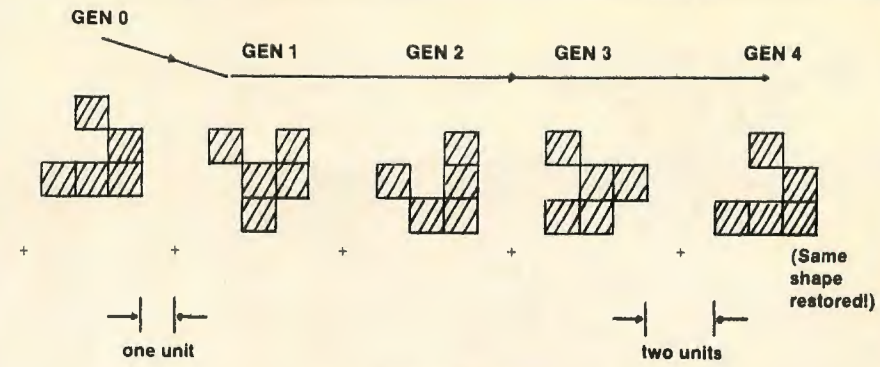

Figure 11: Glider Action

Listing 1: SLOWLIFE

```
10Ø 'RUDIMENTARY LIFE 2Ø X 14
11Ø DIM A(13,19)
12Ø 'CLEAR ARRAY
13Ø FOR Y=Ø TO 13:FOR X=Ø TO 19
14Ø A(Y,X)=32
15Ø NEXT X: NEXT Y
16Ø CLS
17Ø 'READ IN INITIAL VALUES
18Ø PRINT@448,"";
19Ø INPUT "X,Y:";X,Y
2ØØ IF X=-1 THEN 24Ø ELSE PRINT
    @Y*32+X,"O";: A(Y,X)=79
21Ø PRINT@452,"          ";
22Ø GOTO 18Ø
23Ø 'MAIN LOOP
24Ø FOR Y=Ø TO 13: FOR X=Ø TO 19
25Ø XL=X-1: IF XL=-1 THEN XL=19
26Ø XP=X+1: IF XP=2Ø THEN XP=Ø
27Ø YL=Y-1: IF YL=-1 THEN YL=13
28Ø YP=Y+1: IF YP=14 THEN YP=Ø
29Ø 'FIND # OF NEIGHBORS
3ØØ NO=Ø
31Ø IF PEEK(&H4ØØ+YL*32+XL)<>96
    THEN NO=NO+1
32Ø IF PEEK(&H4ØØ+YL*32+X)<>96
    THEN NO=NO+1
33Ø IF PEEK(&H4ØØ+YL*32+XP)<>96
    THEN NO=NO+1
34Ø IF PEEK(&H4ØØ+Y*32+XL)<>96
    THEN NO=NO+1
35Ø IF PEEK(&H4ØØ+Y*32+XP)<>96
    THEN NO=NO+1
36Ø IF PEEK(&H4ØØ+YP*32+XL)<>96
    THEN NO=NO+1
37Ø IF PEEK(&H4ØØ+YP*32+X)<>96
    THEN NO=NO+1
38Ø IF PEEK(&H4ØØ+YP*32+XP)<>96
    THEN NO=NO+1
39Ø IF PEEK(&H4ØØ+Y*32+X)<>96
    THEN IF NO=2 OR NO=3
    THEN A(Y,X)=79 ELSE A(Y,X)=
    32: GOTO 41Ø
4ØØ IF NO=3 THEN A(Y,X)=79
41Ø NEXT X: NEXT Y
42Ø 'PRINT NEXT GENERATION
43Ø FOR Y=Ø TO 13: FOR X=Ø TO 19
44Ø PRINT@Y*32+X,CHR$(A(Y,X));
45Ø NEXT X: NEXT Y
46Ø GOTO 24Ø
```

Listing 2: FASTLIFE

```
                    ØØ1ØØ ************************************************
                    ØØ11Ø * HIGH-SPEED LIFE IN 128 BY 96 PIXELS        *
                    ØØ12Ø ************************************************
                    ØØ13Ø *
                    ØØ14Ø * MAIN LOOP
                    ØØ15Ø *
3EØØ                ØØ16Ø          ORG     $3EØØ
3EØØ CC   7F5F      ØØ17Ø          LDD     #127*256+95
3EØ3 FD   3F83      ØØ18Ø          STD     XY       INITIALIZE X,Y
3EØ6 FC   3F83      ØØ19Ø MANØØ5   LDD     XY         GET X,Y
3EØ9 17   ØØ73      ØØ2ØØ          LBSR    GETADD     FIND ALL ADDRESSES
3EØC 8D   59        ØØ21Ø          BSR     COUNTN     COUNT NEIGHBORS
3EØE A6   9F 3F76   ØØ22Ø          LDA     [ELOC]     GET BYTE
3E12 B4   3F8Ø      ØØ23Ø          ANDA    EBIT       GET CELL
3E15 27   29        ØØ24Ø          BEQ     MANØ4Ø     GO IF EMPTY
                    ØØ25Ø * LIVING CELL HERE
3E17 B6   3F82      ØØ26Ø          LDA     COUNT      GET COUNT
3E1A 84   ØE        ØØ27Ø          ANDA    #$ØE       THIS TRICK
3E1C 88   Ø2        ØØ28Ø          EORA    #2           TESTS FOR 2 OR 3
3E1E 27   1Ø        ØØ29Ø          BEQ     MANØ1Ø     GO IF 2 OR 3
                    ØØ3ØØ * ON AND NOT 2 OR 3
```

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* CLEAR KEY DISABLE: ON/OFF
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```
3E2Ø BE   3F76     ØØ31Ø MANØØ7  LDX     ELOC      POINT TO BYTE
3E23 A6   89 Ø6ØØ  ØØ32Ø         LDA     1536,X    GET BYTE FROM NEXT
3E27 B4   3F81     ØØ33Ø         ANDA    EBITI     RESET BIT - DEATH!
3E2A A7   89 Ø6ØØ  ØØ34Ø         STA     1536,X    STORE BYTE
3E2E 2Ø   17       ØØ35Ø         BRA     MANØ8Ø    GO FOR NEXT CELL
                   ØØ36Ø * ON AND 2 OR 3
3E3Ø BE   3F76     ØØ37Ø MANØ1Ø  LDX     ELOC      POINT TO BYTE
3E33 A6   89 Ø6ØØ  ØØ38Ø         LDA     1536,X    GET BYTE
3E37 BA   3F8Ø     ØØ39Ø         ORA     EBIT      BIRTH OR STAY ALIVE
3E3A A7   89 Ø6ØØ  ØØ4ØØ         STA     1536,X    STORE BYTE
3E3E 2Ø   Ø7       ØØ41Ø         BRA     MANØ8Ø    GO TO NEXT GEN
                   ØØ42Ø * EMPTY HERE
3E4Ø B6   3F82     ØØ43Ø MANØ4Ø  LDA     COUNT     GET COUNT
3E43 81   Ø3       ØØ44Ø         CMPA    #3        TAKES 3 TO TANGO
3E45 27   E9       ØØ45Ø         BEQ     MANØ1Ø    GO IF BIRTH!
                   ØØ46Ø * PREPARE FOR NEXT CELL
3E47 7A   3F83     ØØ47Ø MANØ8Ø  DEC     XY        DECREMENT X
3E4A 2A   BA       ØØ48Ø         BPL     MANØØ5    GO IF $ØØ - $7F
3E4C 86   7F       ØØ49Ø         LDA     #127      RESET X
3E4E B7   3F83     ØØ5ØØ         STA     XY        STORE IN X
3E51 7A   3F84     ØØ51Ø         DEC     XY+1      DECREMENT Y
3E54 2A   BØ       ØØ52Ø         BPL     MANØØ5    GO IF $ØØ - $6Ø
3E56 8E   ØEØØ     ØØ53Ø         LDX     #$EØØ   POINT TO PAGE 1
3E59 1Ø8E 14ØØ     ØØ54Ø         LDY     #$EØØ+1536  POINT TO PAGE 2
3E5D EC   A1       ØØ55Ø MANØ85  LDD     ,Y++      GET WORD
3E5F ED   81       ØØ56Ø         STD     ,X++      STORE IN PAGE 1
3E61 8C   14ØØ     ØØ57Ø         CMPX    #$EØØ+1536  AT END?
3E64 26   F7       ØØ58Ø         BNE     MANØ85    GO OF NO
3E66 39            ØØ59Ø         RTS               RETURN TO BASIC
                   ØØ6ØØ ************************************************
                   ØØ61Ø * COUNT NEIGHBORS SUBROUTINE                    *
                   ØØ62Ø ************************************************
3E67 5F            ØØ63Ø COUNTN  CLRB              SET COUNT TO Ø
3E68 8E   3F66     ØØ64Ø         LDX     #ALOC     POINT TO TABLE START
3E6B 1Ø8E 3F78     ØØ65Ø         LDY     #ABIT     POINT TO TABLE START-1
3E6F A6   91       ØØ66Ø CNTØØ5  LDA     [,X++]    GET BYTE WITH CELL
3E71 A4   AØ       ØØ69Ø         ANDA    ,Y+       TEST BIT
3E73 27   Ø1       ØØ7ØØ         BEQ     CNTØ1Ø    GO IF NO CELL
3E75 5C            ØØ71Ø         INCB              BUMP COUNT
3E76 8C   3F76     ØØ72Ø CNTØ1Ø  CMPX    #ILOC+2   AT END OF TABLES?
3E79 26   F4       ØØ73Ø         BNE     CNTØØ5    GO IF NO
3E7B F7   3F82     ØØ74Ø         STB     COUNT     STORE COUNT
3E7E 39            ØØ75Ø         RTS               RETURN
                   ØØ76Ø ************************************************
                   ØØ77Ø * GET ADDRESS SUBROUTINE. GETS NINE ADDRESSES*
                   ØØ78Ø ************************************************
3E7F 34   Ø2       ØØ79Ø GETADD  PSHS    A         SAVE X
3E81 84   Ø7       ØØ8ØØ         ANDA    #7        TEST BITS
3E83 27   Ø6       ØØ81Ø         BEQ     GETØ15    GO IF ØØØ
3E85 84   Ø6       ØØ82Ø         ANDA    #6        IGNORE LSB
3E87 88   Ø6       ØØ83Ø         EORA    #6        TEST FOR 11Ø OR 111
3E89 26   44       ØØ84Ø         BNE     GETØ22    BYPASS LOC COMP IF ØØ1-1Ø1
3E8B 86   1Ø       ØØ85Ø GETØ15  LDA     #16       16 BYTES PER ROW
3E8D 3D            ØØ86Ø         MUL               16*Y
3E8E 1F   Ø1       ØØ87Ø         TFR     D,X       FOR NEXT ADD
3E9Ø E6   E4       ØØ88Ø         LDB     ,S        GET X
3E92 54            ØØ89Ø         LSRB              X/2
3E93 54            ØØ9ØØ         LSRB              X/4
3E94 54            ØØ91Ø         LSRB              X/8
3E95 3A            ØØ92Ø         ABX               16*Y+INT(X/8)=DISP
3E96 3Ø   89 ØEØØ  ØØ93Ø         LEAX    $EØØ,X    $EØØ+16*Y+INT(X/8)
3E9A BF   3F6C     ØØ94Ø         STX     DLOC      CURRENT ROW
3E9D BF   3F76     ØØ95Ø         STX     ELOC
3EAØ BF   3F6E     ØØ96Ø         STX     FLOC
3EA3 1F   1Ø       ØØ97Ø         TFR     X,D       FOR COMPUTATIONS
3EA5 83   ØØ1Ø     ØØ98Ø         SUBD    #16       FOR PREV ROW - MAY BE MODS
3EA8 1Ø83 ØEØØ     ØØ99Ø         CMPD    #$EØØ     ABOVE TOP?
3EAC 24   Ø3       Ø1ØØØ         BHS     GETØ11    GO IF NO
3EAE C3   Ø6ØØ     Ø1Ø1Ø         ADDD    #1536     WRAP AROUND FROM BOTTOM
3EB1 FD   3F66     Ø1Ø2Ø GETØ11  STD     ALOC      PREVIOUS ROW
3EB4 FD   3F68     Ø1Ø3Ø         STD     BLOC
3EB7 FD   3F6A     Ø1Ø4Ø         STD     CLOC
3EBA C3   ØØ2Ø     Ø1Ø5Ø         ADDD    #32       FOR NEXT ROW
3EBD 1Ø83 13FF     Ø1Ø6Ø         CMPD    #$EØØ+1535
3EC1 23   Ø3       Ø1Ø7Ø         BLS     GETØ2Ø    GO IF NOT OFF BOTTOM
3EC3 83   Ø6ØØ     Ø1Ø8Ø         SUBD    #1536     WRAP AROUND FROM TOP
3EC6 FD   3F7Ø     Ø1Ø9Ø GETØ2Ø  STD     GLOC      NEXT ROW
3EC9 FD   3F72     Ø11ØØ         STD     HLOC
3ECC FD   3F74     Ø111Ø         STD     ILOC
3ECF 35   Ø4       Ø112Ø GETØ22  PULS    B         GET X
3ED1 C4   Ø7       Ø113Ø         ANDB    #7        Ø-7
```

```
3ED3 8E   3F5D    Ø114Ø          LDX     #MASK   MASK TABLE ADDR
3ED6 3A           Ø115Ø          ABX             POINT TO MASK
3ED7 A6   84      Ø116Ø          LDA     ,X      GET MASK
3ED9 B7   3F79    Ø117Ø          STA     BBIT    CURRENT COLUMN
3EDC B7   3F8Ø    Ø118Ø          STA     EBIT
3EDF B7   3F7E    Ø119Ø          STA     HBIT
3EE2 43           Ø12ØØ          COMA            GET INVERTED BITS
3EE3 B7   3F81    Ø121Ø          STA     EBITI   SAVE FOR RESET BIT
3EE6 A6   1F      Ø122Ø          LDA     -1,X    GET LEFT MASK
3EE8 B7   3F78    Ø123Ø          STA     ABIT    PREVIOUS COLUMN
3EEB B7   3F7B    Ø124Ø          STA     DBIT
3EEE B7   3F7D    Ø125Ø          STA     GBIT
3EF1 A6   Ø1      Ø126Ø          LDA     +1,X    GET RIGHT MASK
3EF3 B7   3F7A    Ø127Ø          STA     CBIT    NEXT COLUMN
3EF6 B7   3F7C    Ø128Ø          STA     FBIT
3EF9 B7   3F7F    Ø129Ø          STA     IBIT
                  Ø13ØØ * POSSIBLE ADJUST OF LOC'NS ON BOUNDARIES
3EFC B6   3F78    Ø131Ø          LDA     ABIT    GET LEFT MASK
3EFF 81   Ø1      Ø132Ø          CMPA    #1      IS IT LSB?
3FØ1 26   29      Ø133Ø          BNE     GETØ3Ø  GO IF NO
                  Ø134Ø * TWO-BYTE CASE HERE
3FØ3 8E   ØØØØ    Ø135Ø          LDX     #Ø      FINAGLE FACTOR
3FØ6 F6   3F67    Ø136Ø          LDB     ALOC+1  GET BYTE LOC'N LSB
3FØ9 C4   ØF      Ø137Ø          ANDB    #$F     16-BYTE BOUND
3FØB 26   Ø3      Ø138Ø          BNE     GETØ25  GO IF NOT OFF LEFT
3FØD 3Ø   88 1Ø   Ø139Ø          LEAX    +16,X   OFF EDGE
3F1Ø 3Ø   1F      Ø14ØØ GETØ25   LEAX    -1,X    ADJUST IN EITHER CASE
3F12 34   1Ø      Ø141Ø          PSHS    X       STORE FOR COMPUTATION
3F14 FC   3F66    Ø142Ø          LDD     ALOC    ADJUST LEFT LOC'NS
3F17 E3   E4      Ø143Ø          ADDD    ,S
3F19 FD   3F66    Ø144Ø          STD     ALOC
3F1C FC   3F6C    Ø145Ø          LDD     DLOC
3F1F E3   E4      Ø146Ø          ADDD    ,S
3F21 FD   3F6C    Ø147Ø          STD     DLOC
3F24 FC   3F7Ø    Ø148Ø          LDD     GLOC
3F27 E3   E1      Ø149Ø          ADDD    ,S++
3F29 FD   3F7Ø    Ø15ØØ          STD     GLOC
3F2C B6   3F7A    Ø151Ø GETØ3Ø   LDA     CBIT    GET RIGHT MASK
3F2F 2A   2A      Ø152Ø          BPL     GETØ4Ø  GO IF NOT $8Ø CASE
                  Ø153Ø * TWO-BYTE CASE HERE
3F31 8E   ØØØØ    Ø154Ø          LDX     #Ø      FINAGLE FACTOR
3F34 F6   3F6B    Ø155Ø          LDB     CLOC+1  GET BYTE LOC'N LSB
3F37 C4   ØF      Ø156Ø          ANDB    #$F     16-BYTE BOUNDARY
3F39 C1   ØF      Ø157Ø          CMPB    #$F     TEST FOR OFF RIGHT
3F3B 26   Ø2      Ø158Ø          BNE     GETØ35  GO IF NOT OFF
3F3D 3Ø   1Ø      Ø159Ø          LEAX    -16,X   OFF EDGE
3F3F 3Ø   Ø1      Ø16ØØ GETØ35   LEAX    +1,X    ADJUST IN EITHER CASE
3F41 34   1Ø      Ø161Ø          PSHS    X       STORE FOR CALCULATIONS
3F43 FC   3F6A    Ø162Ø          LDD     CLOC    ADJUST RIGHT EDGE LOC'NS
3F46 E3   E4      Ø163Ø          ADDD    ,S
3F48 FD   3F6A    Ø164Ø          STD     CLOC
3F4B FC   3F6E    Ø165Ø          LDD     FLOC
3F4E E3   E4      Ø166Ø          ADDD    ,S
3F5Ø FD   3F6E    Ø167Ø          STD     FLOC
3F53 FC   3F74    Ø168Ø          LDD     ILOC
3F56 E3   E1      Ø169Ø          ADDD    ,S++
3F58 FD   3F74    Ø17ØØ          STD     ILOC
3F5B 39           Ø171Ø GETØ4Ø   RTS             RETURN
                  Ø172Ø * CELL MASK TABLE
3F5C      Ø1      Ø173Ø          FCB     1
3F5D      8Ø      Ø174Ø MASK     FCB     128
3F5E      4Ø      Ø175Ø          FCB     64
3F5F      2Ø      Ø176Ø          FCB     32
3F6Ø      1Ø      Ø177Ø          FCB     16
3F61      Ø8      Ø178Ø          FCB     8
3F62      Ø4      Ø179Ø          FCB     4
3F63      Ø2      Ø18ØØ          FCB     2
3F64      Ø1      Ø181Ø          FCB     1
3F65      8Ø      Ø182Ø          FCB     128
                  Ø183Ø * BYTE LOCATION TABLE
                  Ø184Ø *        A*B*C
                  Ø185Ø *        D*E*F
                  Ø186Ø *        G*H*I
3F66      ØØØØ    Ø187Ø ALOC     FDB     Ø
3F68      ØØØØ    Ø188Ø BLOC     FDB     Ø
3F6A      ØØØØ    Ø189Ø CLOC     FDB     Ø
3F6C      ØØØØ    Ø19ØØ DLOC     FDB     Ø
3F6E      ØØØØ    Ø191Ø FLOC     FDB     Ø
3F7Ø      ØØØØ    Ø192Ø GLOC     FDB     Ø
3F72      ØØØØ    Ø193Ø HLOC     FDB     Ø
3F74      ØØØØ    Ø194Ø ILOC     FDB     Ø
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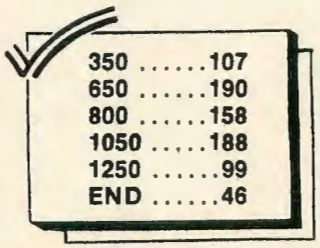
```
3F76    ØØØØ    Ø195Ø ELOC   FDB   Ø
                Ø196Ø * MASK TABLE FOR NEIGHBORS
3F78    ØØ      Ø197Ø ABIT   FCB   Ø
3F79    ØØ      Ø198Ø BBIT   FCB   Ø
3F7A    ØØ      Ø199Ø CBIT   FCB   Ø
3F7B    ØØ      Ø2ØØØ DBIT   FCB   Ø
3F7C    ØØ      Ø2Ø1Ø FBIT   FCB   Ø
3F7D    ØØ      Ø2Ø2Ø GBIT   FCB   Ø
3F7E    ØØ      Ø2Ø3Ø HBIT   FCB   Ø
3F7F    ØØ      Ø2Ø4Ø IBIT   FCB   Ø
3F8Ø    ØØ      Ø2Ø5Ø EBIT   FCB   Ø
3F81    ØØ      Ø2Ø6Ø EBITI  FCB   Ø       INVERTED BITS
                Ø2Ø7Ø * WORKING VARIABLES
3F82    ØØ      Ø2Ø8Ø COUNT  FCB   Ø       COUNT OF NEIGHBORS
3F83    ØØØØ    Ø2Ø9Ø XY     FDB   Ø       CURRENT X,Y
        ØØØØ    Ø21ØØ        END

ØØØØØ TOTAL ERRORS
```



Listing 3: DRIVER

```
1ØØ ' HIGH-SPEED LIFE BASIC DVR
11Ø CLEAR 2ØØ,&H3DFF
12Ø FOR I=&H3EØØ TO &H3F65
13Ø READ A: POKE I,A
14Ø NEXT I
15Ø DEFUSR = &H3EØØ
16Ø DIM PT(4ØØ)
17Ø CLS
18Ø PRINT @15,"LIFE"
19Ø INPUT "USER PNTS (S) OR
    RANDOM (R)";A$
2ØØ IF A$="S" THEN 27Ø
21Ø INPUT "NUMBER OF POINTS";NP
22Ø FOR I=1 TO NP
23Ø PT(I)=(1ØØ+RND(56))*256+85+
    RND(36)
24Ø NEXT I
25Ø I=I-1
26Ø GOTO 36Ø
27Ø I=Ø
28Ø PRINT"ENTER X,Y(-1=END)"
29Ø PRINT@448,"X,Y";
3ØØ INPUT X,Y
31Ø IF X=-1 THEN 36Ø
32Ø PT(I+1)=X*256+Y
33Ø I=I+1
34Ø PRINT@448,"                ";
35Ø GOTO 29Ø
36Ø FOR J=1 TO 2
37Ø PMODE Ø,J
38Ø PCLS
39Ø NEXT J
4ØØ PMODE Ø,1
41Ø SCREEN 1,Ø
42Ø FOR J=1 TO I
43Ø PSET(INT(PT(J)/256),PT(J)-
    INT(PT(J)/256)*256)
44Ø NEXT J
45Ø GN=1
46Ø A=USRØ(Ø)
47Ø GN=GN+1
48Ø GOTO 46Ø
49Ø DATA &HCC,&H75,&H5F,&HFD
5ØØ DATA &H3F,&H83,&HFC,&H3F
51Ø DATA &H83,&H17,&HØØ,&H73
52Ø DATA &H8D,&H59,&HA6,&H9F
53Ø DATA &H3F,&H76
54Ø DATA &HB4,&H3F,&H8Ø,&H27
55Ø DATA &H29,&HB6,&H3F,&H82
56Ø DATA &H84,&HØE,&H88,&HØ2
57Ø DATA &H27,&H1Ø,&HBE,&H3F
58Ø DATA &H76,&HA6,&H89,&HØ6
59Ø DATA &HØØ,&HB4,&H3F,&H81
6ØØ DATA &HA7,&H89,&HØ6,&HØØ
61Ø DATA &H2Ø,&H17,&HBE,&H3F
62Ø DATA &H76,&HA6,&H89,&HØ6
63Ø DATA &HØØ,&HBA,&H3F,&H8Ø
64Ø DATA &HA7,&H89,&HØ6,&HØØ
65Ø DATA &H2Ø,&HØ7,&HB6,&H3F
66Ø DATA &H82,&H81,&HØ3,&H27
67Ø DATA &HE9,&H7A,&H3F,&H83
68Ø DATA &H2A,&HBA,&H86,&H7F
69Ø DATA &HB7,&H3F,&H83,&H7A
7ØØ DATA &H3F,&H84,&H2A,&HBØ
71Ø DATA &H8E,&HØE,&HØØ,&H1Ø
72Ø DATA &H8E,&H14,&HØØ,&HEC
73Ø DATA &HA1,&HED,&H81,&H8C
74Ø DATA &H14,&HØØ,&H26,&HF7
75Ø DATA &H39,&H5F,&H8E,&H3F
76Ø DATA &H66,&H1Ø,&H8E,&H3F
77Ø DATA &H78,&HA6,&H91,&HA4
78Ø DATA &HAØ,&H27,&HØ1,&H5C
79Ø DATA &H8C,&H3F,&H76,&H26
8ØØ DATA &HF4,&HF7,&H3F,&H82
81Ø DATA &H39,&H34,&HØ2,&H84
82Ø DATA &HØ7,&H27,&HØ6,&H84
```

```
83Ø DATA &HØ6,&H88,&HØ6,&H26
84Ø DATA &H44,&H86,&H1Ø,&H3D
85Ø DATA &H1F,&HØ1,&HE6,&HE4
86Ø DATA &H54,&H54,&H54,&H3A
87Ø DATA &H3Ø,&H89,&HØE,&HØØ
88Ø DATA &HBF,&H3F,&H6C,&HBF
89Ø DATA &H3F,&H76,&HBF,&H3F
9ØØ DATA &H6E,&H1F,&H1Ø,&H83
91Ø DATA &HØØ,&H1Ø,&H1Ø,&H83
92Ø DATA &HØE,&HØØ,&H24,&HØ3
93Ø DATA &HC3,&HØ6,&HØØ,&HFD
94Ø DATA &H3F,&H66,&HFD,&H3F
95Ø DATA &H68,&HFD,&H3F,&H6A
96Ø DATA &HC3,&HØØ,&H2Ø,&H1Ø
97Ø DATA &H83,&H13,&HFF,&H23
98Ø DATA &HØ3,&H83,&HØ6,&HØØ
99Ø DATA &HFD,&H3F,&H7Ø,&HFD
1ØØØ DATA &H3F,&H72,&HFD,&H3F
1Ø1Ø DATA &H74,&H35,&HØ4,&HC4
1Ø2Ø DATA &HØ7,&H8E,&H3F,&H5D
1Ø3Ø DATA &H3A,&HA6,&H84,&HB7
1Ø4Ø DATA &H3F,&H79,&HB7,&H3F
1Ø5Ø DATA &H8Ø,&HB7,&H3F,&H7E
1Ø6Ø DATA &H43,&HB7,&H3F,&H81
1Ø7Ø DATA &HA6,&H1F,&HB7,&H3F
1Ø8Ø DATA &H78,&HB7,&H3F,&H7B
1Ø9Ø DATA &HB7,&H3F,&H7D,&HA6
11ØØ DATA &HØ1,&HB7,&H3F,&H7A
111Ø DATA &HB7,&H3F,&H7C,&HB7
112Ø DATA &H3F,&H7F,&HB6,&H3F
113Ø DATA &H78,&H81,&HØ1,&H26
114Ø DATA &H29,&H8E,&HØØ,&HØØ
115Ø DATA &HF6,&H3F,&H67,&HC4
116Ø DATA &HØF,&H26,&HØ3,&H3Ø
117Ø DATA &H88,&H1Ø,&H3Ø,&H1F
118Ø DATA &H34,&H1Ø,&HFC,&H3F
119Ø DATA &H66,&HE3,&HE4,&HFD
12ØØ DATA &H3F,&H66,&HFC,&H3F
121Ø DATA &H6C,&HE3,&HE4,&HFD
122Ø DATA &H3F,&H6C,&HFC,&H3F
123Ø DATA &H7Ø,&HE3,&HE1,&HFD
124Ø DATA &H3F,&H7Ø,&HB6,&H3F
125Ø DATA &H7A,&H2A,&H2A,&H8E
126Ø DATA &HØØ,&HØØ,&HF6,&H3F
127Ø DATA &H6B,&HC4,&HØF,&HC1
128Ø DATA &HØF,&H26,&HØ2,&H3Ø
129Ø DATA &H1Ø,&H3Ø,&HØ1,&H34
13ØØ DATA &H1Ø,&HFC,&H3F,&H6A
131Ø DATA &HE3,&HE4,&HFD,&H3F
132Ø DATA &H6A,&HFC,&H3F,&H6E
133Ø DATA &HE3,&HE4,&HFD,&H3F
134Ø DATA &H6E,&HFC,&H3F,&H74
135Ø DATA &HE3,&HE1,&HFD,&H3F
136Ø DATA &H74,&H39,&HØ1,&H8Ø
137Ø DATA &H4Ø,&H2Ø,&H1Ø,&HØ8
138Ø DATA &HØ4,&HØ2,&HØ1,&H8Ø
```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Old English **Cartoon**

Old English **Cartoon**

Gay Nineties

Gay Nineties

The CoCo Calligrapher requires 32K ECB.
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Old English **Gay Nineties** **Cartoon**

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Broadway **Oldstyle**

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Disk 2 - all type styles on Tapes 4, 5 and 6.

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Wild West **Checkers**

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Stars שלום

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Block

COMPUTER

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Requires OS-9 Version 01.01.00 and a dot matrix printer. **The OS-9 Calligrapher** reads a standard input text file which contains text and formatting directives to produce standard utput for printer or disk. You can specify which font to use; centering; left, right or full justification; line fill; narrow mode; margin; line width; page size; page break and indentation.

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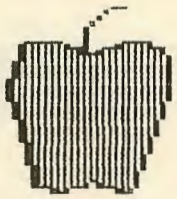

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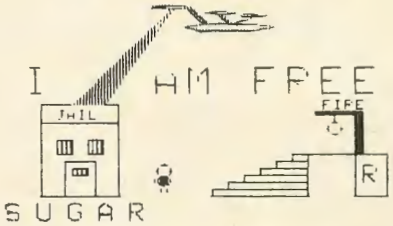

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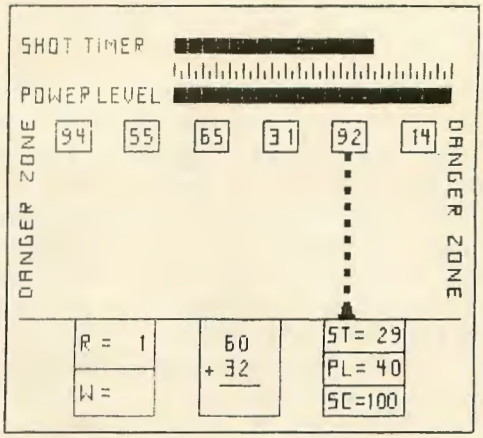

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KISSable OS-9

The Disk BASIC/OS-9 Connection

By Dale L. Puckett
Rainbow Contributing Editor

To build better soldiers, drill sergeants tear down new recruits to nothing before rebuilding them into soldiers. Installing a new version of an operating system on the personal computer is an analogous process. I love the new 2.00.00 version of OS-9. However, the transition hasn't been painless and we'll share the observations of one OS-9 software wizard this month.

We'll take an in-depth look at a new product that should make it easier for dedicated Disk BASIC users to enter the OS-9 world. We'll also introduce several new RAM disks and show different ways to use them, plus spotlight some programs from Kevin Kuehl. To show how the same job can be done with two different languages, we are listing versions written in both assembly language and C.

Dale L. Puckett, who is author of The Official BASIC09 Tour Guide *and co-author, with Peter Dibble, of* The Official Rainbow Guide to OS-9, *is a free-lance writer and programmer. He serves as director-at-large of the OS-9 Users Group and is a member of the Computer Press Association. Dale works as a U.S. Coast Guard chief warrant officer and lives in Alexandria, Virginia.*

Drivers Needed for New Version

We have been reading the mail on the CompuServe OS-9 SIG with interest. Immediately after OS-9 Level II hit Radio Shack shelves, people started complaining their *Word-Pak* and *Word-Pak II* drivers would not work. Ed Bender, the software wizard at PBJ, handled most of the inquiries personally.

Bender worked hard with a disassembler and a little assistance from Fort Worth to get the new drivers online. But, the new drivers were not compatible with the earlier *Word-Pak* drivers or the *O-Pak* drivers from FHL.

"We didn't have much trouble implementing the drivers for the *Word-Pak* once we figured out what Microware did with the CO80 driver for the phantom Tandy video board," Bender said. "Most of our problems came after the fact and we have been getting some complaints about the reduced screen control functions implemented in the current version.

"Actually, this is good and bad at the same time," Bender said. "Someone had to define a standard for screen control functions. While this was somewhat accomplished by *O-Pak* and *Word-Pak*, much of Tandy's OS-9 software was not compatible with either. Now, it is guaranteed that all Tandy (and hopefully all third-party software) will be *Word-Pak* compatible."

Bender also received some complaints about the loss of control for the *Word-Pak II* screen control relay. *Word-Pak II* users with a single composite video-monitor connected to *Word-Pak II* and the standard CoCo video output can no longer switch the screen back and forth to alternately display graphics and text.

For example, if you were editing a BASIC09 program that used graphics with the earlier PBJ drivers the *Word-Pak II* display could be used to edit it. Later, when running the program, the screen could display text while the graphics were being drawn. Now, the only solution is a POKE to *Word-Pak II* to switch the screens back and forth — a method that does not find favor with OS-9 purists.

Bender has an idea that may solve the problem: "First, create a small OS-9 procedure that, once invoked, would put itself to sleep, only to wake up once every second or two to check the path descriptor for TERM to see if the TYPE byte has been changed," Bender said. "If a change is detected, toggle the screen control relay to the appropriate display. The program should be simple and use very little CPU time."

Bender also noted that something

needs to see if GRFO is active in order to control the graphics display. This program needs to allow all other programs to run concurrently with it.

Bender says PBJ has had very few complaints about the loss of control for the scroll rate of *Word-Pak II*. But, they have had many complaints about the loss of cursor-style control and they plan to fix it.

"Please point out that the way CO80 is linked into CCIO as a subroutine makes it nearly impossible to add display codes to the CO80 module without patching CCIO," Bender said. "Any codes other than those defined by Tandy are not passed on to the CO80. So, even if the routines are in place, they never get called. The cursor-style control is an exception, since Tandy provided a sequence to change the cursor color in CO32."

Here's good news for people using public domain *Word-Pak* drivers. A new public domain driver for *Word-Pak II* that runs with Version 2.00.00 is now available in he DL6 database on the CompuServe OS-9 SIG, according to SysOp Wayne Day. The new offering was written by Bill Dickhaus, the OS-9 section leader on the CoCo SIG.

CO80 Patches Work with DISTO Display 80

Dennis McMillan has contributed a set of patches to Delphi's CoCo SIG. They let the DISTO Display 80 adapter card work with the CO80 subroutine module that is standard with Tandy's Version 2.00.00 of OS-9. Some of you may want to use them to maintain a strict Tandy standard.

"This structure is invisible to Disk BASIC and requires no knowledge of OS-9."

However, many may want to use the new DISTO drivers that Brian Lantz is writing. They will be compatible with *O-Pak* and the old *Word-Pak* drivers and will eliminate some of the shortfalls in the Tandy CO80 module.

In the Tandy CO80 module, there are six occurrences of $FF78. To make the DISTO board work with the module, change each $FF78 to $FF54. Also set the ":switch" at $FF57 to "on" before booting OS-9. Here is the list of offsets supplied by McMillan.

```
. <SPACE>.+24
. <SPACE>.+48
. <SPACE>.+19
. <SPACE>.+3E
. <SPACE>.+EF
. <SPACE>.+69
```

Note that these offsets move from one to the next. You do not need to link to CO80 each time — only the first time. After making these changes, save them in a file and store them in the modules directory of the "Boot/Config" disk so they can be loaded easily. Or install them into the boot file with the Config utility.

With the additional capability made possible by the new hardware from Tandy and third-party vendors, we must make choices about managing the operating system on our Color Computers. OS-9's modularity makes it possible and new hardware and software make it fun. Next month we hope to review the concept of modularity and introduce several approaches to the management of our Version 2.00.00 system software.

***WBASIC* — An OS-9 Disk that Thinks It's Disk BASIC**

Late last year, Alan Reinhart of Royersford, Pennsylvania, had a novel idea. Today, he has a major product, and CoCo users migrating to OS-9 time will find it very interesting. *WBASIC* is a ROM-based program. It replaces Disk Extended BASIC and stores Disk BASIC data and programs in OS-9 formatted files on a hard disk.

When I saw *WBASIC*, I was immediately impressed. Reinhart had written code that makes directories on an OS-9 formatted hard disk look like standard Disk BASIC floppy disks.

Why is this significant? Since the entire hard disk uses a standard OS-9 format, OS-9 programs and data can be stored on it also. And, since the "RSDOS Floppy" directories are actually OS-9 directories, OS-9 application programs and utilities can also read from or store data in them. People with a heavy investment in standard Disk BASIC programs and data can continue to use their original programs and accumulated data while they move up into full OS-9 operation.

With *WBASIC* you can copy a floppy disk containing a number of *Elite, VIP*

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All disk prices are for CoCo OS-9 format; for other formats, specify and add $2.00 each. Order prepaid or COD, VISA/MC accepted, add $1.50 S&H for software, $5.00 for CCRD; actual charges added for COD.

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or other Color Computer word processor files; edit with an OS-9 word processor like *DynaStar* or *Stylograph*; check spelling with an OS-9 program like *DynaSpell* and print using an OS-9 text processor like *TS Word*. *WBASIC* should ease the entry of thousands of Color Computer users into the OS-9 computing world.

"The existing Disk BASIC file structure has no real expansion cababilities," Reinhart said. "Several vendors selling Winchester drives discovered that quickly. Managing the 20,480 sectors on a five-megabyte disk instead of the usual 620 sectors on a floppy has been a real problem. Several attempts have been made to solve the problem by placing a number of standard floppy-sized volumes on a hard disk drive but this approach is not totally successful."

Reinhart came up with his method because he was concerned about what he perceived as a "go to OS-9 or forget it" policy at Tandy.

"Their policy is fine if you are interested in working with OS-9," Reinhart said. "But, if you are just starting and are not interested, there was no easy answer."

A common file structure lets Reinhart's *WBASIC* talk to OS-9. While Disk BASIC has been hard-coded to live in a 35-track, single-sided environment, OS-9 was designed for expandability.

"I have recreated the OS-9 file handling system with my own code," Reinhart said. "The result is the Disk BASIC user gains the benefit of a second, more capable file structure while keeping compatibility with the old. But, at the same time, OS-9 users can now write short programs in Disk BASIC then boot OS-9 and access the same data files from BASIC09."

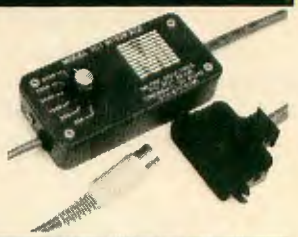
WBASIC uses the drive number part of a file specification to communicate with the hard disk drive. Drive numbers 4 through 13 are placed on the hard disk, each in its own directory. This structure is invisible to the Disk BASIC user and requires no knowledge of OS-9. However, to use OS-9, simply type DOS and log to the Winchester. OS-9 users see a standard OS-9 disk.

To make *WBASIC* work, Reinhart did his homework with *Disk Basic Unraveled*. He located the addresses where he could intercept the various Disk BASIC statements and jump to his own code. When you use a *WBASIC* OPEN statement with a drive number higher than three, it creates an OS-9 file in a directory on the hard disk drive.

Reinhart stores all Disk BASIC flop-

Metric Industries

Model 101 Interface $39.95

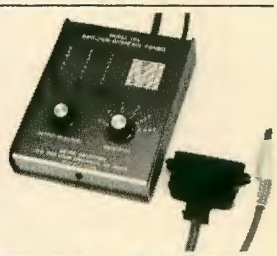


The Model 101 is a serial to parallel interface intended for use with a COCO and any Centronics compatible parallel input printer. The 101 has 6 switch selectable baud rates (300-9600). The 101 is only 4" × 2" × 1" and comes with all cables and connectors for your computer and printer.

The Model 104 Deluxe Interface $51.95

The Model 104 is a serial to parallel interface like the Model 101 but it has the added feature of a serial port (sometimes referred to as a modem switch). This feature allows the connection of a parallel printer and any serial device (modem, serial printer etc.) to your computer. You may then select either output, serial or parallel, with the flip of a switch. The 104 is only 4.5" × 2.5" × 1.25" and comes with all cables and connectors for your computer. You supply the serial cable for your modem or other serial device.

Model 103 Combo $68.95



With the turn of a knob the model 103 switches your computer's RS232C serial port to any one of 3 outputs — 2 serial and 1 parallel. The serial ports may be used for modems, serial printers or even another computer. The parallel port can be used with any Centronics compatible printer. The 103 has the best features from the 101 and 102: color coded position indicator lights, 6 switch selectable baud rates, heavy anodized aluminum cabinet, and many more.

Model 102 Switcher $35.95

The Model 102 has 3 switch positions that allow you to switch your computer's serial output between 3 different devices (modem, printers or another computer). The 102 has color coded lights that indicate the switch position. These lights also act as power indicators to let you know your computer is on. Supplied with the 102 are color coded labels that can be applied to your accessories. The 102 has a heavy guage anodized aluminum cabinet with non-slip rubber feet.

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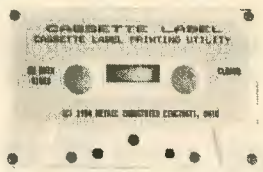
This fancy printing utility prints 5 lines of information on pinfeed cassette labels. "Cassette Label" is menu driven and is very easy to use. It uses the special features of your printer for standard, expanded or condensed characters. Each line of text is automatically centered. Before the label is printed, it is shown on your CRT — enabling you to make changes if you like — then print 1, 2 or 100 labels. The program comes on tape and it is supplied with 24 labels to get you started. 16K ECB required.



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Listing 1: *COMM.C*

```
/* COMM:  A UNIX-like utility to print  non-identical  lines  in
two files.
   Microware C Language

   Kevin Kuehl
   806 Division Road
   Valparaiso, IN 46383
   February 5, 1986

   Calls:   comm file1 file2
            comm file1 <file2

*/
#include <stdio.h>
#include <ctype.h>

main(argc, argv)
int argc;
char **argv;
{
     FILE *fp1, *fp2, *fopen();

     if (argc == 1)
          error("Usage: comm file1 [file2]", NULL);

     else if (argc == 2)
          if (fp1 = fopen(*++argv, "r")) {
               comm(fp1, stdin);
               fclose(fp1);
          } else
               error("Can't open", *argv);

     else if (fp1 = fopen(*++argv, "r"))
          if (fp2 = fopen(*++argv, "r")) {
               comm(fp1, fp2);
               fclose(fp1);
               fclose(fp2);
          } else
               error("Can't open", *argv);
     else
          error("Can't open", *argv);
}

compare(string1, string2)
char *string1, *string2;
{
     while (isspace(*string1))
          *string1++;

     while (isspace(*string2))
          *string2++;

     return(strcmp(string1, string2));
}

comm(ptr1, ptr2)
FILE *ptr1, *ptr2;
{
     char line1[120], line2[120];
     static char filler[10] = "      ";
     int length1, length2;

     while  (fgets(line1, 120, ptr1) && fgets(line2, 120, ptr2))
{
          length1 = strlen(line1);
          length2 = strlen(line2);
```

pies or directories in a master directory named RSDOS. Each floppy is actually a subdirectory named RSDOS0 to RSDOS9. When you type a Disk BASIC command line like DIR 8, *WBASIC* performs the equivalent of the OS-9 command, DIR /HO/RSDOS/RSDOS8.

To make room for his code, Reinhart moved the start of Disk BASIC's free memory area from $0989 to $0C00. This means that any Disk BASIC machine language programs that are not position-independent and start at $0989 do not work with *WBASIC*. However, Reinhart says he has tested hundreds of programs and almost all of them work.

New RAM Disks Increase OS-9 Speed

I met Tony DiStefano for the first time at RAINBOWfest-Palo Alto and one of the things we discussed was his new Super RAM Disk. I was so impressed with his products that I bought a 512K Super RAM cartridge and a DISTO Controller with an enhanced Display 80 adapter.

When DiStefano came up with the idea to add adapters to his controller and RAM disk cartridges, he solved a lot of problems. Some of us have had our Multi-Pak slots full for a while. We have been wondering how to add more hardware like the Radio Shack Speech Cartridge to our CoCo. Tony has come to the rescue.

Many people at Palo Alto were impressed, too. By the time I talked to Tony, his distributor (CRC Inc., 10802 Lajeunesse, Montreal, Quebec, Canada H3L 2E8, phone 514-383-5293) had sold out. I had to order mine.

Bob Rosen — WHIFFLE on Delphi's Color Computer SIG — helped me out. He shipped Tony's 256K Super RAM cartridge and it arrived the next day. The 256K Super RAMDisk sells for $129.95. The 512K version costs $169.95.

I quickly installed the OS-9 RAM Disk drivers licensed by Brian Lantz and was soon working with a 512K CoCo: the DISTO Super RAMDisk plus the *ThunderRAM*. My own 512K Super RAM has also arrived and very soon I'll be cooking with a 768K CoCo. And, as if that weren't enough, DiStefano has made it possible to put an additional 512K of RAM on his Super RAM cartridge. If I added that 512K, I would be running with 1280K — in a CoCo. I'm impressed.

Getting the Most from RAMDisk

Brian Lantz certainly gives versatility

in the RAMDisk software for the Super RAM cartridge. A ready-made device descriptor makes the 256K RAM disk look like a single-sided, 40-track floppy disk. Data and programs can be moved quickly from a floppy to the RAM disk using the OS-9 Backup utility command. It takes less than 40 seconds to do the whole job.

A modules directory on the disk contains a device descriptor that covers almost every option. The descriptors are in the correct format to work with the Config utility that comes with Version 2.00.00. By selecting the proper descriptor, you pick the number of the drive, either R0, R1 or R2; the Multi-Pak slot number desired, one through three; and the size of the RAM disk, either 256K or 512K.

After I had used the RAMDisk as the mirror of a single-sided, 40-track disk for several weeks I decided to take a closer look. I discovered that I was losing 77,824 bytes or 304 sectors of high speed RAMDisk by operating in this mode. There are 262,144 bytes or 1,024 sectors of memory available on the DISTO Super RAMDisk. However, the 40-track floppy can only only 184,320 bytes or 720 sectors.

At first, I thought I had only two alternatives. I could run the RAMDisk as a single-sided, 40-track drive and gain the advantage of the high-speed backup operation. Or, I could configure the RamDisk with 1,024 sectors and use all available RAM. Unfortunately, with the latter method I would need to use the Dsave utility command to copy OS-9 directories or disks to the RAMDisk — an operation that takes several minutes.

After a little thought I decided to take advantage of my double-sided, 40-track drives. I would use both sides of the drive, but not all of the tracks. I wound up formatting a disk with 56 tracks — 28 per side. This produces 1,008 sectors of storage.

I called up the OS-9 Debug utility and modified the /R1 device descriptor to make the RAMDisk look like 28 tracks with 18 sectors per track on two sides. I then used the new Version 2.00.00 Format utility to create the disk. Format ran properly and the OS-9 Free utility command reported that I had 1,008 sectors available. I moved right ahead and ran the Backup utility program. Backup up ran successfully and copied about half of the special 28-track double-sided disk. Then it reported a Media Full error. It made sense to me that you can't have two sides on a

```
          line1[length1 - 1] = line2[length2 - 1] = '\0';

          if (compare(line1, line2))
               printf("%-25.25s  %-25.25s\n", line1, line2);
          else
               printf("%52.52s  %-25.25s\n", filler, line1);
     }
}

error(err1, err2)
char *err1, *err2;
{
     fprintf(stderr, "COMM: %s %s\n", err1, err2);
     exit(0);
}
```

Listing 2: *TR.C C*

```
/* TR: A UNIX-like transliteration utility.
   Microware C Language

   Kevin Kuehl
   806 Division Road
   Valparaiso, IN 46383
   January 20, 1986

   Calls:  tr from to <file   changes 'from' to 'to'
           tr from <file   deletes 'from'

*/
#include <stdio.h>

int not = FALSE;       /* Regular pattern match */
int squeeze = FALSE;  /* Do not compress repeated characaters */

main(argc, argv)
int argc;
char **argv;
{
     char set1[4], set2[4];
     int argcount = 3;

     if (argc == 1) {
          fprintf(stderr, "Usage: tr [-s] to from\n");
          exit(0);
     } else if ((*++argv)[0] == '-') {
          if (((*argv)[1] == 's') ||-((*argv)[1] == 'S')) {
               squeeze = TRUE;
               argv++;
               argcount++;
          } else
               error("Parameter error ", *argv);
     }

     if (makeset(*argv, set1) == FALSE)
          error("Parameter error ", *argv);

     if (argc == argcount) {
          if (makeset(*++argv, set2) == FALSE)
               error("Parameter error ", *argv);
     } else
          makeset(NULL, set2);

     translit(set1, set2);
}

convert(c, conversion, boundptr)
char c, conversion;
```

```
char *boundptr;
{
     c = c - conversion + *boundptr++;
     if (c > *boundptr)
          c = *boundptr;

     return(c);
}

error(err1, err2)
char *err1, *err2;
{
     fprintf(stderr, "TR: %s %s\n", err1, err2);
     exit(0);
}

makeset(param, set)
char *param, *set;
{
     int ptr;

     for (ptr = 0; ptr < 4; ptr++)
          set[ptr] = NULL;

     if (*param == '~') {
          not = TRUE;
          param++;
     }

     set[0] = param[0];
     if (set[0] != NULL)
          switch (strlen(param)) {
               case 1:
                    set[1] = param[0];
                    break;
               case 3:
                    set[1] = param[2];
                    break;
               case 2:
                    set[1] = param[0];
                    set[2] = param[1];
                    set[3] = param[1];
                    break;
               case 6:
                    set[1] = param[2];
                    set[2] = param[3];
                    set[3] = param[5];
                    break;
               default:
                    return(FALSE);

          }
          return(TRUE);
}

translit(from, to)
char *from, *to;
{
     char c, lastc = '\0';

     while ((c = getchar()) != EOF) {
          if (c >= from[0] && c <= from[1]) {
               if (not == FALSE)
                    c = convert(c, from[0], &to[0]);
          } else if (c >= from[2] && c <= from[3]) {
               if (to[2] == NULL) {
                    if (not == FALSE)
                         c = convert(c, from[2], &to[0]);
               } else if (not == FALSE)
                    c = convert(c, from[2], &to[2]);
```

RAMDisk, but I thought I could fool the software.

As it turned out, I did fool the software by taking a different approach. Fortunately for my experiment, the Backup utility command does not check everything when it looks to see if the two disk formats are the same. It only checks the total number of sectors.

After discussing the problem with Brian Lantz, I changed the number of sides in the RAMDisk descriptor back to one and changed the number of tracks to 56 rather than 28. I left the number of sectors per track set to 18 so it would match the floppy media. I saved the new version of the device descriptor again, ran the Attr utility command on it to set the execute and public execute attributes of the new file.

Then, I formatted the RAMDisk again using the new descriptor. Free again reported 1,008 sectors available. I ran Backup again. It worked.

What did I gain from the experiment? Time, mainly. When I did a backup from my specially formatted 28-track, double-sided floppy to the RAMDisk it took 41 seconds. Then, I ran *DirCopy*, a fast directory copy utility from Computerware. It took three minutes and 26 seconds.

You probably noticed that this method does not use 4,096 bytes of the 256K available on the RAMDisk. I wasted 16/18 of a track. You can get around this by modifying the device descriptor for the floppy disk so you can format the double-sided 40-track disks in an even more non-standard fashion.

For example, why not format them to hold 64 tracks (32 tracks on two sides) with 16 sectors in each track? This gives exactly 262,144 bytes or 1,024 sectors on the floppy. A RAMDisk formatted this way does the job nicely and wastes no space. Since you won't be exchanging these non-standard floppies with anyone, set them up any way you desire.

I haven't decided how to handle my 512K RAMDisk yet. If I buy a double-sided, 80-track disk I could use a similar trick. 512K of RAM holds 2,048 sectors. If I formatted a disk to hold 128 tracks (64 on each side) with 16 sectors in each track it should work perfectly. To maintain the 18 sectors per track standard so the device descriptor won't have to be modified for the 80-track floppy disk, set it up with 112 tracks (56 tracks on each side) containing 18 sectors per track.

Changing Device Descriptors

To change the device descriptors used

by the floppy disk drives, use the OS-9 Debug utility command. We'll go step by step, but first we need to give a short description of a device descriptor.

Following the standard module header in every device descriptor that uses the RBF file manager, there is a table that defines the disk drive being used. The first byte of the table is located 18 decimal bytes ($12 bytes hexadecimal) from the start of the module containing the device descriptor. The following table shows the offset from the start of the module, the name of the location in the OS9Defs files and a short description of the information it contains.

Offset	Name	Description
$12	IT.DTP	Type of device (always 01 for disk drives)
$13	IT.DRV	Drive number (DISTO slot number)
$14	IT.STP	Step rate (00 for RAMDisks)
$15	IT.TYP	Device type
$16	IT.DNS	Media density
$17	IT.CYL	Number of tracks
$19	IT.SID	Number of sides
$1A	IT.VFY	Verify if 00, no verify if 01
$1B	IT.SCT	Number of sectors per track
$1D	IT.TOS	Number of sectors per track in Track 0

To change the format on the RAM-Disk and floppies, change IT.CYL, the number of tracks and IT.SCT, and the number of sectors per track. To start, type:

```
OS9: debug <ENTER>
```

When you see the Debug prompt, D:, type:

```
L R0 <ENTER>
```

This links debug to the start of the module containing the device descriptor named R0. Use the name of the device descriptor you want to modify here. After linking to the descriptor, move to the byte containing the number of tracks. Since it is at an offset of $17 hexadecimal bytes from the start of the module, type:

```
. <SPACE> .+17 <ENTER>
```

Notice how the debug utility commands use hexadecimal notation for these offsets. Displayed now is an address followed by the value of the data stored at that address. It should contain two zeros (00).

```
            } else if (not && (c != '\n'))
                    c = to[0];

            if (squeeze && (c == lastc))
                 ;   /* If we compress repeats, then do nothing */
            else
                 putchar(c);
            lastc = c;
        }
}
```

Listing 3: ***COMM.A***

```
* COMM: A UNIX-like file comparison utility with three columns
* 6809 Assembly Language
*
* Kevin Kuehl
* 806 Division Road
* Valparaiso, IN 46383
* February 5, 1986
*
* Calls:  comm file1 file2    compares 'file1'  to  'file2'  and
prints lines
*          comm  -1  file1  file2 print only identical lines and
from 'file2'
*
*
 NAM Comm

 IFP1
 USE /D0/DEFS/OS9Defs
 ENDC

 MOD commend,commnam,PRGRM+OBJCT,REENT+1,comment,commmem
commnam FCS /Comm/

**************************************
*
* DATA AREA
*
 ORG 0
flag RMB 1
path1 RMB 1
path2 RMB 1
buffer1 RMB 120
buffer2 RMB 120
storage RMB 120
 RMB 200 Parameter Area
 RMB 200 Stack Area
commmem EQU .

**************************************
*
* PROGRAM AREA
*
comment CLR flag we print all columns
 CLRB clear the flag holder
comm05 LDA ,X get first parameter character
 CMPA #'- is it an option?
 BNE opnfile no, then open the files
 LEAX 1,X bump up the pointer
comm10 LDA ,X+ get next character
 CMPA #$0D are we done?
 LBEQ errmsg yes, then syntax error
 CMPA #$20 or just some white space?
 BEQ opnfile yes, then go
 CMPA #'1 do we blank first column?
```

```
 BNE comm15 not yet, go
 ORB #%00000001 yes, set the flag
 BRA comm10 and go for more
comm15 CMPA #'2 do we blank second column?
 BNE comm20 not yet, go
 ORB #%00000010 yes, set the flag
 BRA comm10 and go for more
comm20 CMPA #'3 do we blank third column?
 LBNE errmsg no, then syntax error
 ORB #%00000100 set the flag
 BRA comm10 and go for more
opnfile STB flag save the option flag
 LDA #READ. use READ access mode
 OS9 I$OPEN open the first file name
 LBCS error branch on error
 STA path1 save the path number
 LDA #READ. use READ access mode
 OS9 I$OPEN open the second file name
 LBCS error branch on error
 STA path2 save the path number
readin LEAX buffer1,U point to the first buffer
 LDY #120 get its length
 LDA path1 get the path number
 OS9 I$READLN read a line of input
 LBCS commerr branch on error
 TFR Y,D put line length in 'B'
 STB -1,S save it for a bit
 LEAX buffer2,U point to the second buffer
 LDY #120 get its length
 LDA path2 get the path number
 OS9 I$READLN read a line of input
 LBCS commerr branch on error
 TFR Y,D put line length in 'B'
 LEAX buffer1,U else point to the first line
 LEAY buffer2,U and also to the second line
 CMPB -1,S are the lengths the same?
 BNE test05 no, then go
test DECB are we done?
 BEQ test30 yes, then we must go
 LDA ,X+ else get a character in line 1
 CMPA ,Y+ is it the same as in line 2?
 BEQ test yes, then get next character
test05 LDB #25 get length of first section
 LEAX buffer1,U point to the first line
 LEAY storage,U point to the out line
 LDA flag get the flag
 CMPA #%00000001 do we print this column?
 BEQ test15 no, but we print second
 CMPA #%00000011 do we print any columns?
 BEQ readin no, we print nothing
test10 LDA ,X+ get the next character in line
 CMPA #$0D is it a carriage return?
 BEQ test15 yes, then go
 STA ,Y+ no, then save the character and bump 'Y'
 DECB are we done?
 BNE test10 no, then store next character
test15 ADDB #2 add in the spacer length
 LDA #$20 get an ASCII <space>
test20 STA ,Y+ and save it
 DECB are we done?
 BNE test20 no, then save it again
 LDA #$0D get a carriage return
 STA ,Y save in case we need it
 LDA flag get the flag
 CMPA #%00000010 do we print this column?
 BEQ prntthem no, then go
 LDB #25 get length of second section
 LEAX buffer2,U point to second section
test25 LDA ,X+ get the next character
```

Press the ENTER key once to move to the lowest significant byte of the two-byte value being modified. Debug prints the next address followed by a one-byte value. If you are changing the device descriptor of a 40-track drive, Debug returns a value of $28 (hexadecimal) here. Now type an equal sign (=) followed immediately by the new value wanted in the descriptor. For example, to wind up with a 64-track RAM disk, type:

```
=40 <ENTER>
```

Note here that $40 is 64 decimal. After changing the number of cylinders, link to the start of the device descriptor module again like before. Move to the location of IT.SCT, which is at an offset of $1B. Make this change in a similar manner, then check or set the value of IT.TOS. Exit the debug utility by typing a Q or q as the first letter following the prompt. You then see the standard OS-9 prompt.

At this point, you can use the modified device descriptor. However, you will probably want to save it using the OS-9 Save utility command. If the device descriptor module is named R0 in memory and you want to save it in a file called R0.New, use the following command line.

```
OS9: save R0.New R0 <ENTER>
```

This command line creates a file named R0.New in the current execution directory which is usually /D0/CMDS. The module R0 is stored in that file. Before attempting to load the file, run the Attr utility command to set the execute and public execute attributes for the file.

Banker RAM disk is an Alternative

I recently had a chance to see the J&R Electronics 512K Banker. It supports all versions of the Color Computer and, since it installs inside the Color Computer, a multipack is not needed.

With the Banker you get a RAM Disk. And, since OS-9 already allows printing in the background by using an ampersand (&) at the end of a command line, you get a simple print spooler without buying any special software. When listing a file from the RAM disk to the printer, there is no wait for floppy access, so the system works efficiently at the same time.

The installation procedure for the Banker is simple if you have two drives. Put the system disk in Drive 0 and your Banker OS-9 disk in Drive 1, then run the install procedure file for the type of RAM disk desired and the CoCo does

all the rest. A utility that fixes the OS-9 boot disks to boot with the Banker installed is also included.

The Banker can be installed as a 512K or 256K RAM system and it comes in varying levels of completion. Options start with a bare board at $34.95 — you buy the parts — and run up to a completely assembled and tested 512K board that sells for $149.95. Get the details from Jesse at J & R Electronics, P.O. Box 2572, Columbia, MD 21405, phone (301) 987-9067.

All except the assembled and tested 512K board require piggybacking RAM chips for expansion to 512K. If you do not feel comfortable with piggyback chips, purchase their new Memory Expansion Board Kit for $29.95. This kit is necessary to install a Banker in the two-chip Korean CoCo 2s.

KShell Makes Life Pleasant

Computerware's *KShell* is the star of a new set of *Advanced Utilities for OS-9* from Paul Searby's Encinitas, California software house. It's UNIX-like features let you work quicker and smarter. *KShell* is a direct replacement for the standard OS-9 Shell. In fact, internally it is named Shell.

KShell gives you the ability to use wild cards on the OS-9 command line, set the priority of any process and make multipath searches. If you are tired of receiving the Error #216 "File Not Found" message, *KShell*'s path facility will make your day. To install and run it, simply type:

```
OS9: ex load /d0/cmds/kshell <ENTER>
```

A *KShell* path command line looks like this:

```
OS9: path=/d1/cmds <ENTER>
```

After this line is typed, *KShell* first checks the current execution directory when it is looking for a program. If it does not find the program there it looks in /d1/cmds. You are not limited to one additional path, since you can place as many as will fit in a 64-character line. Each path in that line must be separated by a colon. Here's a sample:

```
OS9: path="/r1:/h1/cmds:/d1:cmds" <ENTER>
```

If you forget which paths have been assigned to *KShell*, find out by typing, "Echo $path". If you forget something when you type the path, append things to it like this.

```
OS9: path=$path+":/d1" <ENTER>
```

The beauty of these commands is they only need to be typed once. And if you

```
 STA ,Y+ save it and bump 'Y'
 CMPA #$0D is it a carriage return?
 BEQ prntthem yes, then go
 DECB are we done?
 BNE test25 no, then get next character
 LDA #$0D else get a carriage return
 STA ,Y save it in the string
 BRA prntthem print the lines
test30 LDA flag get the flag
 CMPA #%00000100 do we print this column?
 LBHS readin no, then go
 LEAY storage,U point to the line
 LDA #$20 get a SPACE
 LDB #54 get loop count
test35 STA ,Y+ save it in the line
 DECB are we done?
 BNE test35 no, then save some more
 LEAX buffer1,U point to the line
 LDB #25 get amount to be shown
test40 LDA ,X+ get next character
 STA ,Y+ save it in string
 CMPA #$0D is it a carriage return?
 BEQ prntthem yes, then go
 DECB are we done?
 BNE test40 no, then go
 LDA #$0D get a carriage return
 STA ,Y+ save it in the line
prntthem LEAX storage,U point to the line
 LDY #120 get its length
 LDA #1 use standard output
 OS9 I$WRITLN and print the line
 LBCC readin if no error, then go
 BRA error branch on error

errmsg LEAX message,PCR get the message
 LDY #120 get its length
 LDA #2 use STANDARD ERROR path
 CLRB clear the error channel
 OS9 I$WRITLN print the message

commerr CMPB #E$EOF is error and 'EOF'?
 BNE error no, then error exists
 LDA path1 get the path number
 OS9 I$CLOSE and close the file
 BCS error branch on error
 LDA path2 get the path number
 CLRB clear the error channel
 OS9 I$CLOSE and close the file
error OS9 F$EXIT terminate the process

message FCC /Usage: comm [-[1,2,3]] file1 file2/
 FCB $0D

 EMOD
commend EQU *
 END
```

Listing 4: *TR.A*

```
* TR: A UNIX-like transliteration utility.
* 6809 Assembly Language
*
* Kevin Kuehl
* 806 Division Road
* Valparaiso, IN 46383
* February 5, 1986
*
```

```
* Calls:   tr a A <file      converts all 'a' to 'A' in 'file'
*          tr A-Z a-z <file  converts all letters to lower case
*          tr -s a A <file   strips  out  all  same  consecutive
characters
*          tr ~A-Za-z <file  delete  all non-alpha characters
*
*
 NAM Tr

 IFP1
 USE /D0/DEFS/OS9Defs
 ENDC

 MOD trend,trnam,PRGRM+OBJCT,REENT+1,trent,trmem
trnam FCS /Tr/

**********************************
*
* DATA AREA
*
 ORG 0
lastc RMB 1
not RMB 1
squeeze RMB 1
from RMB 4
to RMB 4
set1 RMB 7
set2 RMB 7
line RMB 120
 RMB 200 Parameter Area
 RMB 200 Stack Area
trmem EQU .

**********************************
*
* PROGRAM AREA
*
trent LEAY set1,U point to storage
 LEAY 1,Y leave space for length
 CLR not use regular matching
 CLR set1 length = 0
 CLR set2 length = 0
 CLR squeeze we do not compress lines
 CLRB set counter = 0
tr05 LDA ,X+ get next character
 CMPA #$20 is it white space?
 BEQ tr05 yes, then go
 CMPA #$0D are we done?
 BEQ message yes, then error
 INC not set to use NOT
 CMPA #'~ is it a NOT?
 BEQ tr15 yes, then go
 CMPA #'- do we have an option?
 BNE tr10 no, then go
 LDA ,X+ get next character
 ANDA #%11011111 convert to UPPER CASE
 CMPA #'S do we compress lines?
 BNE message no, then go
 INC squeeze set to compress lines
 BRA tr05 and go for more
tr10 CLR not no, then correct
 STA ,Y+ else save in set
 INCB length = length + 1
tr15 LDA ,X+ get next character
 CMPA #$20 are we at end of string?
 BEQ tr20 yes, then go
 CMPA #$0D or at end of parameter?
 BEQ tr40 yes, then go
```

do it from a procedure file, the whole operation can be semi-automatic. *KShell* also supports up to four macros. Each macro can contain up to 48 characters.

Like the UNIX Shell, *KShell* treats a command placed in single quotes with the output of that command. This sounds complicated, but it makes sense. Look at a few examples:

```
OS9: echo The date is 'date'. <ENTER>
OS9: echo chd 'pxd' <ENTER>
OS9: echo The disk in drive one
     is 'free /d1'<ENTER>
```

The first line prints "The date is" followed by the output of the standard OS-9 date utility command. The second example changes the current data directory to the same as the current execution directory since pxd returns the name of the current execution directory on the standard output path. The last command line works like the first.

The wild cards are the asterisk (*) and the question mark (?). An asterisk matches any number of characters. A question mark matches any single character. Since the files that match the wild cards are substituted in the command line before they are passed to a command, *KShell*'s wild cards are available to all programs.

The ability to assign default paths alone makes *KShell* worth the price of the entire *Advance Utilities for OS-9* package. Additionally, you get a new copy utility command named cpy that allows copying multiple files to a given directory.

The archive utility in the package is valuable if you have a hard disk and want the ability to make backup copies easily. Operation is almost automatic and after archive fills one floppy it prompts for a new one.

To round out the package, Computerware includes an unload utility that completely removes modules from memory and a flink utility that gives a way to make any existing file that is contiguous the boot file.

A Helpful Hint

There is a way to make a new boot file that's almost easier than using the new Config utility. First, create a new directory on the disk and copy each file you want in the new OS9Boot file into that directory. Then, instead of creating a separate bootlist file, use either the Microware 'd' utility or the "ls" utility from several of the third-party vendors and type this command line.

```
OS9: ls ! dsave <ENTER>
```

Two from Kuehl

This month, our feature programs were written by Kevin Kuehl, a senior high school student in Valparaiso, Indiana. Kuehl contributed several assembly language programs to "KISS-able OS-9" last summer. He's back with two new programs written in both assembly language and C.

Comm is a utility that compares two text files or a file to standard input. It is handy for programmers who are looking for changes they have made in a source file. *Tr* is a standard translit utility that can squeeze lines and use sets of characters. Sample OS-9 command lines are shown as comments in each listing.

Kuehl also sent some advice with his programs. "Tell everyone how important it is to write their assembly language programs in modules," he said. "This makes them much easier to debug.

"Also, make sure they *always* send their errors to the standard error path," Kuehl added. "It is unnerving to send a file down a pipeline and find (if you are lucky) an error at the end. Or worse yet, garbage that once was an error message. Use LDA #2 in assembly language or "fprintf (stderr, " ") in C for all error messages."

Our Future

The 68K version of OS-9 may very soon be the standard operating system on most home-oriented computer systems. At a recent conference sponsored by Microsoft, Sony and Phillips proposed a new file format standard for the new compact disc technology. OS-9 68K is at the heart of the standard that supports sound and graphics as well as data on the new disks. The CD-I system uses a Motorola 68000 processor and custom graphics and sound processors still under development by Sony and Phillips. The systems may be sold as complete systems or as add-ons to existing audio CD players.

Modularity and Version 2.00.00

Next month we hope to review the concept of modularity and present several approaches to operating system management. We need these skills when adding new hardware and software to our OS-9-based Color Computers. During the process, we'll introduce several new utility packages that help make the job easier. And, we'll publish a few more short programs to give you some programming practice and new tools at the same time. □

```
 STA ,Y+ save it in set
 INCB length = length + 1
 BRA tr15 go for more
tr20 STB set1 save the length
 LEAY set2,U point to storage
 LEAY 1,Y leave space for length
 CLRB set counter = 0
tr25 LDA ,X+ get next character
 CMPA #$20 is it white space?
 BEQ tr25 yes, then go
 CMPA #$0D are we at end of parameter?
 BEQ tr40 yes, then go
 STA ,Y+ save in the set
 INCB length = length + 1
tr30 LDA ,X+ get next character
 CMPA #$20 are we done with string?
 BEQ tr35 yes, then go
 CMPA #$0D are we at end of parameter?
 BEQ tr35 yes, then go
 STA ,Y+ save it in set
 INCB length = length + 1
 BRA tr30 go for more
tr35 STB set2 save the length
tr40 LEAX set1,U point to first string
  LEAY from,U point to storage
  LBSR makeset make the set
  TSTB was there an error?
  BNE message yes, then go
  LEAX set2,U point to second string
  LEAY to,U point to storage
  LBSR makeset make the set
  TSTB was there an error?
  BEQ translit no, then go
 message LEAX usemess,PCR
  LDY #120 get its length
  LDA #2 use Standard Error path
  CLRB clear the error channel
  OS9 I$WRITLN print the message
  BRA error branch on error

 ****************************************
 *
 * TRANSLIT 'FROM' TO 'TO'
 *
 translit LEAX line,U point to storage
  LDY #120 get its length
  CLRA use Standard Input
  OS9 I$READLN read the line
  BCS transerr branch on error
  CLR lastc set initial value to NULL
  LEAX line,U point to the line
 trans05 LDA ,X get the character
  CMPA #$0D are we done?
  BEQ print yes, then go
  PSHS X save the pointer
  LEAX from,U point to compare set
  LEAY to,U point to adjust set
  CMPA ,X do we change the char?
  BLO trans10 not yet, check more
  CMPA 1,X maybe, is it in range?
  BLS trans15 yes, then convert
 trans10 LEAX 2,X push 'X' to second range
  LEAY 2,Y push 'Y' to second range
  CMPA ,X is char in range?
  BLO trans20 no, then go
  CMPA 1,X maybe, is it in range?
  BHI trans20 no, then go
  TST ,Y is there a second adjust range?
  BNE trans15 yes, then use it
```

```
 LEAY -2,Y back 'Y' down to first range
trans15 TST not do we have regular matching?
 BEQ convert yes, then convert char
 BRA store then print the character
trans20 TST not do we have regular matching?
 BEQ store yes, then print character
 LDA -2,Y no, then get the character
 BRA store and print character
convert SUBA ,X make 'A' and offset
 ADDA ,Y make 'A' a char in range
 CMPA 1,Y is char in the range?
 BLS store yes, then save char
 LDA 1,Y else get upper limit
store PULS X get old pointer
 TST squeeze do compress line?
 BEQ store05 no, then go
 CMPA lastc do we print the character?
 BNE store05 yes, then save it
 CLRA no, then save a NULL
store05 STA ,X+ save the character
 TSTA is 'A' a character?
 BEQ trans05 no, go for more
 STA lastc else save it as last character
 BRA trans05 go for more
print LEAX line,U point to character
 LDY #120 get its length
 LDA #1 use Standard Output
 OS9 I$WRITLN print the char
 BCC translit no error, go for more
transerr CMPB #E$EOF is error an End Of File?
 BNE error no, then error exists
 CLRB else clear error channel
error OS9 F$EXIT terminate the process

**********************************
*
* CONVERT TO A FOUR CHAR. SET
*
makeset PSHS A,X,Y save these registers
 CLR ,Y make the set a NULL set
 CLR 1,Y
 CLR 2,Y
 CLR 3,Y
 TST ,X do we use the NULL set?
 BEQ mkst20 yes, then go
 LDB ,X+ get the length
 LDA ,X get first character
 STA ,Y save it in set
 CMPB #1 is length one?
 BNE mkst05 no, then go
 LDA ,X get first char
 STA 1,Y save as upper limit
 BRA mkst20 and go
mkst05 CMPB #3 is length three?
 BNE mkst10 no, then go
 LDA 2,X get last char
 STA 1,Y save as upper limit
 BRA mkst20 and go
mkst10 CMPB #2 is length two?
 BNE mkst15 no, then go
 LDA ,X get first char
 STA 1,Y save as upper limit one
 LDA 1,X get next char
 STA 2,Y save as lower limit two
 STA 3,Y and as upper limit two
```


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```
 LDA 2,X get last char
 STA 1,Y save as upper limit
 BRA mkst20 and go
mkst10 CMPB #2 is length two?
 BNE mkst15 no, then go
 LDA ,X get first char
 STA 1,Y save as upper limit one
 LDA 1,X get next char
 STA 2,Y save as lower limit two
 STA 3,Y and as upper limit two
 BRA mkst20 and go
mkst15 CMPB #6 is length six?
 BNE err no, then parameter error
 LDA 2,X get third char
 STA 1,Y save as upper limit one
 LDA 3,X get fourth char
 STA 2,Y save as lower limit two
 LDA 5,X get last char
 STA 3,Y save as upper limit two
mkst20 CLRB no error
return PULS Y,X,A,PC get old registers
err INCB error is true
 BRA return and return

usemess FCC /Usage: tr [-s] from [to]/
 FCB $0D

 EMOD end of module
trend EQU *
 END
```

CORRECTIONS

"The Computerized Shopping List" (April 1986, Page 216): Dennis Weide has written to give us a correction and a hint to his *Shoplist* program. The hint: The last entry in Table 1 on Page 217 explains that an OD Error will occur if STOP is omitted from the data section of the program. This is Line 2010 in the listing, but the line number will vary depending on how many items you enter. Also, it is important to keep in mind that the program takes a few minutes to compile the data, so don't get excited if there isn't an immediate response.

The correction: In some instances a BS might occur in Line 1300 if the program isn't used properly. To alleviate this situation, delete Line 421. The program will work as it should.

"A Peace Treaty for Computer Hackers and Couch Potatoes" (March 1986, Page 49): Bill Bernico has written to tell us there is an error in his program *TV Shows*. If you pick the Network News option, the word "magazine" appears. This is because the variable "Z$" was not defined. To correct the problem, add the following line to the program:

```
375 Z$="BR3BU4R2DG2DR2"
```

"The CoCo Zone" (April 1986, Page 26): There are no reported problems with the actual program *CoCo Zone*. There have been, however, numerous calls from readers who are having trouble creating a working copy of the game. RUNning the *CoCo Draw* program draws and saves the graphics screens, *Zone 0* through *Zone 9* to the tape or disk for you. The final, working game tape or disk **must** have these files in the following order: *Boot*, *Zone 0*, *Zone 1*,..., *Zone 9* and *CoCo Zone*. Then, CLOAD and RUN *Boot*, answer all prompts and you'll soon be ready to play the Adventure. Notice that *CoCo Draw* has nothing to do with the actual play of the game.

For quicker service, Corrections will be posted on Delphi as soon as they are available in the Info on Rainbow topic area of the database. Just type DATA at the CoCo SIG prompt and INFO at the Topic? prompt.

Recommended Reading for Your CoCo from . . .

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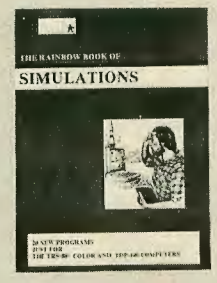

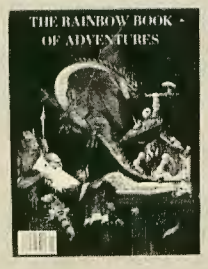

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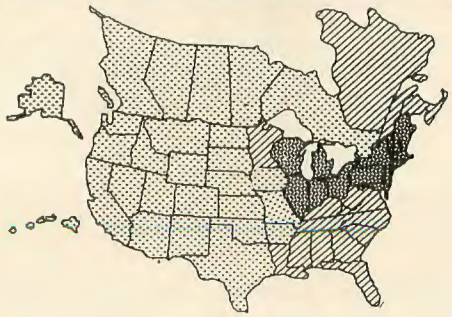

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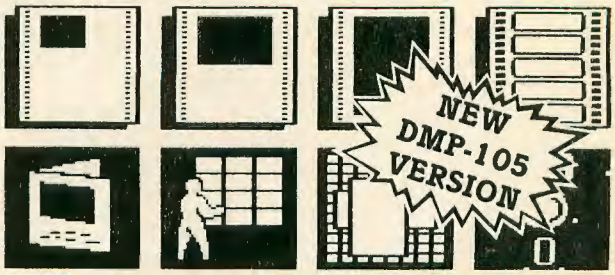

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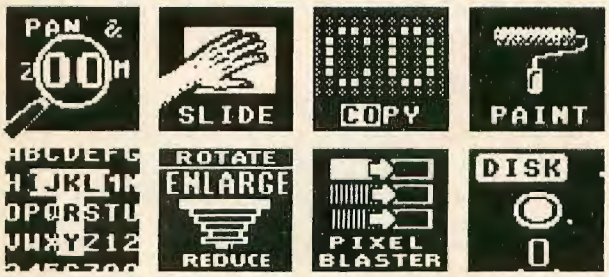

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Add text in 16 different sizes, also supports user definable foreground & background colors. Design & Edit characters for use in the typesetter.

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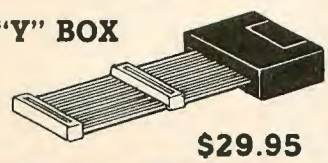

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- Supplied utility for loading screens from Basic or other sources
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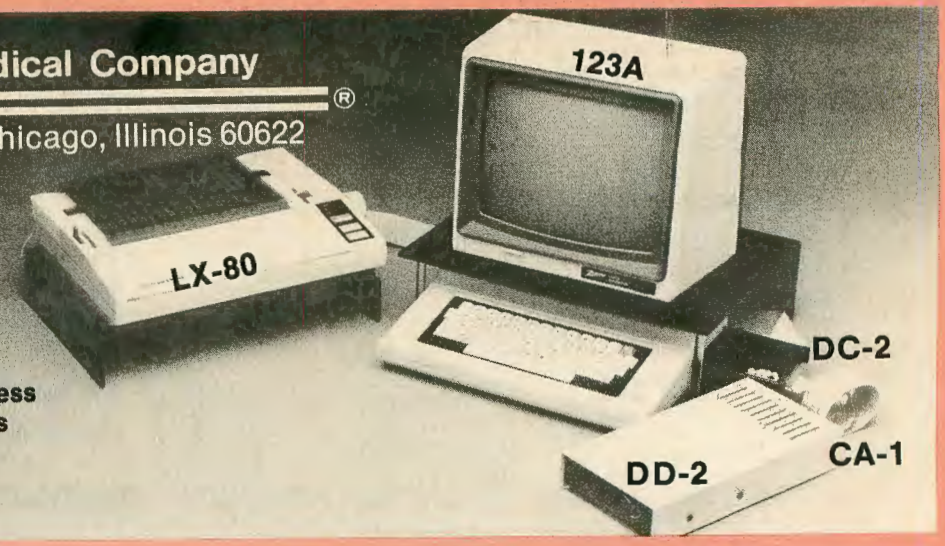

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LX-P package includes an LX-80, a serial interface, a Color Computer to Epson cable, and Printer Tutorial that teaches you how to program the different type styles ($29.95 value).

LX-P: LX-80 package $317 ($7 shpg)

ET-1 tractor option for LX-80. $29.50.

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Complete EJ-P package $425.00 ($7 shpg)

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CA-2	Two drive cable	**$29.50**
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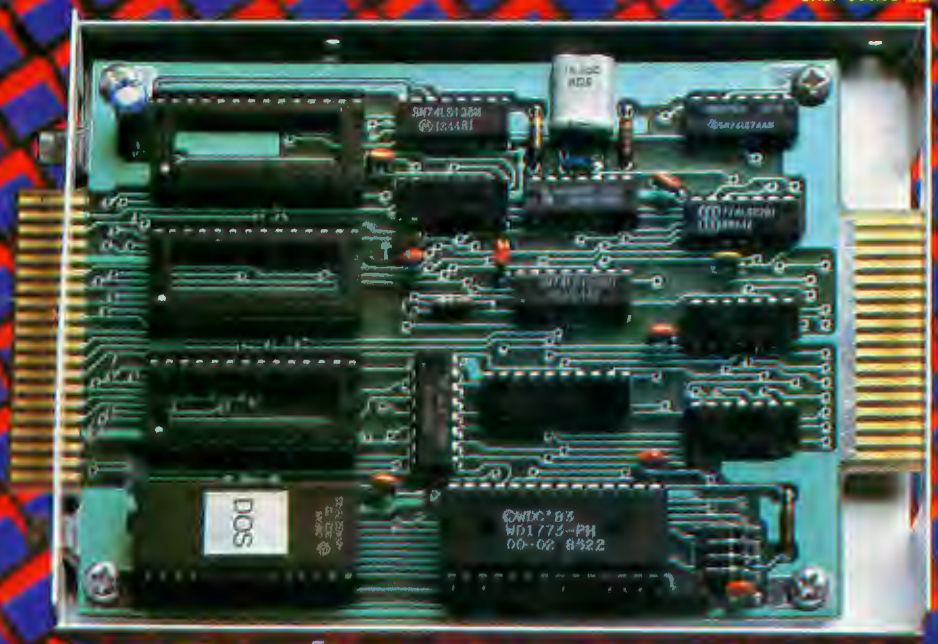

FEATURES:

- Gold contacts on all connectors.
- Shielded metal box for low RF noise.
- 4 28-pin sockets for software expandability.
- Uses 2764 or 27128 EPROMS.
- EPROMS are software selectable.
- Internal Mini-Expansion Bus interface for;
  - 80 Columns
  - Real Time Clock and/or
  - Parallel Printer or
  - EPROM Programmer or
  - User Projects.
- Complete Radio Shack compatibility.
- New technology, no adjustments needed.
- Very Accurate 16mhz High Speed Master Clock.
- Needs + 5 volts only, works on all COCOs or COCO IIs.

EXPANSION ADD-ONS:

There are currently four add-ons available from DISTO for this controller;

PPRINT

The first is a Centronics Compatible Parallel Printer adapter. This adapter will allow you to connect a Centronics compatible printer directly to your controller, leaving the serial port of your computer free for your modem. Printer driver software included.

RTIME

The second is a Real Time Clock. This is a clock chip that will keep the proper time, date and year. A small battery keeps the time when the Computer is off, retreive and set the time by using simple Basic POKES. Also available with the Real Time Clock is the optional Centronics Compatible Parallel Printer adapter. Software to set the clock and printer driver included.

MPROM

The third is a Mini EPROM Programmer. Yes, a low cost programmer that attaches to the disk controller. A [illegible] for the DISTO Super Controller. Program those often used utilities into EPROM and plug them directly into your controller. Will program 2764's or 27128's, a perfect mate for the DISTO Super Controller.

DISPLAY80

The fourth is a real knock-out. This is a three in one card. It's major function is to add an 80* 24 display to your computer. A feature packed package also includes RTIME and PPRINT. All in one neat package that fits inside the controller. OS9 software available. Call for more information.

CREDITS:

The DISTO Super Controller, add-ons and all its documentation are conceived and designed by Tony Distefano. The DISTO Super Controller and add-ons are manufactured and distributed by; C.R.C. COMPUTER INC. 10802 Lajeunesse, Montreal, Quebec, Canada H3L 2E8 1-514-383-5293

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HEAT UP YOUR COCO!

New HARD DRIVES

Besides the obvious advantage of increased disk access speeds and a vast amount of storage, our COCO hard drives boast many innovative features. For instance, you may boot OS/9 directly from JDOS - no intermediate boot floppy is required. Our software can run with virtually any winchester with a ST412 type interface. Our drives have capacities of 5, 10, or 20 MBytes (formatted), and may be either partitioned into up to 7 logical units or left as one large logical unit. Our COCO hard drive systems are complete with case, power supply, cables, OS/9 drivers, and instructions. Prerequisite: OS/9, JFD-CP controller.

5¼" 5 MByte full size	$495
5¼" 10 MByte ½ size	$650
3½" 20 MByte (shown above)	$795

JFD-CP DISK CONTROLLER

Our new JFD-CP, compatible with both the original COCO and the COCO 2, features a parallel port to support a Centronics compatible printer or our hard drive, and an external ROM switch, which allows you to select JDOS or an optional RS DOS-type ROM. It comes in a case and includes JDOS 1.2 and manual. JDOS implements all RS DOS commands, plus many more, including auto line numbering, error trapping, baud rate selection, OS/9* boot from floppy or hard drive, and Memory Minder**, our disk drive analysis program (Precision Alignment Disk not included).

JFD-CP Disk Controller with JDOS $139

COCO-CLASSIC

Our old JFD-COCO controller remains a strong seller. Some people just like old "classics" best! So we have brought it back at the lowest price ever!

JFD-COCO Disk Controller with JDOS $99

New TERMS

One-year warranty on parts & labor; 30-day money back guarantee (except shipping) if not totally satisfied. Items must be returned in like new condition.

Free shipping via UPS in continental United States for payment by VISA, MasterCard, or cashiers check. COD requires 10% prepayment by bank card plus 3% shipping. Blue Label and foreign shipping extra.

DRIVE SYSTEMS

Upgrade your Color Computer by adding our new JFD-CP disk controller, supercharged with JDOS 1.2 operating system, and a top quality drive with case and power supply. Comes complete with cable and JDOS manual.

Drive 0 System with one single side drive	$279
Drive 0 System with one double side drive	$349
Drive 0,1 System with two single side drives	$389
Drive 0,1 System with two double side drives	$489

MEMORY MINDER**

Memory Minder is a disk drive test program now included in JDOS. Used with a Precision Alignment Disk, Memory Minder allows you to check your drives for speed, alignment, sensitivity, hysteresis, and more! You can actually align or adjust the drives while viewing the graphics on the screen. No special equipment needed!

PRECISION ALIGNMENT DISKS (From Dysan)

PAD-40X1: Tests single side disk drives	$26
PAD-40X2: Tests double/single disk drives	$33

Memory Minder is available on diskette for those who don't own a JFD-CP controller with JDOS. Includes Precision Alignment disk.

Memory Minder: single side package	$59
Memory Minder: single/double side package	$75

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