

September
1984
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THE Color^{*} Computer

For Users of TRS-80™ Color Computers

MAGAZINE

Radio Shack Computer Learning Tools

• What You Need • How To Use Them

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For Teachers and
Imaginative Parents

- Students Write GOTO School
- Understanding Dennis Kitzsz
- Who Is Fibonacci, Anyway? Barden Tells All

• Kids and Piracy — By Plessner



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

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 - 04 INCLUDES CP/M 2.2 WHICH ALLOWS YOU TO RUN THOUSANDS OF CP/M PROGRAMS
 - 05
 - 06 GENERATES HIGH QUALITY 80 COLUMN BY 24 LINE DISPLAY AS IN THIS REAL PHOTO
 - 07 WITH UPPER and lower case characters on your composite video monitor,
 - 08 INSTRUCTIONS INCLUDED ON USING MOTOROLA 6845 DIRECTLY FROM YOUR CoCo
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 - 12 INCLUDES POWERFUL FOUR MHz Z-80A MICROPROCESSOR
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THE Color Computer MAGAZINE



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ARTICLE FEATURES

21/Custom Color by Dennis Kitsz **(General)**
Dennis catches us up on what's important in his life, things you should know before trying his projects, and updates on some past projects.

38/Gradebook by Lynn Davis **(Education)**
Here's something specially for teachers: a gradebook that's flexible, easy to use, and time-saving.

60/Tools For Home by J. Craig Dickenson **(Education)**
Will your kids be overwhelmed by the vast amounts of information that must be sifted through nowadays? Here are suggestions that will help parents help their kids be ready and able to deal with the Information Age.

66/Color Computing For Kids by Jean Plesser **(Education)**
Take a look at a software publishing house — as your knowledge expands, so will your appreciation!

72/Big Numbers by William Barden, Jr. **(Tutorial)**
Bill explains what a Fibonacci series is, what problems the Color Computer causes, then fixes the problem, and admits (as do we) that he knew Fibonacci wasn't a new type of pasta all along (right?).

TAPE FEATURES

14/CLOAD by Lynn Rognsvoog
A new page for Load Tape users or perusers, featuring:

Gradebook: page 38; revised, Tape only **(Education)**

Fibonacci: page 73 **(Utility)**

Break Key Disable: Tape only **(Education)**

Fractions: Tape only **(Education)**

Recall: Tape only **(Game)**

COLUMNS

16/On Line by Wayne Day
Efficient database travelling.

34/GOTO School by Sven Bonnichsen and Bill McHenry
Paul Kimmelman loans his column to a pair of guest experts on educational software.

120/END OF FILE by Kerry Leichtman
The Color Computer Magazine gets an education.

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REVIEWS

88/Games

Grabber (Tom Mix)
Reactoid (Radio Shack)
Devil Assault (Tom Mix)
Ice Master (Arcade Animation, Inc.)

90/Languages

Newbasic (H.L. Johnson Services)
Programming in C (Hayden Book Co.)

94/Education

Classroom Management
(Sailors System Software)
Speed Math (West Bay Co.)
Vector Addition (Radio Shack)
Math Menu (Inter + Action)
Educational Software Three-Pack
(Computer Island)

106/Utilities

Semigraf (Sugar Software)
Graphics System (Quicksilva)
Page Plus (Skyline Marketing)
Advanced Editor for OS-9 (Computerware)

111/Hardware

Video Reverser (Dynamic Electronics, Inc.)

DEPARTMENTS

8/INKEY\$

14/CLOAD

86/DEFUSR

115/NEW: PRODUCT\$

Cover Photography by Kip Brundage, Kids
by Clara Urbahn, Computer by Debra
Brown.

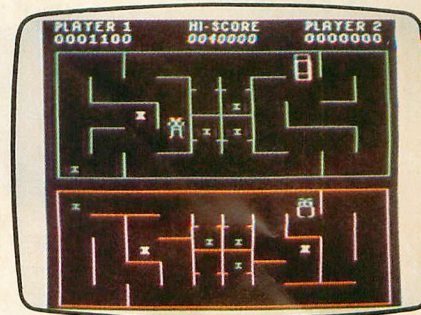
PEEK (09,84)

This annual education issue should prove a boon to everyone in the field of computer education. Teachers will especially be interested in "Gradebook," written by Lynn Davis with a teacher's special insight; parents (and teachers) should spend some thoughtful moments with "Tools For Home," a piece by Craig Dickenson about the Information Age and software tools students should learn to use at home; and everyone, including educational software manufacturers, will be interested in our special guest-written GOTO School, wherein two grade-school computer users look at educational software's good and bad points.

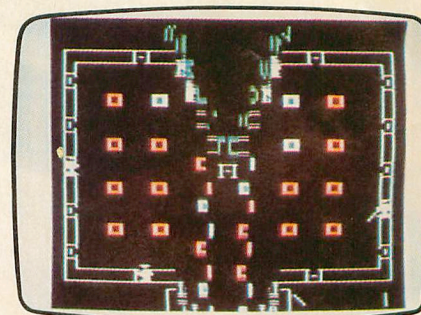
We also begin a new department this month: CLOAD, by Lynn Rognsvoog, TCCM's Managing Editor. The success of our Tape Loader program has encouraged us to expand the programs available on it each month. This department will serve as a guide and aid to each month's tape that Tape Loader users won't want to miss.

Finally, a note for next month: we received so many letters when we decided to end Jake's ROM disassembly that we're convinced we should finish the series. We will print the last four commented sections in October's issue. Hey readers — we think it's great that so many of you wanted this series to continue. Your letters are the only way we have to measure an article's, or author's, popularity. Keep 'em coming.

— D.M., Editor



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NOW...COMPUTER BUFFS

Powerful 64K Extended BASIC TRS-80 Color Computer 2

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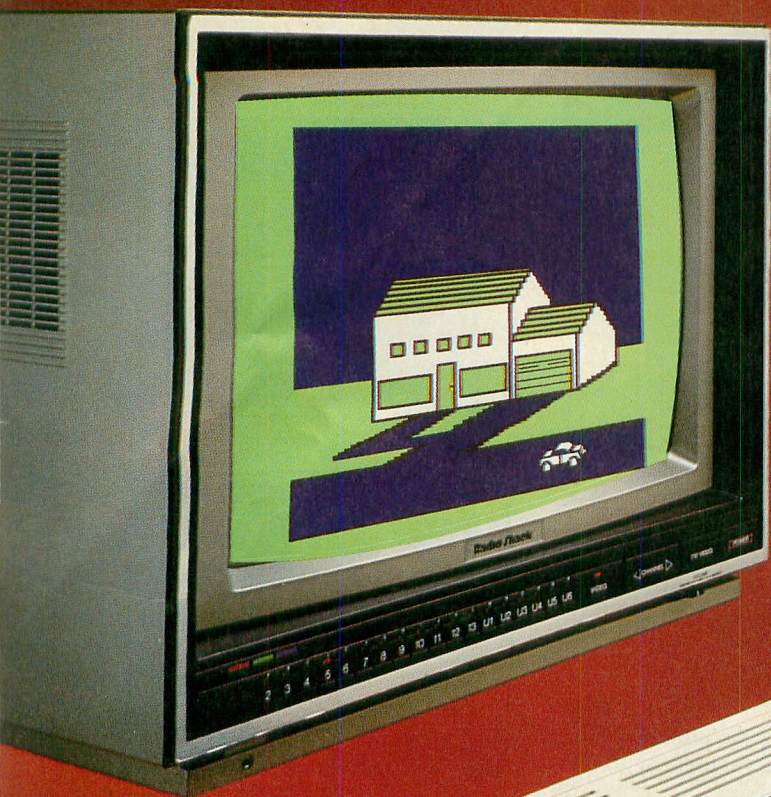
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The Color Computer 2 has a compact case with typewriter-style keys. Add a disk drive and our OS-9 operating system to utilize the full 64,000-character memory. Or access 32K of memory using the powerful built-in Extended BASIC language. You get two tutorial manuals to make programming easy.

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Best of all, the Color Computer 2 expands as your skills and needs grow. You can add a printer, plotter, disk drives, or a telephone interface for communications. And we offer a wide variety of software for entertainment, education, personal and household tasks.

Print Superb Color Graphics!

The CGP-220 drop-on-demand, high-resolution printing system is the perfect companion for your TRS-80 Color Computer. It can print text and graphics in yellow, violet, red, green, cyan, magenta and black! The graphics mode produces 2600 dots per second with a resolution of 560 dots per line (in the multi-color mode). The text mode gives you 12 characters per inch at 37 characters per second in a 7 x 5 dot matrix. A screen print utility is included for spectacular multi-color printouts of color graphics screens.

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
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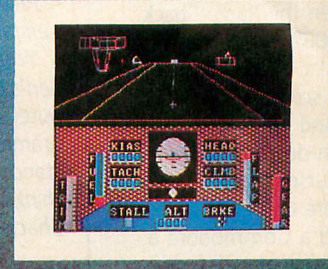
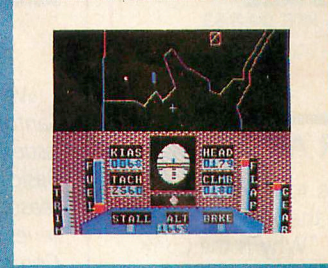
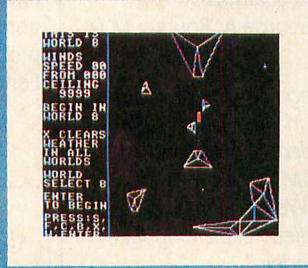
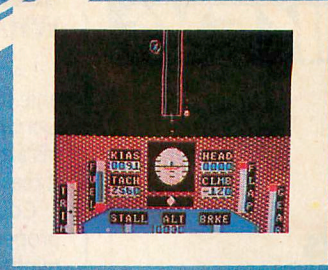
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New From Tom Mix...

Worlds of FLIGHT

Not A Game — A Very Realistic Flight Simulation



WORLDS OF FLIGHT (WOF) is a "view" oriented flight simulation for the TRS-80 Color Computer, written entirely in Machine Language. "View" oriented means that the pilot may determine his or her position by actually viewing the surrounding landmarks as opposed to using instruments which sense navigational references. This is a major departure from "instrument only" simulations which can be achieved through BASIC programs. Most instrument maneuvers and procedures may be practiced. The craft is a light-weight, single-engine airplane with low wings. A nose wheel which is both steerable and retractable is also modeled. Some aerobatics are possible including sustained inverted flight, aileron rolls, spins and stalls.



The Experts Say:

C.L. — "As a pilot I found "Flight" to be an outstanding simulation.

M.H. — "No one has created a more realistic flight simulator for the Color Computer."

D. HOOPER, pilot for major airline — "An outstanding flying experience. Very realistic."

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DEFUSR ANSWER

In regard to R.M.'s letter to DEFUSR in the May, 1984 issue R.M. asks, "Why is the Commodore 64K disk drive only \$200, when the Radio Shack drive is \$400?" And in another spot, he asks, "Why is the Color Computer screen size so small?... And why doesn't it have a non-destructive, fully-movable cursor, such as the Commodore 64?"

I've used a Commodore a few times, and the disk drive is slower than the Color Computer's tape system. The screen is impossible to read on the 64, unless you buy a monitor. In other words, on a scale from one to ten, one being the worst, ten being the best, I think I'd rate the Commodore at about -4, and the Color Computer at about 14.

K.M. Thompson
Leola, SD

Some people like their Color Computers so much... they can't stand any criticism!

— Eds.

HELP NEEDED

I recently purchased the game Bedlam, but when I played it, it did not accept some of my verb commands. Now I just guess what verbs the computer will accept, but most do not work. If anyone has a list of verbs or even a way to get out, I would deeply appreciate it. Please send your help to Inkey\$, c/o **The Color Computer Magazine**.

Tom Keck
Pittsburgh, PA

WHAT IS IT?

I would very much like to be able to understand what Mr. Commander talked about in his articles on ROM dissection, it makes no sense to me.

Could you steer me to the proper reading material so I might be prepared to understand the columns?

George A. Rourke, M.D.
Lebanon, OH

We began a series by James Sanford in the March, 1984 issue called "Explaining Color Basic ROM" for that exact reason. We hope to publish a series called "Explaining Jake Commander."

Problem is, no one here understands Jake, either.

You might also use Bill Barden's book, TRS-80 Color Computer Assembly Language Programming to help you understand how your computer thinks. The book is sold at Radio Shack stores.

— Eds.

WHERE IS IT?

In the November, 1983 issue you answered a letter asking for a series on assembly language by saying there would be such a series for beginners, "early next year." In the December, 1983 issue you again said the same thing.

Was this series cancelled?

Dave Babulak
Strongsville, OH

No, it hasn't been cancelled. The author of the series is in the process of finishing the last installment. The project has taken a little longer than originally anticipated.

— Eds.

ON 3-D GRAPHICS

Re: 3-D Graphics by Dale Keller (March, 1984, p. 106). In the source code for the space shuttle, Line 9 should be changed from -45,0,19 to -82,0,52. As listed, part of the tail will be pointing down.

William W. Duncan
Kosciusko, MS

DEVIL'S EDITOR

In regard to William Barden, Jr.'s article on the Devil's Editor, I have noticed that the Basic program gives an FC Error message on many occasions in Line 1020. Also the routine for the previous block for named file does not work as it should. I have listed changes and additional lines which correct the problems (see Listing for Devil's Editor changes).

Ashok Basargekar
Orange, CA

MATH

Help! I have a number of equations to solve on my 16K Color Computer and am unable to write or find a program.

I need to find a solution to an equation for a rotated ellipse. Wanted are the maximum x and y values.

Equation for an ellipse:
 $x^2/A^2 + y^2/B^2 = 1$
Angle of rotation = 0
 $x' = y \cos \theta + y \sin \theta$
 $y' = y \cos \theta - x \sin \theta$

Devil's Editor Changes

```
130 PRINT @ 198, "DEVIL'S DISK EDITOR" : GOSUB 135 : GOTO 140
135 PRINT @ 416, "(F) FILE (S) SECTOR (E) EDIT (+) NEXT (-)
PRIOR (Q) QUIT" : RETURN
150 B$="FS+;-EQ" + CHR$(12)
210 ON I GOTO 250,750,900,900,1110,1300,2100,120
660 P$=SH$: GOSUB 670 : GOTO 700
685 RETURN
940 CLS : PRINT @ 0, "DRV#:"D"TRK#:"T"SECTOR#:"S
1050 ' DELETE THIS LINE
1060 ' DELETE THIS LINE
1070 GOSUB 670 : GOTO 940
1180 O=O-1 : IF O-1 THEN 940
1190 O=3 : RN=RN-1 : S=S-1 : NS=NS+1 : IF (S=0) OR (S=9) THEN 1200 ELSE 940
1260 FT=I-1 : GOSUB 670 : S=S+NS-1 : NS = 1 : GOTO 940
1290 PRINT @ 416, "(ARROWS) TO MOVE CURSOR. (CLEAR)TO
EXIT. (ENTER)MODIFY DISK"
2080 NEXT C,R : GOSUB 135
2100 END
```

BULLETIN BOARDS

COMMUNICOM-80 UPDATE

A description of Communicom stated the BBS is running at 300 baud. I should add that I am also running at 1200 baud. Call Mike Goodglick, Sysop, at (805) 484-5040 (Camarillo, CA).

COLOR PACIFIC BBS

The Color Pacific BBS is on-line 24 hours every day, and supports uploading, downloading, on-line games, graphics, and current news about club activities in British Columbia. The BBS can be reached at (604) 738-2773. Debbie Cooper is the Sysop.

BRIDGEPORT BBS

A Color bulletin board in Bridgeport, CT is on-line 24 hours a day with a message center and full upload and download capabilities. The voice number is (203) 579-4541 and the computer number is (203) 334-5778. Sysops are Laurie Cavaliere and Larry Bussell.

NORTHWEST BBS

The Northwest Data Bulletin Board features Email, uploading, downloading, on-line games, club sections and an electronic joke book. Hours of operation are from 6 p.m. to 6 a.m. daily. To log-on, call (509) 489-5133.

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TYPE Node = RECORD
Next := Node;
NodeName : String(15);

TYPE Month = (Jan, Feb, ...)

MthDys : ARRAY [Month] OF 28..31;

WITH ThisNode DO
Next := Next.Next;

READ (A,B);
WRITELN ('RESULT', 3.2E5*SIN(A));

CASE ThisMonth OF ...

The Education Testing Service (ETS, famous for managing the SATs) have based the college computer science advanced placement (AP) test on Pascal.

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combines multiple program objects
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DEFT Bench \$49.95

DEFT Debugger

debug Pascal machine programs
symbolically

DEFT Macro/6809

supports entire 6809 instruction set
lets you define your own instructions

DEFT Edit

Full screen editor

DEFT Linker

(see DEFT Pascal)

DEFT Lib

create and maintain program object
libraries

DEFT Pascal Workbench \$119.95

(DEFT Pascal And DEFT Bench Together)



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All programs require a minimum of 32K and 1 disk drive but will take advantage of 64K and multiple drives. Each package features a hi-res 51 x 24 black on green screen. 16K versions available without hi-res screen. Specify 16K or 32K versions when ordering. Future integrated packages will include: Inventory Control, Sales Analysis, Accounts Payable.

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INKEYS

In shortened form, the equation for the rotated ellipse becomes: $Ax^2 + Bxy + Cy^2 = D$. The full solution of my problem involves three different ellipses and fourteen angles of rotation.

J.A. Scott
Pittsburgh, PA

GAME OF LIFE

Mr. Kitz's rendition of John Conway's Game of Life (April, 1984) is fascinating and up to what we have come to expect of his high-quality column.

Unfortunately, the program will not work on disk-based

systems as the origin conflicts with the disk I/O communications area. Simply change the origin statement in Line 200 from \$0C80 to \$0E00 and you may also enjoy.

Claude Pouliot
Roxboro, Quebec

ANOTHER GAME

Already a fairly proficient Basic programmer, I am hoping to learn enough about assembly language to begin writing my own games and utilities. I would like to thank Dennis Kitz for his article, the Game of Life, and to encourage you to include more tutorials about assembly language in the future.

Steve Olson
Madison, CT

CLUBS

LOSS AND GAIN

The Plaquemine Color Computer Users Group is no longer in existence. We had to close down because we didn't have enough members. There is, however, another club nearby. The Redstick Color Computer Club in Baton Rouge, has no age limit for membership. This club is going strong and even I, Peter Kazmir, the former president of TPCCUG, have elected to join the Redstick club. For more information, call Peter A. Kazmir after 3:00 p.m. at (504) 687-8459.

NORTH CAROLINA

Piedmont Area Color Computer Club meets on the second and fourth Wednesday of each month. For more information write Buster Brafford, P.O. Box 340, Alamance, NC 27201, or call (919) 227-9669.

ATHENS, GREECE

The Olympian Computer Club meets at Hellenikon Air Base in Athens, Greece. Correspondence can be sent through the military mail system by writing Olympian Computer Club, care of Paul A. Mullens, Box 4277, APO New York 09223.

FORMING A CLUB

I am trying to form a Color Computer club in the Mount Vernon-Evansville, IN area. Anyone interested please contact Brian Broyles, (812) 874-2210, Box 462, Poseyville, IN.

CENTRAL FL

Color Computer World Of Central Florida may be contacted at 5121 Mortier Ave., Orlando, FL 32812.

CLUB IN SOUTHBURY?

I am interested in joining or forming a Color Computer club in the Southbury, CT area. If you have information or would like to start a club, please contact Rob Johnson at 209 Carriage Drive, Southbury, CT 06488, or call me at (203) 264-6357.

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SORT ANY SIZE FILE whether it's 200 or 2000 records
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SCAN FILES alphabetical by any field
SUMMARIZE FILES to find totals, averages, low and hi values
8 REPORT FORMATS for obtaining hard or soft copy reports
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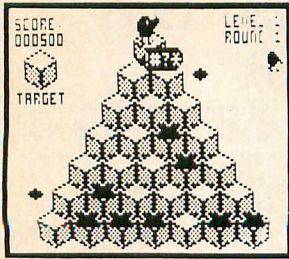
PRO-COLOR-DIR **\$24.95**

Tired of not knowing which diskette has that program you're looking for? **PRO-COLOR-DIR**ectory will create a data file of all your disk directories that can be used by **PRO-COLOR-FILE** to generate alphabetized reports for easy reference. **PRO-COLOR-DIR** will store a diskette ID name, filename, extension, file type, number of grants allocated, number of sectors allocated, number of sectors used, machine language addresses and length, date it was created and date it was updated. 1000 entries are easily stored on one diskette!

All programs require a 32k Disk with at least one disk drive. **PRO-COLOR-FORMS** and **PRO-COLOR-DIR** require **PRO-COLOR-FILE** to be used. All programs (c) 1983 by Derringer Software, Inc.

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THE TOP 4 COCO GAMES...

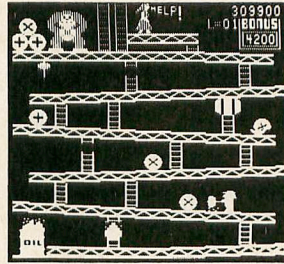
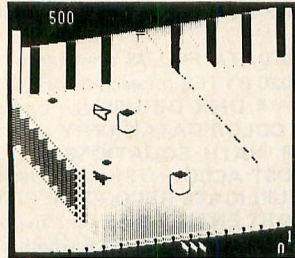


CUBIX

By Spectral Associates. Very much like the arcade smash! Jump little Cubix around the 3D maze trying to change the color of all the squares. With Death Globes, Discs, Snakes, etc. 32K Tape: \$24.95

ZAKSUND

From Elite Software comes this fantastic arcade style space action game with 3 different stages of moving 3-D graphics. You've never seen anything like this on your CoCo! Great sound too! 32K Tape: \$24.95

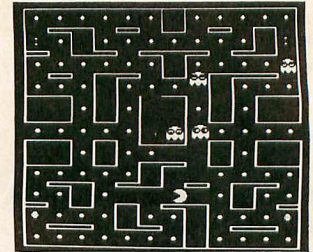


THE KING

Previously called 'Donkey King', you simply cannot buy a more impressive game for your CoCo. With 4 different screens and loads of fun! From Tom Mix Software. 32K Tape: \$25.95

GHOST GOBLER

From Spectral Assoc. This "PAC" theme game has been improved several times. It is definitely the best of its type. Brilliant color, action and sound, just like an arcade. 16K Tape: \$24.95



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JOYSTICK INTERFACE/RAPID FIRE/6 FT. EXTENDER ALL IN ONE! The Colorcade allows connection of any Atari type joystick to your CoCo (including the Wico Red Ball). These switch type sticks are extremely rugged and have a faster and more positive response. They will improve the play of almost any action game.

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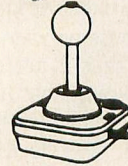
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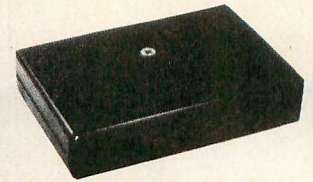
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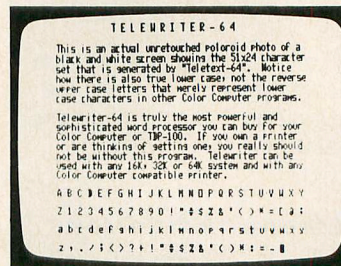


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The Colorware Light Pen plugs directly into your joystick port and comes with six fun & useful programs on cassette. Easy instructions show how to use it with Basic and it's compatible with light pen software such as Computer Island's "Fun Pack." Order yours today. Only \$19.95 complete.

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CASSETTE... \$49.95

Colorware researched the word processors available for the Color Computer. This is the best. Telewriter-64 is a truly sophisticated system that is marvelously easy to use. It works with any 16K, 32K or 64K system and any CoCo compatible printer.

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'REAL TALKER'

HARDWARE Voice Synthesizer

NEW from
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only...\$59.95

**THINKING OF BUYING A
COCO VOICE SYNTHESIZER?
READ THIS....**

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

FREE TEXT-TO-SPEECH

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

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

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



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

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

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

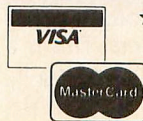
'Y-BRANCHING CABLE' For disk systems. This 40-pin, 3 connector cable allows 'Real Talker' to be used with any disk system \$29.95

YOU DECIDE....

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



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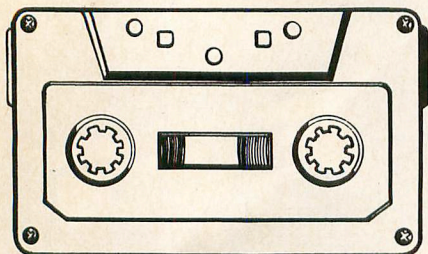


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CLOAD

BY LYNN ROGNSVOOG



You've probably noticed a new topic on our Table of Contents pages called "Tape Features." Listed there are all the programs included on this month's Tape Loader. All the article program listings in this issue are included on the tape, and (now, here comes the good part) we've included a few extra goodies we couldn't let sit on the shelf a moment longer!

These bonus programs don't require any more documentation than each program's instructions, or the few sentences of description you'll find here. This new department, CLOAD, will appear each issue to answer the specific questions you have about **The Color Computer Magazine** tape service, and to give you tips on using the tapes.

What's on this month's tape? First, programs for two articles in this issue. Teachers will find Lynn Davis' "Gradebook," a record-keeping dream come true. Read the article on page 38 for system requirements and a full description of Gradebook.

(Lynn Davis also wrote a version of Gradebook based on a point system. You won't find it written up in this issue — it's just on the Tape Loader under the name "Pointsys.")

The rest of us can delve into "Big Numbers," Bill Barden's description of Fibonacci series. "Fibo-what series?" you ask. The article on page 73 explains them; the program on the tape loader lets you use them.

On to the bonus programs. If you've watched children using the computer, you'll have noticed that the Break key is one of the first keys they press. This can cause a real problem in a classroom — the program stops running, and a simple GOTO command doesn't always fix the situation.

Ron Mummaw wrote three Break key-disable routines, and we've included them on the Tape Loader. BREAKA is the Extended Basic version, BREAKB is for Color Basic, and BREAKC is for Extended Basic programs that include string input statements. Choose the version that's right for your system, and put the lines near the beginning of your program. (Color Basic users: Lines 1–5 of BREAKB must be the first lines. Replace Line 10 with the beginning of your program.)

The next bonus program, "Fraction," does arithmetic using fractions — it doesn't convert them to decimal numbers. This is a great drill idea. Thanks for writing it, Harold Schneider!

Fraction has three modes. In each case, you type in the left side of an equation. If you type an equals sign, the screen displays the correct right side of the equation. If you type ϵ (for exhibit) instead of the equals sign, the result is displayed and retained in memory so you can perform further calculations on it (like a calculator). If you type c (for check) the answer is not displayed. You are prompted to enter an answer. If it is incorrect you can try again or display the right answer.

You can even use Fraction to reduce a fraction to lowest terms — just enter it and an equals sign. For instance, enter $4/8 =$ and the program will display $1/2$.

To run Fraction in a 4K machine, delete Lines 20–60, 780, 790, and all remarks.

Finally, some fun! "Recall" (by Scott and Andrea Bain) is a computerized adaptation of the card-matching game. You remember it — a group of card pairs is laid out randomly in a grid. By turning over two cards and remembering the card in each location, each player tries to match the greatest number of card pairs.

Plug in your right joystick and get started. Up to four people can play, or you can play alone against the computer. (It won't cheat. Honest.) Use the joystick to position the cursor over the cards of your choice. If you find a match, you get another turn.

The real trick to the game, naturally, is finding ways to remember where the cards are located. It is fascinating to see what mnemonic and spatial devices people come up with to aid their memories.

Tape Loader Directory

Program	Author	Page
Gradebook	Lynn Davis	38
Pointsys	Lynn Davis	Bonus
Fibonacci	Bill Barden	73
BREAKA	Ron Mummaw	Bonus
BREAKB	Ron Mummaw	Bonus
BREAKC	Ron Mummaw	Bonus
Fractions	Harold Schneider	Bonus
Recall	Scott and Andrea Bain	Bonus

TALKHEAD FOR THE 'REAL TALKER'

"Way beyond anything you have ever seen for the CoCo"

That's a strong statement, we know. But wait until you see 'TALKHEAD'! It's a dazzling creation—easily the most impressive display of CoCo graphics you can buy!

If you have a 'REAL TALKER' voice synthesizer, DO NOT deprive yourself of this absolutely incredible Talking Head simulation program! TALKHEAD uses the 'Real Talker' and extremely high speed/high resolution machine language to create an audio-visual simulation that clearly goes way, way beyond anything that you have ever seen on ANY home computer!

TALKHEAD's fast, smooth-talking animation is so stunningly life-like that it resembles a movie more than a cartoon! This page shows some still shots of the actual moving image as it will appear on your TV screen.

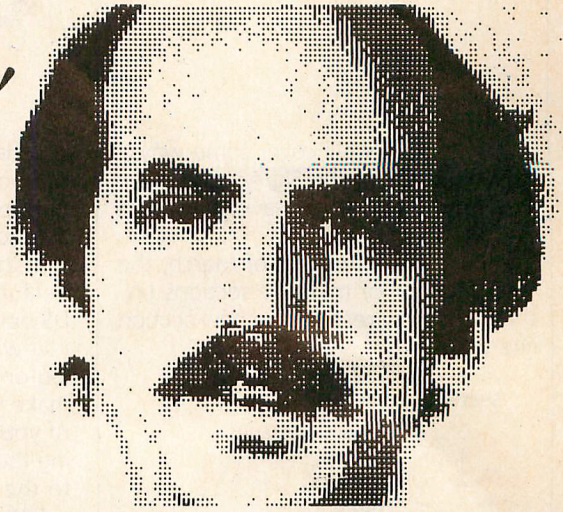
And, TALKHEAD is a real snap to use in Basic, thanks to a new command that we give you: SAY. Type SAY "ANYTHING YOU WANT" and Talkhead instantly appears and speaks ANY text—it has an unlimited vocabulary!

The most impressive CoCo program you can buy . . .

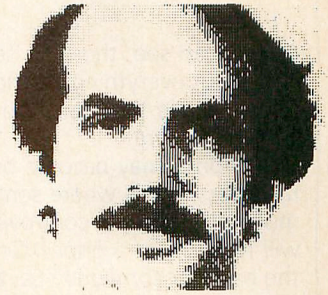
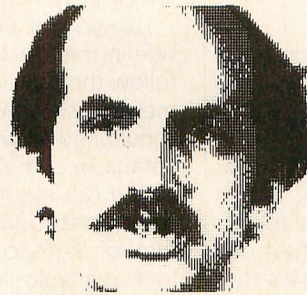
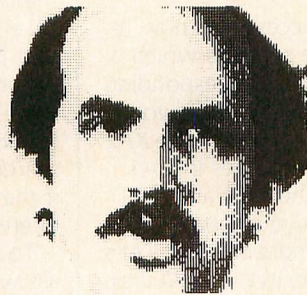
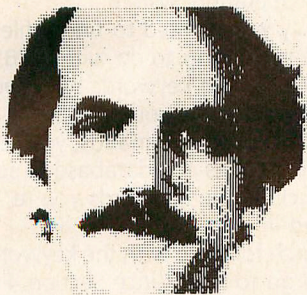
'TALKHEAD' is available on cassette or disk (please specify) for **only \$29.95**. The cassette version can be transferred to disk in case you ever upgrade. TALKHEAD requires 64K of memory and a Colorware 'REAL TALKER' voice pak.

PROGRAM BY TIM JENISON

SPEECH PROGRAMMING BY H. PUNYON



ONLY \$29⁹⁵ FROM COLORWARE



'TALKHEAD's eyes, mouth and jaw move, realistically animating his speech. The effect is amazing!

MORE SOFTWARE FOR THE 'REAL TALKER' VOICE PAK

STELLAR SEARCH ADVENTURE

If you ever had an urge to command the USS Enterprise, this talking version of 'STELLAR SEARCH' from Owl-Ware is for you! It uniquely combines the best aspects of 'adventure' and graphic 'action' type games and puts the 'Real Talker' voice pak to good use. You'll find graphics galore in this exciting package containing more than 86K of action adventure. Requires 32K and a 'Real Talker' voice pak. **Cassette....\$24.95. Disk....\$26.95**

TALKING EDUCATIONAL SOFTWARE

SOFTWARE FOR CHILDREN FROM COMPUTER ISLAND

Math Drill \$ 9.95
Foreign Languages \$ 9.95
Spelling Tester \$ 9.95

All 3 for Only \$24.95
 Requires 16K and a Colorware 'Real Talker' voice pak.

ADVENTURE STARTER

The popular 'ADVENTURE STARTER' from Owl's Nest Software is now available in a speaking version for the 'Real Talker' voice synthesizer. Adventure Starter is a painless and enjoyable way to learn about computer adventure games. Included are two adventures. The first is "MYHOUSE", an easy game with plenty of help and hints. A second adventure, 'PIRATES', is more challenging. Both are great fun for the adventure minded. This is the only way to get into CoCo adventuring! Requires 16K Extended Basic and a 'REAL TALKER' voice pak. **Cassette, only \$17.95.**



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ALL SOFTWARE ON THIS PAGE REQUIRES A COLORWARE 'REAL TALKER' VOICE PAK.

ON LINE ON LINE ON LINE

BY WAYNE DAY

This month we'll cover some ways to move around the Sig/Access databases more efficiently, saving you time and money.

During the latter part of March, the total number of message sections on the Sig was increased. The new section line-up is:

Section	Subject
0	General messages
1	Games
2	Graphics
3	Music
4	Telecomm/SIG
5	Business/Utilities
6	OS-9/Flex
7	Hardware
8	MC-10
9	The Soapbox

As you can see, there's a section for just about everything. Section 0 is only for messages that don't obviously belong elsewhere.

Section 9 may become one of your favorites. This is where some of the more interesting or controversial topics will reside. Got a gripe? Got a pat on the back for someone? Section 9's the place to sound off.

The expansion of messages (and Sig/Access database) sections will especially help users who are interested in selected topics on the Sig, and who don't want to read every message.

For example, you could set your session on the Sig so you read only those messages in Section 6, OS-9 and Flex. Just use the `SS6` command at the main Sig menu or function prompt. To cancel this command, use `SSALL`.

The `SS` command is temporary, valid only for the particular session in which it's invoked. Suppose you commanded `SS3`. You could then read all of the messages in Section 3 (and only Section 3). If you then moved to another Sig or information page on CIS and returned to Color Sig, you would be set to access all sections automatically.

A more permanent fix would be to permanently change your default log-on section by modifying user options.

`OP` is the command to change your options; it will produce the `OPTION:` prompt. Enter a blank line to list the available options.

In this case, you want to change your default log-on section, so choose the `DS` option. It will ask you which section you wish to be exclusively tied to at log-on. When you're through, you can make your changes a permanent part of your membership record by choosing the `P` option. Then, hit `T` to go back to the Sig menu or function prompt.

Setting individual sections means everyone must post their messages in the proper sections. Please make sure the subject of your message follows the general topic of the section into which it's going.

Likewise, all Sig/Access files now reside in the database sections which follow the topic of their corresponding message sections. For example, you should find all graphics files in the `XA2` database, and all the games in `XA1`.

You can modify the `BRO` and `CAT` commands to make your journey through Sig/Access more efficient. Let's look at a typical entry in the Sig/Access database (see the Figure). This one is from the `XA5` (Utilities) files.

Starting at the top of the output you'll notice the ID of the submitter (in this case, me). The next line shows the file name (`DOS64.CC`), the date the file was submitted to the Color

```
[76703,376]
DOS64.CC 16-Feb-84 9295
24 02-Apr-84
```

Keywords: DISK DOS UTILITY 64K

Vers 3.2 dated 2/16/84

Vers 3.2 corrects a bug with the `RUNM` command and keyboard hang-up.

`DOS64.CC` is a Basic program that loads the Basic ROMs into RAM, and modifies them to add or modify the built-in commands and functions.

This version includes `AUTONUMBER`, 40-track disk and dual-sided disk-drive support and a new command, `RUNM` which loads and automatically starts an assembly language program.

Sig (Feb. 16, 1984), and the file length in bytes (9295). The next line shows the number of times other Color Sig users have accessed the file (24), followed by the date of last access (Apr. 2, 1984).

The keywords line is important to someone browsing through the databases, for these keywords should give you a good idea of what the file is, what it does, and how it does it. Following the keywords is a short description of the file.

Taking `DOS64.CC` as an example, the keywords alone tell you that this program is for someone with a 64K Color Computer, with at least one disk drive, and that it does something to the Disk Operating System.

Let's say you wanted to find a file that had something to do with a BBS system. Could the keywords help you there? By modifying your use of the `browse` or `catalog` commands, you can search all the files in a database to see if they include the keywords you're interested in.

To search for a file with the keyword `BBS` we'd go to `XA4` (since Section 4 deals with telecommunications) and issue the command `BRO/KEY:BBS`. The slash mark after the `BRO` command tells the Sig you want to limit the search to something specific, in this case `KEY:`. Another modifier is `AGE:(X)` where (X) is the number of days you want to check through, counting the current day as 1. If you wanted to see what was entered in `XA2` during the past week, you would use the command: `BRO/AGE:7`.

Another way to move through a database selectively is to search by the user ID number. For example, `BRO [76703,376]` would search for all files I have submitted. Since many members of the Sig specialize in a program type, this method of searching the database can be surprisingly rewarding.

By using these different ways of searching through the Sig/Access database, you can optimize your session on the Sig, letting you really enjoy the end of summer! ■

Figure. Typical Entry

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 (LPV7/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminus, etc).

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

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

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

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

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

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

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

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

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

...truly a state of the art word processor...
outstanding in every respect.

— The RAINBOW, Jan. 1982

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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.)

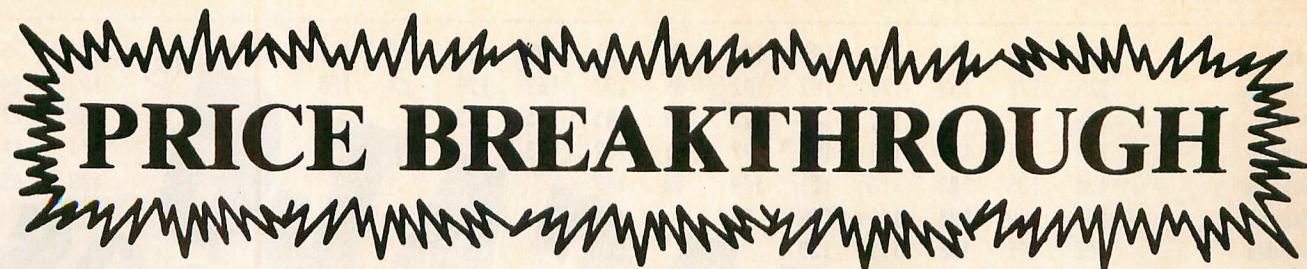
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Bach	136	139	119	161	130	104	84	121	95	115	75	161	1440	144	161	75
Chalone	120	170	152	170	182	102	89	157	162	129	64	158		144	182	64
Dolan	188	157	103	112	161	122	99	145	145	103				144	188	97
Feagan	105	94	127	115	157	97	61	132	113					144	174	61
Graham	135	135	183	116	151	104	86	149						144	183	63
Harpel	134	102	190	161	180	85								144		
Jordan	105	109	188	171	120									144		
Latour	112	128	124	129										144		
Lucido	158	110												144		
Phelps	167													144		
Prats														144		
Schaeferle														144	193	78
Taylor														144	190	88
Torres					131									1620	135	177
Turner				127	131									1635	136	190
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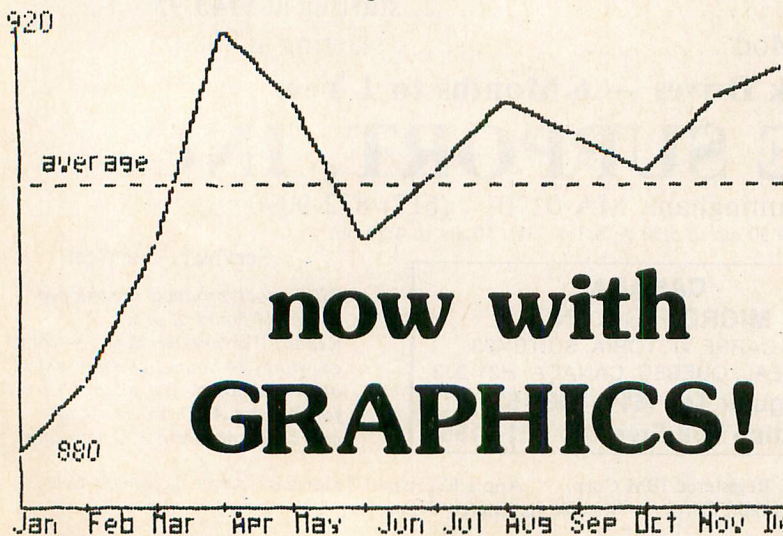
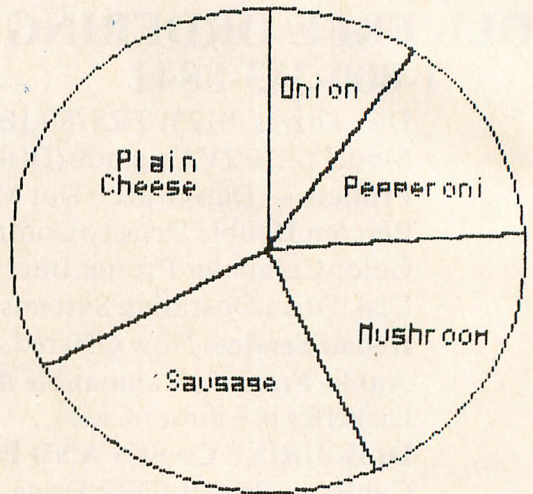


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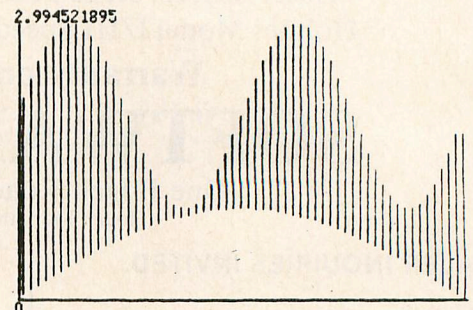
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CUSTOM COLOR

A medley of notes and information.

Change of season housecleaning time. This month I've got updates about the Color Computer 2, a new version of the TV Buff video output (originally presented in March, 1983), some EDTASM+ clarifications, a couple of anecdotes, and other scraps in my get-to-it later file.

64K FOR 2. The upgrade to 64K on the Color Computer 2 was designed for great simplicity. In fact, it's the easiest Color Computer memory upgrade ever put together by Radio Shack. Here's how it goes.

Turn off and unplug the machine. Open the computer by removing the bottom screws. You can punch through the ever-present warning label, or use the hair-dryer method (read on for that one). Flip the computer onto its feet, lift off the cover, and find the memories. They are the eight integrated circuits to the right of the keyboard cable.

Pull all eight memories with an IC puller or flat blade (watch the keyboard cable) and set them aside in non-static conductive foam or aluminum foil (if you don't know what to do with them, see the end of this article). Insert the new 64K memory integrated circuits, all pointing in the same direction as the ones you removed.

Find the point marked W1 (to the left of integrated circuit U7; see Figure 1). Solder a jumper wire between these two points. Your 64K upgrade is finished. Replace the cover and screws, and restore the power. A PRINT MEM command should reveal 24871 (Extended Basic) and 31015 (Color Basic). If 24871 or 31015 don't sound like 64K, read on.

COMPUTERS AND HAIR DRYERS. Many of you have struggled with that Radio Shack warning label, wondering whether you should punch through it and void the warranty. Sometimes you only want to find out what revision computer you have, or need to know some small hardware detail that will influence your decision to buy one peripheral device or another.

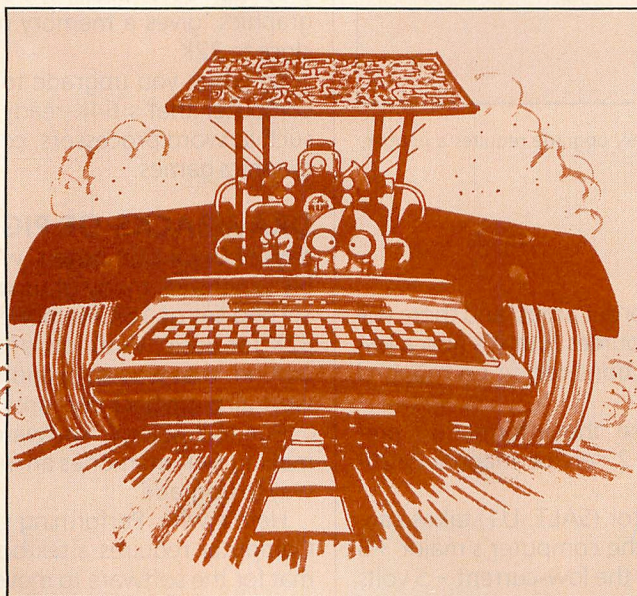
Trouble is, the Shack uses a non-removable glue for that label. Well, Joe Sabin of Princeton, New Jersey, dis-

covered a little trick when his machine sat upside down in the warm sunlight. Heat curls that nasty label up and off. The safest method, he discovered, is to use a hair dryer, gently heating the label. The computer should be turned off, and not be allowed to get too hot from the dryer. Eventually, the label will loosen and curl up.

Put the label on a piece of wax paper, do your snooping around inside the computer, and then slap it back on. Thanks, Joe.

To perform a 64K upgrade on the Color Computer 2, you've got to remove the 16K memories and replace them. But when you pull those 16K memory chips from

the Color Computer 2 to perform the upgrade, don't mix them in with other 16K memories you may have around. The Color Computer 2 16Ks are different — and a hacker's delight. These are 5 volt 16K memories, meaning one of the main obstacles to building projects with dynamic memories — the requirement for +12, +5, and -5 volts — is gone. Tandy's house-numbered 16K memories are 8040016, and those are the three-voltage ones; these newer 5 volt memories are marked 8040517. The former 5 volt line becomes line MA7; the former 12 volt and -5 volt lines are simply tied to



+5 volts.

By the way, this voltage simplicity has another result. If you intend to upgrade your Color Computer 2 to 32K by the old piggyback method — don't. You must use 5-volt-only memories for the piggies, and there are other drawbacks to piggybacking that apply to all Color Computers. Read on for more about that.

2 CHIP CHANGES. It seems that Tandy has committed itself to the Color Computer in a big way. The evidence is their choice to have Motorola develop and manufacture two customized integrated circuits for the Color Computer 2 — a very expensive process. These two circuits combine the functions of a number of individual integrated circuits and discrete parts used in the original Color Computer. For those of us interested in hardware, this customization means there are special parts to order

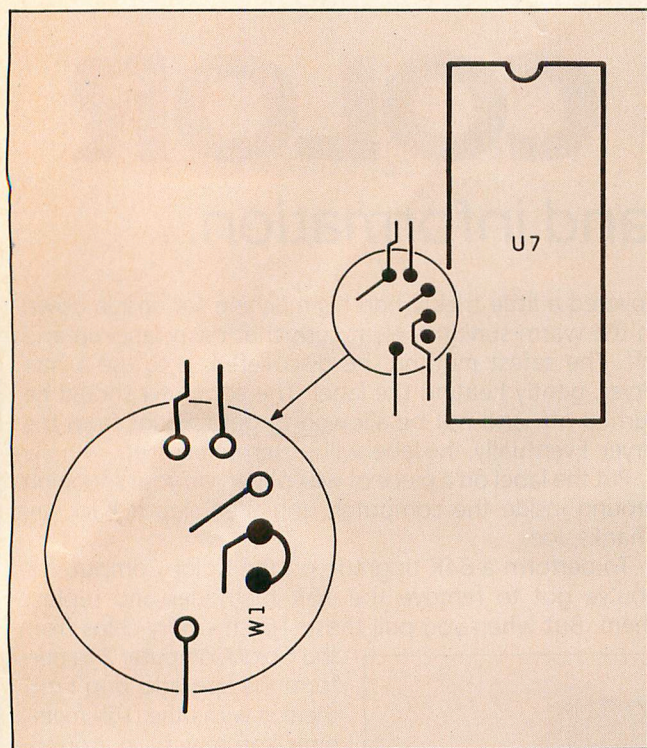


Figure 1. Color Computer 2 64K memory upgrade requires a jumper, connecting points marked "W1."

for repairs, at extra cost, longer order times, and there will be some trouble finding parts sources. But it's also a lesson in how many different functions can fit on mongrel integrated circuits like these.

These descriptions summarize the information presented in the Color Computer 2 service manual (#26-3206/7):

The Supply and Level Translator (SALT, U1) takes care of power supply regulation for the computer's major +5 volt circuitry, and also generates the low-current -5 volts needed for RS-232 transmission. The SALT also converts RS-232 incoming signals to the TTL levels required by the computer, and converts the computer TTL levels to RS-232 output. Incoming cassette data in audio format is digitized to TTL level and shape by a "zero crossing detector," and the current necessary to drive the cassette relay is provided by an internal power transistor.

The Digital-to-Analog Converter (DAC, U3) contains not only the standard 6-bit digital-to-analog converter, but also the analog-to-digital comparator for joysticks, and the analog switch to select various sound enables and outputs, including the cassette data output. The linearity (accuracy) of this DAC is higher than the one made of discrete comparators and resistors in the original Color Computer.

24K, 32K or 64K? We've all contributed to some confusion in this Color Computer business. Many folks, especially those who want more memory but don't want to hear pages of technical jargon, have been asking why they only get 24,871 or 31,015 bytes of memory when they upgrade to 64K.

Here's a quick précis. A 64K Color Computer is really a "64K-ready" machine. There's a 32K of read/write memory (RAM) that Basic can use, and 32K of RAM that Basic can't use. The Color Computer is a 64K "box." Only 64K of any kind of memory can fit in the box. Basic and plug-in cartridges occupy about 32K of read-only memory (ROM), and read/write memory (RAM) occupies the remaining 32K. If you want 64K RAM in the box, Basic and cartridge ROM have to come out to make RAM fit in. So Basic gets turned off and RAM gets turned on in the 64K mode; that's why only machine code programs (not Basic) can make full use of that extra RAM.

The Color Computer powers up into Basic with 32K RAM. But PRINT MEM in Extended Basic only returns 24871. That's because 6,144 bytes of your RAM are reserved for graphics. Color Basic, which doesn't use high-resolution graphics, gives a memory report of 31015, convincingly close to 32K.

So when you upgrade to 64K, you've got a 32K Basic computer that's 64K-ready for machine code programs such as word processors, communications packages, and graphics games.

DRAWBACKS OF PIGGYBACKING. In the early days of Color Computers, when 64K memories were terribly expensive, many of us recommended piggybacking a second set of 16K memories to get a full complement of 32K for Basic. With lots of spare 16K memories floating around, that was an economical route. My first machines were all piggyback versions.

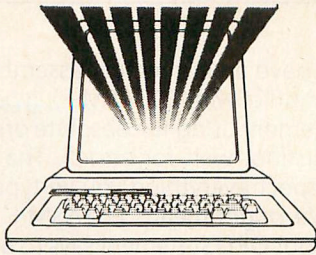
But technology, software and prices have changed, making 64K memories an inexpensive — and essential — way to upgrade.

Here's why. Performing the video display in the Color Computer requires a textbook-perfect 64K memory format for the software to move the "video window" around in memory. The "video window" can display the information from any area of memory — so long as when you turn the machine on, the synchronous address multiplexer (the SAM) is informed that 64K of memory is plugged in. With the 32K piggyback method, the SAM thinks there's only 16K. Memory above 16K won't be displayed; the screen will be a quivering, snowy mass instead of the information you expected.

Software that moves the video window isn't the only reason to avoid 32K piggybacking. With the additional demands on the address lines and greater requirement for power, the proliferation of Color Computer add-on hardware may put too much strain on the machine, causing unexpected glitches or memory flaws. The heat build-up in the memory piggies may also cause early chip failure, though this is less of a concern.

And finally, the Color Computer 2 isn't any cheaper to piggy because it must have 5-volt-only memories to do it.

SUPER SCREEN



- A big 51 character by 24 line screen.
- Full upper and lower case characters.
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- PRINT @ is completely functional on the big screen.
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- Works with 16K, 32K or 64K computers.
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51 CHARACTERS BY 24 LINE DISPLAY

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

COMBINE TEXT WITH HI-RES GRAPHICS

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

PRINT @ IS FULLY IMPLEMENTED

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

ON ERROR GOTO

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

AUTO KEY REPEAT

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

CONTROL CODES FOR ADDITIONAL FUNCTIONS

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

AND MORE GOOD NEWS...

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

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Mark Data Products SUPER BUG is a powerful, relocatable machine code monitor program for your Coco. If you are a beginner, the program and documentation are an indispensable training aid, helping you to gain a better understanding of your Color Computer and machine code programming. If you are an accomplished computerist, SUPER BUG's capabilities, versatility and convenience will prove invaluable during programming and debugging.

SUPER BUG offers so many outstanding features that we are unable to list them all in this limited space. hex and alpha numeric memory display, modify, search and test; full printer support with baud rate and line feed select; up to 220 breakpoints; mini object code disassembler; 64K mode setup; decimal, hex and ascii code conversion routines and extensive documentation. Only \$29.95 on cassette or \$32.95 on disc.

ORDER ENTRY SYSTEM

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

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

The MDP system:

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

This accounting software equals or exceeds higher priced packages for other computers and includes a detailed operating manual. For just \$99.95.

ACCOUNTING SYSTEM

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

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

The MDP system:

- Is accurate, user friendly and simple to use.
- Is easy to customize for specific user requirements.
- Immediately updates the chart of accounts.
- Provides an audit trail.
- Includes end of period procedures.
- Is capable of future expandability.

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All in all, it's time to say that piggybacking memory upgrades is a technique of the past. To those who have been happy with their piggies, I say, keep them until you need the real thing. To those considering the technique (presented in March, 1983), I say, it's not worth it now.

PROBLEMS WITH EDTASM+. I have received quite a bit of mail from readers who have been confused by the EDTASM+ instruction manual. Here are the symptoms: you've entered a listing from the magazine and are calling for an assembly using the EDTASM+ manual's recommended in-memory assembly command, `A/IM/WE`. But the listing consistently shows the wrong addresses and announces bad memory or DP errors. What gives?

The answer lies in that in-memory assembly command. When EDTASM+ assembles the listing into memory, EDTASM+ puts the assembled results where *it* wants, not where the listing indicates. So, EDTASM+ tells you where it put your program, and identifies as errors any places where *its* assembly doesn't jive with *your* listing's requests regarding direct page commands and available memory.

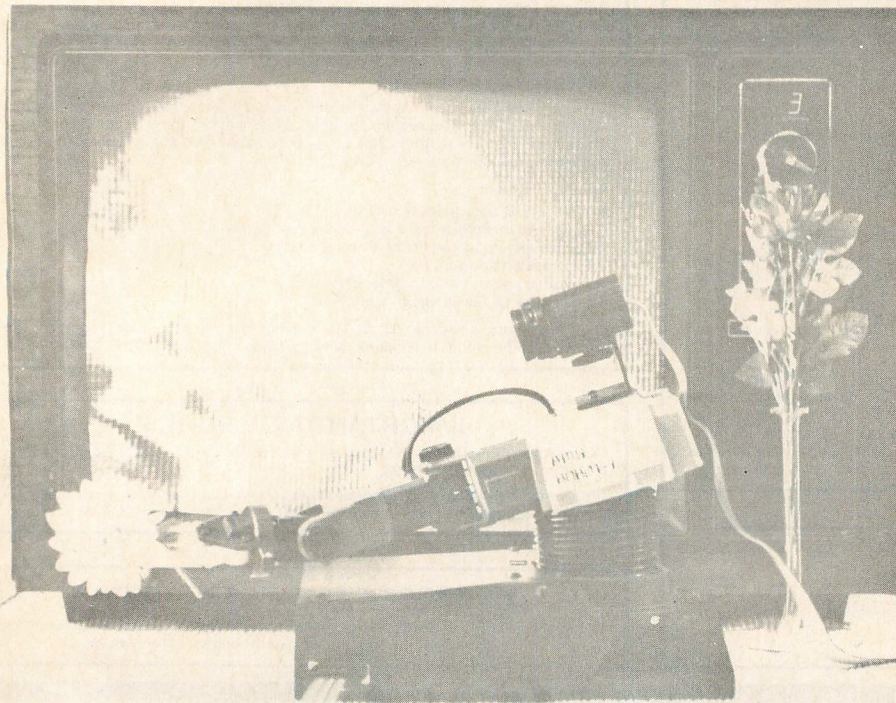
To test the accuracy of your typing, don't use the in-memory assembly! Instead of `A/IM/WE` (assemble into memory, wait for errors), type `A/NO/WE` (assemble without object code, wait for errors). You'll get a display of listing and labels, and only the real errors will show up.

If you must have an in-memory assembly (and you are sure it won't conflict with EDTASM+), type `A/IM/AO/WE` (assemble into memory using the absolute origin specified in the program listing, wait for errors). That will force EDTASM+ to respect everything you've typed in your program. *Absolute origin* means EDTASM+ will use whatever location your `ORG` statement says to use.

The other confusion with EDTASM+ is how to get effective and legible on-screen listings. Here's a summary of the most popular modes:

- `A/NO/WE` displays the listing and waits for each error, but doesn't create a tape.
- `A/NO/NL` displays only the number of errors and the list of labels; `A/NO/NL/LP` is a good way of printing only a list of labels for your reference.
- `A/NO/NL/NS/WE` displays nothing but the number of errors, stopping at each error to tell you what kind it is.
- `A/NO/NS/WE` displays the listing and the errors, but doesn't whip that list of labels by at the end.
- `A/NO/SS/WE` makes looking at errors easier, because it puts the assembled information (what EDTASM+ creates) on a separate line from the source information (what you've typed).
- `A/NO/LP` sends a complete assembled listing to the printer.

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CUSTOM COLOR BACKGROUND. Now that the mailbag is cleaned out, I'd like to review some of the basic assumptions I make about you when I write my Custom Color columns. I assume you know about soldering irons, entering program listings and where to get parts. Since my assumptions might be false, I'm going to run down some of those subjects. This background should be good for about a year, I'm guessing.

● Soldering — How about soldering irons and solder for a start? There are two schools of thought on soldering irons. One holds that a good temperature-controlled iron will give you years of service, whereas the other school says you'll be able to buy 20 inexpensive irons for the price of the least costly professional iron. I went through more than a dozen \$2.79 irons before buying a temperature-controlled unit. The expensive irons heat quickly, give evenly heated soldering, and their tips have a life of several months. I like them. But at \$70 or more, they are a luxury for most of us; the Weller WCTPN that I purchased from Fordham Radio (260 Motor Parkway, Hauppauge, New York 11788, (800)645-9518; Cat. No. WCTP-N, \$69.95) is the one I use daily. On the other hand, my dozen or so Radio Shack 30-watt specials (Cat. No. 64-2067, now up to \$3.49) live a double life... first as soldering irons, and after their demise, as a supply of ceramic spacers, screws, heating wire, metal pieces, plastic parts, and ever-scarce line cords. So either way, if the tip is well-

tinned (covered with a layer of fresh solder), you've got a serviceable tool.

Soldering itself is a skill that requires practice. Soldering modern digital components isn't quite the same as the heavy-duty construction of old. First, there's the solder; you'll want a very thin solder with a consistent core of flux. The flux helps the solder clean joints and flow onto the parts. Remember that the job of solder is to make an *electrical* connection, not a physical connection like a water pipe. Among the best is Spirig and Multicore. Multicore is available from Digi-Key Corporation (Cat. No. PC-115ND, \$1.99). Adequate for occasional work is Radio Shack #64-005, which I've found to have a spotty and sometimes empty flux center. If you must get the Shack's solder, don't get any but #64-005; all the others are too thick and require too much heat.

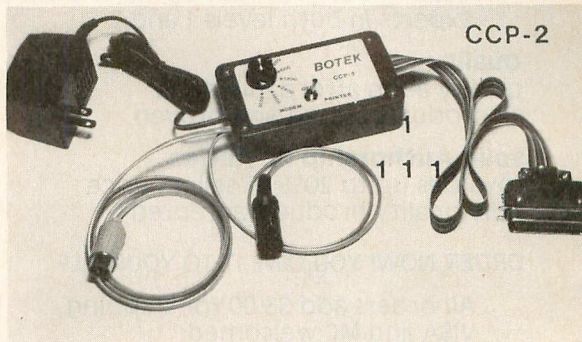
To solder properly, you have to balance the iron, the solder and the components, and have a sense of time and temperature.

The tip of the iron should be hot, tinned with fresh solder, and free of crusts of burned flux; keep a damp sponge handy to clean the iron, and wipe it off regularly. Simultaneously bring the solder and the iron against the components and circuit board to be soldered, making firm contact with the side of the iron's tip. My technique is to bring the solder exactly to a point where the iron meets the part.

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The solder will melt. Wait until it flows evenly over the part and the circuit board; it should take no more than about two seconds. First remove the solder, then the iron. The contact should cool and remain shiny (it will dull just a little), never forming a blob or ball, or have an ice cream peak of solder. If the joint looks blobby or whitish, it hasn't been heated enough, or it has been jostled while cooling. The result is called a cold-solder joint, a connection where air can penetrate and oxidize. Eventually the contact will develop resistance and may even become intermittent. Always reheat cold-solder joints, pull off the old solder with the iron, and rework with fresh, fluxed solder.

The soldering of each connection will take three seconds or so. When soldering transistors, diodes and integrated circuits, take their temperature often. If they are too warm to hold a firm finger on, work somewhere else in the construction and let the hot parts cool. Since their leads (connections) are rated 300 degrees for 10 seconds, try not to exceed that.

● **Basic Traumas** — Even Basic listings have quirks these days; but have faith that published Basic listings are relatively free of gross bugs. Nevertheless, some listings contain very important — and unusual looking — strings and data statements.

So here's Rule One: if you're simply copying a program from the magazine, copy it exactly as it's printed. Then have someone proofread it. You can *not* proofread your own work; that's why newspapers and magazines employ proofreaders and never leave the task to authors and typesetters. It's frustrating to hear from readers who are themselves frustrated...by their own typing errors. So have it proofread, preferably by someone who has no idea what a program is supposed to look like.

Rule Two: Once the listing is typed in, don't run it. Save it! (Actually, you should be saving it as you go along). Basic programs often modify themselves, delete parts of themselves, or install machine code copies of themselves and disappear. Save that original.

Now about those unusual strings and data statements: type strings exactly as printed, including every space. Some of these strings will turn out to be ordinary display information, but others are critical storage areas for binary information and machine code subroutines. Errors here can cause massive program crashes. The same caution applies to data statements. There are special strings and data statements that might look something like this: `A$ = "+PRINTREMREM<9DELaCONTD"`. Somewhere in the article accompanying the program listing you should be told how to create this string, since typing it as shown usually won't work. In its listed form it looks like what you see (and is the only way the magazine can print it), but in its displayed form it might look like a graphic shape; on the other hand, in its binary form, it might represent a machine code subroutine.

Once you've entered a Basic program, save it. Then follow Rule Three: Read all of the accompanying article before typing RUN. Basic programs and Basic programmers have come a long way since the days of `INPUT "What is your name";A$: PRINT "Hello there,";A$`. Expect sophistication in contemporary Basic programs.

● Assembly Listings — are a different genre from Basic, and a very specific one at that. You've got little freedom when you enter these.

Most magazine listings are printed in assembled form for your reference; that is, not only what you type, but also what the computer produces, is shown on the page. At the left of the listing you will see several columns of hexadecimal numbers; these are computer output. The input — what you must type — starts with the five-digit line numbers. Lines are automatically numbered by the editor/assembler.

It may seem obvious to some, but to enter an assembly listing you must have an editor/assembler; the standard for the Color Computer is Radio Shack's EDTASM+ program cartridge. From the printed listing, you type the *label column* (immediately after line number column, often blank), the *opcode column*, and the *operand column* (in order from left to right). Any programmer's comments follow an asterisk (the star, *), and are optional (like Basic's REM statements).

“To a processor, memory is memory is memory is memory, no matter how it's used.”

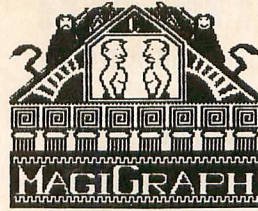
So what do you actually type? You let EDTASM+ handle the line numbers. You type the labels (if any) and you separate columns with a tab (the right arrow on the keyboard). The opcodes and operands have to be typed precisely as shown. With some instructions, the form is very peculiar (for example: LDY ,-X). Type them just that way.

You can leave out anything following an asterisk, but, at least for the first run-through, enter the asterisked lines and the asterisks themselves. As you become familiar with EDTASM+, you'll know what to drop and how to eliminate unnecessary typing.

When you're all finished, you'll need to save what you've typed (called the *source code*) and assemble the source code into binary form (called the *object code*). The computer can only use that binary object code, but you'll need the source code for reference and updating. I'll leave you there; the EDTASM+ manual will take you through the details, and you'll want to work with it before trying to enter your first assembly listing from the magazine.

● Machine Code — appears in unlikely ways and places. To a processor, memory is memory is memory is memory, no matter how it's used. Memory can hold a Basic program, ASCII characters, graphics, or — of course — machine code programs themselves.

As I pointed out earlier, machine code can appear in strings and data statements as curious groupings. Sometimes they'll be a group of data statements and program POKEs. Other times you'll see a printed listing made up of a lump of hexadecimal numbers (like AA 4E C3 01 00 5B 91).



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DENNIS KITSZ

The key to using machine code successfully is to read the article and find out what the author wants you to do. Since the machine code stuff is so specific, you must put it into memory exactly as described. If the author tells you to reserve memory, find out how, and do it in precise order. For example, if the author says CLOADM, just do it. If the author says CLOAD a Basic program, CLEAR200,16384, CLOADM, then RUN...don't run first and then break into the program. As the structure and use of the programs become clear, you might make changes, but at first never believe you know more than the instructions.

In some cases, machine code will be embedded in a Basic program as the program runs. This kind of situation is visible by listing the Basic program before and after running it. If strings or data statements seem to change right in the listing, then you've probably got a program that uses *string packing*, a popular way of hiding a binary machine code program within a Basic program. A sure way to make a mess of things is to run this kind of program before saving it.

If there's just a block of hex code shown in an article, you'll probably be asked to use a monitor. A machine code monitor is a program that permits the direct entry of binary instructions in hexadecimal form. ZBUG is the machine code monitor part of EDTASM+.

WHERE DO PARTS COME FROM, MOMMY?

I've been reading popular electronics magazines for years, but I can still remember the day I walked into Lafayette Radio for the first time. I was 13 — and those were the days when 13-year-olds were still kids.

I had seen the schematic for an am radio published in *Popular Electronics*. I wanted to build that am radio, with its white plastic case and two shiny gold knobs. So I copied down the value of every part, parts with mysterious names like *capacitor* identified by unpronounceable values such as *mmF*. I carefully typed the parts list with my new typewriter. I titled it "PARTS LIST" and underlined those words, then put my full name and address at the bottom. I even made a carbon copy.

In those days, you took a number at Lafayette Radio, and waited up to an hour for service. The number machine (I think it was called Tak-A-Chek) loudly and viciously spit paper tickets. A shy fat boy like me hated to attract attention, so I hoped the crowd would thin before I would have to pull the machine's lever. I stood studying Parts List for what seemed all afternoon, shifting from one foot to the other, pretending I already had a number.

My mother returned from shopping. The store was still crowded and I was still ticketless. She made a loud fuss about needing a number, and demonstrated that Tak-A-Chek wouldn't hurt me, for goodness sakes. Although the sunlight outside suddenly looked very inviting, Parts List (now my Holy Grail) brought me through the embarrassment and humiliation.

Salesmen were pulling the chain of a black machine that read "Now serving..." in big, curly, ivory letters. The

clacks of the chain combined with the warm summer air, the hum of the crowd and an occasional "Thirty-two?" or "Forty-nine?" to lull me. Time blurred. It was my number they were calling now. I was paralyzed with the realization that I didn't know what I was supposed to respond. They repeated the number. Finally, my hand shot up and I called out "Here!" in a voice that sounded deafening. It sounded like the time I'd laughed out loud in church when a classmate showed me the fingernail he'd painted black.

The salesman scrutinized the crowd, looking for the tiny voice. "Where?" I pushed through the crowd, and offered the salesman Parts List. "I want to build a radio. How much do these cost?" I asked. His response seemed bizarre. "Do you have a nickel?" I pushed out through the crowd and back again with a nickel from my mother, and placed it on the counter.

The salesman folded Parts List, creasing it over and over, took the nickel and said, "It's too busy today. I'll write the prices on your list and send it to you. The nickel's for the envelope and stamp." He turned away and pulled the chain. "Number fifty-four?"

"The terror of the fat boy wanting to build something from pieces he didn't understand . . . remains with me to this day."

A week later, an envelope arrived with a purple Statue of Liberty stamp postmarked *Fight TB With Easter Seals*. Parts List was covered with catalog numbers and prices, and signed "Bill, Salesman." The total was over twenty dollars. Twenty dollars! The am radio seemed far away.

I never did build the am radio with the white case and gold knobs, and the sacred Parts List has long since disappeared. But that feeling, the terror of the fat boy wanting to build something from pieces he didn't understand and couldn't pronounce which were purchased in a crowded, adult, overwhelmingly alien place, remains with me to this day.

In 1984, Radio Shack has supplanted Lafayette Radio. Its salespeople use catalog numbers, and don't understand much more about parts than the little fat boy. Stamps cost nearly seven times as much, and an am radio hardly half. But when I type "Parts List" in **The Color Computer Magazine**, you've still got to find them. I always make sure Green Mountain Micro has the complete kit of parts for my projects, but if you want just one or two, see Table 1. Those sources will have the parts for any project in Custom Color, and will know what you mean when you ask for them. No embarrassment, humiliation, or venomous Tak-A-Chek.



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UPDATES. About the Color Burner (March and May, 1984): a current-limiting resistor is recommended in the 21-volt circuit. The life of the 21-volt zener diode will be extended by not clobbering it with 25 volts. Insert a 75-ohm, 1/4 watt, 5 percent resistor between the collector of the transistor in the 25-volt circuit and the collector of the transistor in the 21-volt circuit.

About Quaver (December, 1983). In order to get anything musical out of this program, you've got to define both a set of envelopes and a set of waveforms.

About the CoCoPort (April and May, 1983). Some users with high-performance applications have noticed a 5 to 10 nanosecond glitch at the optional address decodings (\$FF54, \$FF58, \$FF5C). The solution is the use of a 74S139 in place of the 74LS139 shown in the original circuit. There is no re-wiring necessary. Also, glitches due to the high-speed switching of the '139 may appear. The 0.1 mF decoupling capacitor shown in the circuit is essential, and must be placed physically and electrically close to the integrated circuit. I am using a flat capacitor that seats directly underneath the IC known as a Micro-Q capacitor (Rogers Corporation, Q/PAC Division, 5750 East McKellips Road, Mesa, Arizona, 85205).

I've got a new TVBuff circuit for those of you using video monitors. My first design was a quick-n-dirty one using a minimum of parts. More folks are using video monitors now, and their visual consciousness seems to have been raised by the quality of the Tandy 2000 and the IBM PC. So the new circuit uses lots more parts (16 total parts — eight resistors, five capacitors, two transistors and a variable resistor), but provides either a color or monochrome output. This TVBuff isn't for the Color Computer 2... I'm working on that one!

See Figures 2 – 5 for color and monochrome hook-ups for Color Computer revisions B, C, D, E, E1, E2, F and NC (is that it?).

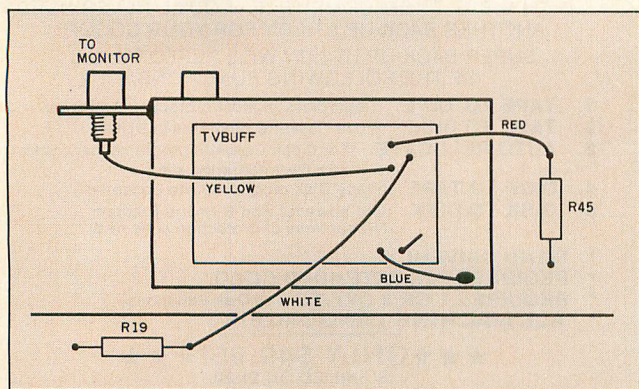


Figure 2. TVBuff II connection points for output to a color monitor for Color Computers revision B, C, D and E.

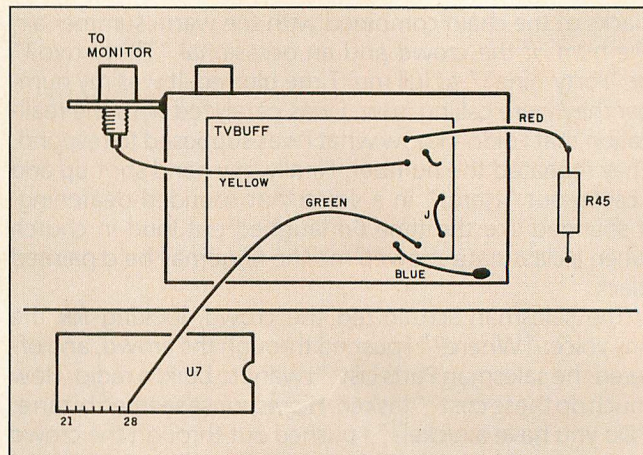


Figure 3. TVBuff II connection points for output to a monochrome monitor for Color Computers revision B, C, D and E.

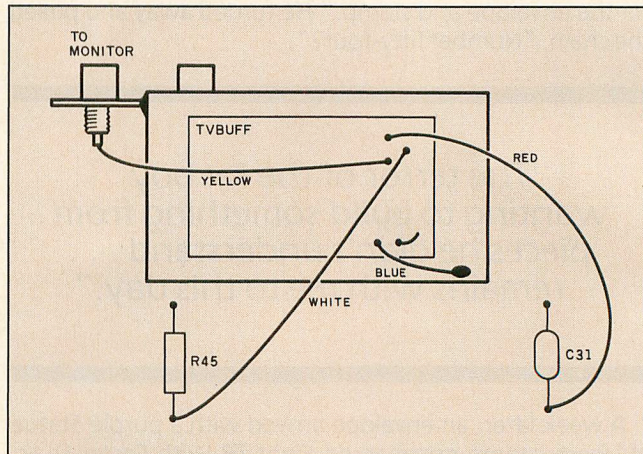


Figure 4. TVBuff II connection points for output to a color monitor for Color Computers revision E1, E2, F and NC.

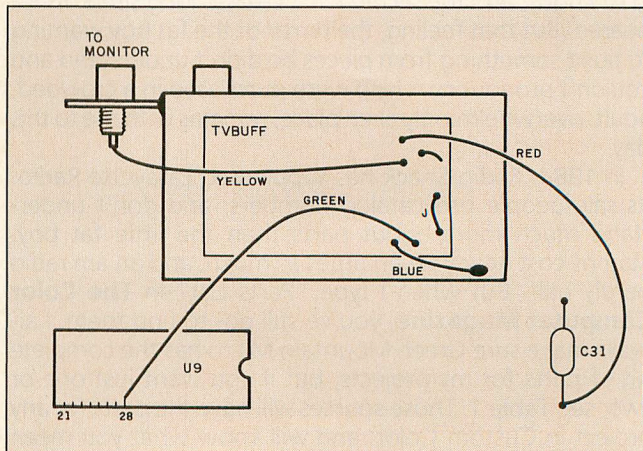
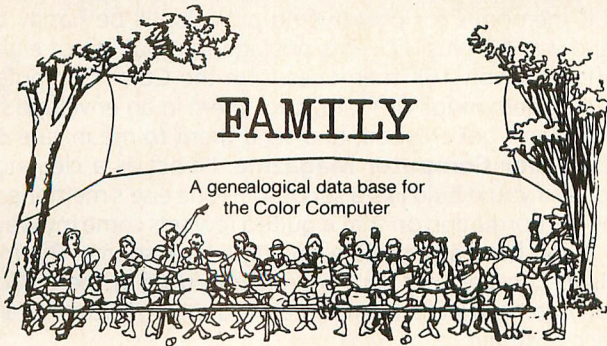


Figure 5. TVBuff II connection points for output to a monochrome monitor for Color Computers revision E1, E2, F and NC.

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PHILOSOPHICAL THOUGHTS. Those of us with our little Color Computers are part of an incredible period in the history of humanity, a period which has theologians and philosophers scrambling for an answer to the question, "What is human?" With discussions of artificial intelligence finding their way onto page one of the popular press, it might be time for a pause for thought. I'd like to offer a story, and a little reading. Two excellent articles are "Living in a World with Thinking Machines," by Allen Emerson and Cheryl Forbes (*Christianity Today*, 28:2, February 3, 1984, pp. 14ff) plus the book review that follows it; and "The Dominus Demonstration" by Charles Sheffield, (*Analog*, 104:4, April, 1984, pp. 54ff).

The story I want to relate involved a discussion I had about artificial intelligence with my friend Peter Clarke, minister of the First Congregational Church in Redding, Connecticut. After grappling over the usual preliminaries involving intelligence, humanity, theology, self-awareness, creativity, and so on, we concluded that eventually (and perhaps not so far down the technological road), computers would be endowed with so much that is human that both we — and they! — might believe in their humanity. "What," I asked Peter, "if Peter Clarke were the minister and, for the first time, an apparently self-aware computer presented itself for communion during Rev. Clarke's service?" Because the question was presented in such personal terms, Peter thought for a long time, and then responded, "I think the answer is John 3:16, '...that whosoever believes in him should not perish but have eternal life.'"

I was just as confounded as satisfied by Peter's answer. After a moment, so was he. The question could of course have been rephrased within the framework of any religion, i.e., can a machine created by humans share in what we consider uniquely human, spiritual experiences?

Even we users of the lowly Color Computer can deal with those questions. May I hear from you? Write to Adam and Eve Version 2.0, c/o Dennis Kitsz, **The Color Computer Magazine**, Highland Mill, Camden, Maine 04843.

TRADE NOTES & OTHER STUFF. I use buckets of 16K memories for prototyping projects. I'll be happy to send you \$2 plus 37 cents postage for your set of eight leftover 5-volt 16K memories from the Color Computer 2. Put them in foil or foam, pack them in an envelope so they don't get crushed, and send them to me in care of **The Color Computer Magazine**. I'll act as a clearing-house if you would like a set of someone else's memories; more information on that if quite a few sets come my way.

If you have any trouble finding a local source, 0.1 mF Micro-Q capacitors for 16-pin ICs (as used in the CoCo-Port) are available from Green Mountain Micro for \$1 each postpaid.

Due to the increased cost of parts, please note that the price of the Color Burner (March/May, 1984) has been raised to \$64.95 assembled, \$49.95 kit, plus \$2.50 shipping.

The Bubble Memory project has been discontinued due to lack of interest. For those readers who were waiting for an operating system, my apologies; overall interest was so low that the time required to complete it couldn't be justified. ■

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Table 1. Selected parts sources. Not a comprehensive list, but those often used by the author. Listed in order of the author's preference.

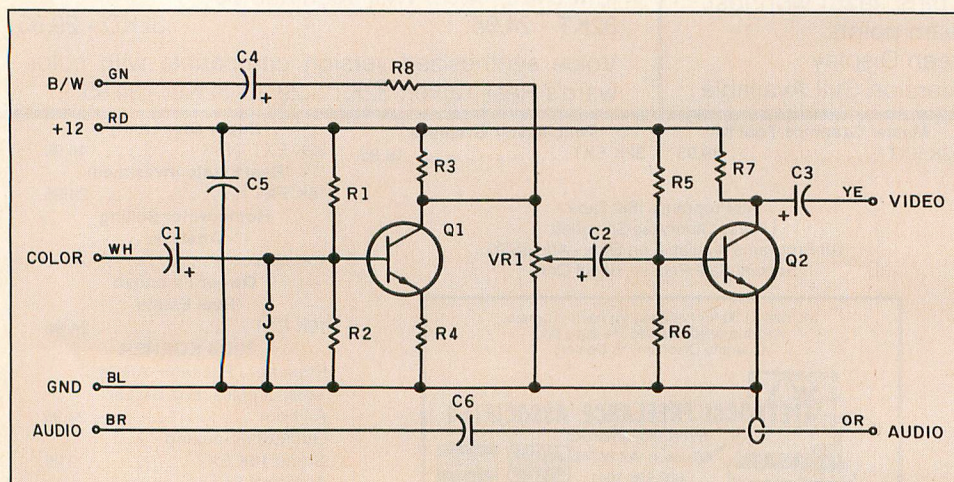


Figure 6. Schematic of the TVBuff II video output circuit.

- C1 10 μ F, 16V
- C2 10 μ F, 16V
- C3 10 μ F, 16V
- C4 10 μ F, 16V
- C5 0.1 μ F MONO
- C6* 1.0 μ F POLY

- R1 10K
- R2 4.7K
- R3 220 Ω
- R4 75 Ω
- R5 100K
- R6 47K
- R7 75 Ω
- R8 470 OR 510

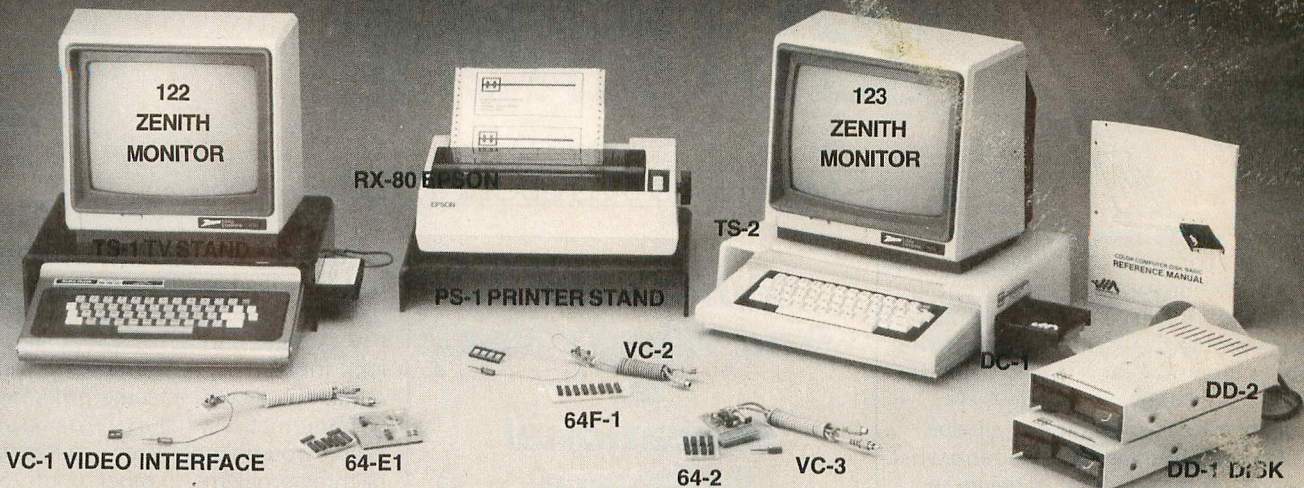
- Q1 2N3904
- Q2 2N3904

- VR1 10K

*ON SCHEMATIC FOR AUDIO; NOT ON TVBUFF IIPC BOARD.

Table 2. Parts list for the TVBuff II video output circuit.

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DC-1 Disk Controller reads and writes to 35 and 40 track single and double sided drives with all models of the color computer. (J&M) **\$134** (\$2shpg)

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VC-3 for Color Computer 2—color and monochrome. **\$39.45** (\$2)

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64-2 for Color Computer 2. Kit requires two solder joints, no trace cuts. **\$69.45** (\$2)

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All disks include drive system case and power supply. All contacts are gold-plated.

DD-1 Half-height 5 1/4" 40-Track SSDD— 179,712 bytes available. **\$269** (\$5shpg)

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DD-3 Dual 3" 40-Track SSDD (Amdek)— 359,424 bytes. **\$474** (\$5)

CA-1 Cable to connect disk to controller. **\$24.44** (free shpg with disk order)

CA-2 Cable to connect two disks. **\$29.44** (free shpg with disk order)

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122 Zenith 12" Amber Monitor has excellent resolution, is easy on the eyes. **\$134** (\$6shpg)

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HM-2 Package: 123 Monitor, VC-2 Video Controller, TS-2 Stand. **\$144.44** (\$7)

All monitors require video controller.

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TS-3 Same for COCO 2. **\$39.50** (\$2.75)

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GOTO SCHOOL GOTO SCHOOL GOTO SCHOOL

BY BILL MCHENRY & SVEN BONNICHSEN

What lights up a kid's eyes and sets his or her brain a-whirring? What inspires them to spend hours working out a problem presented in class? What keeps them so interested in a subject they forget they're learning?

In most cases, a computer helps.

It's hard to think like a kid; and what impresses an educator as being an excellent presentation of material may impress the kids who have to use it as so deadly boring that they'll never use it, or worse, it'll teach them to consider computers as a form of arcane torture. We decided to go straight to the experts in kid's fancy for some uninhibited advice on educational programs — kids know what they like, and they like what they like!

Bill and Sven are in the sixth grade at the Asa C. Adams School in Orono, Maine. They've been using computers through Craig Dickinson's classes (Craig has written several articles on Logo for **TCCM**), and on their own. Bill and Sven spent many after-school hours and weekends looking at several educational software packages generally thought well of by educators, just so they could write this article. We hope their observations will be meaningful to teachers, parents and educational software producers.

It made us feel good to know that the educational "games" that held their interest and merited their praise weren't shoot-em-up arcade-style clones, but programs that required thought and concentration and true, rather than rote, learning.

We were also happy to learn that kids are well aware of the programming sophistications possible, and weren't impressed by anything but the best programming efforts. I'm not sure I would have been so astute at 12 years old.

Here is a note about the programs they considered: "The Factory," from Sunburst Communications, is listed as suitable for Grades 4 – 9; "Geography Search," from McGraw-Hill, for Grades 5 – 8; "Timebound," from Children's Computer Workshop, age 10 and up;

What's Hot, And What's Not, In Educational Software.

"Flipside," also from CCW, age 10 and up; the other programs did not include age guidelines with their packaging.

To begin, we conducted a mini-interview. The answers are a collaboration:

TCCM: What are the biggest mistakes a software manufacturer makes when designing educational software?

- The problem with some educational programs is that the directions are confusing. Sometimes the directions are too long and complex, filling several screens.

Much of the time the directions don't tell how a game is scored. Sometimes the points don't even appear on the screen; you might think you got 1000 points, while you really only got three. At other times you get points and don't know what they are for!

Sometimes the games are too easily scored. It is very difficult for adult software makers to estimate how hard a game is. One solution would be to test the game with different age levels; that way the manufacturers would see who the game is too hard for and too easy for.

Most software manufacturers do not use the full power of the Color Computer. The Color Computer has excellent sound and graphics, and to create a good program manufacturers must use these capabilities without distracting the player from the object of the software (it's very difficult to do math while listening to the *1812 Overture!*).

TCCM: Should educational software be better than, or different from, games?

- A game should be something to look forward to, not something you automatically get to the game part even if you did poorly, or only did two or three problems. In other words, you should work for your fun.

TCCM: For what areas of education is educational software unsuited?

- We'll have to see about spelling and reading in the next ten years, but for math and social studies, computers are tops. In our social studies class we played a simulation called "Geography Search" (TRS-80 Model III). It was about sailing across the ocean to the new world in the 1500 – 1600's. Simulations are good in social studies because they make you feel like you are there. You can really understand it.

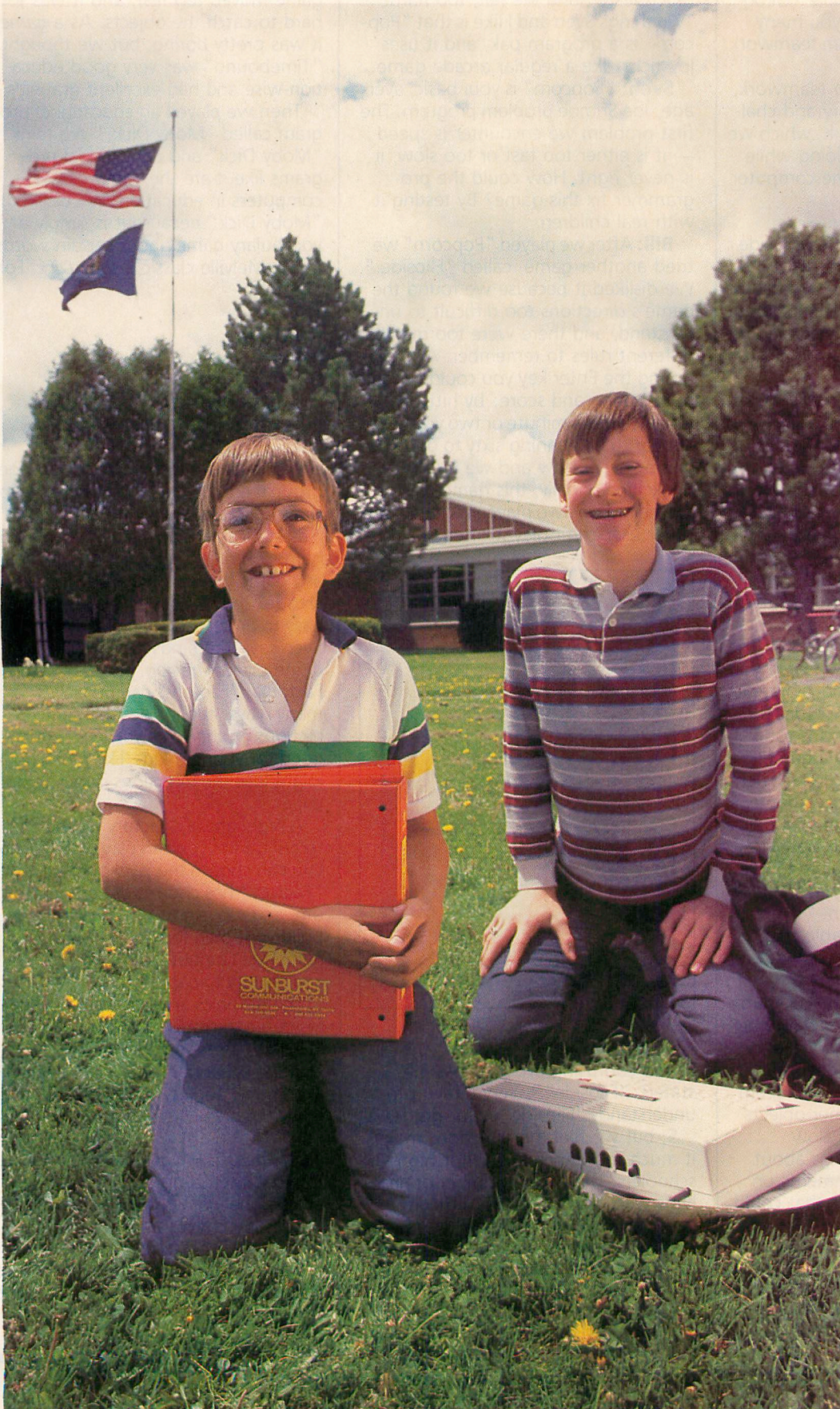
The reason we hesitate over reading and spelling programs is because there is little creativity: it's just "punching in the right answer."

Good science programs should come in the future. We are working on some right now for our science fair. We have found the Color Computer to be the perfect tool to work with for science projects.

TCCM: Describe the ultimate educational software package.

- Out of all the programs we have run, we picked two we think are the best: "Geography Search," and "Factory," which we write about later. We liked them because they had the two "E's" — Education and Entertainment.

"Geography Search" helps you understand something that would have been much harder to learn from a book. We would have thought it better than "Factory" except that it had no graphics. "Factory" and "Geography Search" allow users to participate in something they couldn't ordinarily do inside a classroom. If you are preparing to be a sailor or navigator when



Kip Brundage

Bill McHenry (left) and Sven Bonnicksen (right) in front of The Asa Adams School in Orono, ME. The boys are sixth graders, and our resident GOTO School guest writers this month.

you grow up, a program like "Geography Search" will teach you many things. Also, in this program teamwork is needed.

In "Factory" there is no teamwork, but you can build a factory and challenge someone to rebuild it, which we have seen many people doing while using the game here in the computer lab.

SOME EXAMPLES. To provide examples of what Sven and Bill told us in this interview, here is an excerpt of their reactions and comments about some of the educational programs.

Sven begins. He looks at games in general:

When you go into an arcade, what is the first thing you notice about the games? The graphics. When you see a bright colorful game with hi-res graphics it automatically catches your attention, and in that way makes it seem the best choice of games to play.

Then you notice the sound. Sound is a very important part of games; there are four things that determine the quality of sound. First is the volume: if the sound is so quiet you can't hear it, you won't notice it; if it's blasting your eardrums you won't go near it for fear of internal damage. Second is tone: I, for one, would never play a game whose laser blasts sounded like a belching boar. Third is creativity: a game with new, good effects that sound like what they are supposed to be will attract people. And last of all is songs: a nice, clear, familiar song at the end of a game is a good touch.

Another important variable that attracts us to a game is speed. We don't like games in which it is very difficult to get the odds between the computer and the player even, that always play either too fast or too slow. We also don't like speed that's not proportionately realistic — where you seem to be moving fast, but other objects on the screen are moving slow.

- Bill tells us a few things about the games, and Sven comments on aspects and improvements that could be made.

Bill: Sven and I first played a preschool game called "Popcorn." The game is simple: you have a pan in which to catch large pieces of popcorn falling from the sky. On the first screen the popcorn fell slowly, so the game was too easy. Soon the action was

much faster, and we felt, too hard. Two things Sven and I like is that "Popcorn" is a program pak, and it uses joysticks, like a regular arcade game.

Sven: "Popcorn" is your basic, average, Joe Shmoe problem program. The first problem we encounter is speed — it is either too fast or too slow, it is never right. How could the programmer fix this game? By testing it with real children.

Bill: After we played "Popcorn" we tried another game, called "Flipside." We disliked it because we found the game's directions too difficult to understand, and there were too many different rules to remember. Also, by hitting the Enter key you could change both screen and score; by hitting it rapidly, after a minute or two you could appear to be winning sixty to one! The game is very slow and we found it unexciting. Finally, this game can be played only by two players. A lone computer user can't play it often.



Sven: We voted "Flipside" the all-round confusing program. As Bill stated, "Flipside" is very difficult to understand. "Flipside" is for grades 2 – 5, but we feel the directions make it much too difficult even for high-schoolers. There are a number of problems with this game: its difficulty; speed (too slow); and poor graphics.

Bill: To contrast, here's a run-down on some other games we played and liked better. "Timebound" is an educational game. To play, you become a scientist who invented a time machine. In the course of the game, objects are hurled at you and you have to catch them. Sven and I thought the

game moved too fast, and it was too hard to catch the objects. As a game it was pretty boring, but we thought "Timebound" was very good education-wise and had excellent graphics.

Then we played an educational program called "Moby Dick." We think "Moby Dick" and educational programs like it are the worst use of computers in education. We disliked "Moby Dick" because it is simply a vocabulary game about certain words in the Melville classic, *Moby Dick*. For example:

WORD:MAST

(1)CREW

(2)POLE

(3)KIND OF WHALE

(4)NICKNAME FOR CAPTAIN

The choices are too simple for the age group it is aimed at, and it doesn't capture the imagination.

Last, Sven and I tried an educational game which has graphics superior to any game we have played outside the arcade. The game is very educational, easy to understand, and really fun! Sven says it reminds him of the card game *Concentration*. It's called "The Factory." "Factory" can be played in many ways, and it gives the game directions on the screen when it starts, good for younger kids (like me) who might lose the directions if they're on paper.

A highlight of "Factory" is the different games you can play with it. Also, you can choose the level of difficulty. "Factory" has choices of hard, medium, and easy. In two of the games you build your own factory. In the third game the computer builds the factory and you try to copy it.

The graphics are interesting as they resemble the moving parts of a factory. "Factory" uses sounds we have never heard in other games. We especially liked how "Factory" really makes you think.

TCCM SPEAKS AGAIN. We found it interesting that the boys feel educational games need to be field-tested; we know that many are, and those the boys criticized were field-tested. Perhaps the methods used were not accurate, or these boys' reaction is atypical — it's hard to know. In any case, now we know what's hot and what's not in educational software! ■

Kip Brundage

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GRADEBOOK

BY LYNN DAVIS

Maintaining a student gradebook requires a lot of time. As a teacher and computer enthusiast, I have been looking for a program that would minimize this time-consuming task, and be flexible enough to handle a wide variety of grading situations. Often a teacher wants to give different assignments to different students, assign reinforcement activities to selected students, grade one group of students differently from another, or needs a variable choice of grading categories.

I have written a program that gives the classroom teacher almost total flexibility when maintaining a set of classroom grades. Besides 32K, you will need Extended

Basic, one disk drive (or cassette), a printer (optional), and a program that removes remarks (REM) and spaces and packs lines.

The program takes over 23K of memory. Approximately 1K of additional memory is set aside for string storage, another 1K is used for program variables, and a maximum of about 9.5K can be set aside for arrays. If you add these numbers together, you find you need 34.5K of memory. To cram it into a machine that really has less than 32K of usable RAM we need a stripping program and a structured way to enter the program.

TYPING. There are a couple of tricks you will have to use to produce a working copy of the program. The steps follow, in order:

- Enter the command `PCLEAR 1`. This will give you room to enter the program and experiment a little.
- Type in and run the program.
- Enter a small class (five students, two grade categories, ten grades/student, and four marking periods) as data for testing. Thoroughly debug the program.
- Save several copies of the debugged program.
- Renumber your gradebook program by one's to free some additional memory. Note: do *not* renumber the program once it has been stripped.
- Enter your stripping program. This program, if it's compact enough, can be loaded into the one graphics page still free that was set aside by the `PCLEAR 1` command. Directions will be given with the documentation accompanying the stripping program.
- Execute the stripping program in the sequence suggested by its documentation to produce the shortest program.
- Immediately save several copies of the stripped program version. You cannot *edit* a stripped program: if you find a bug in your stripped program you will need to make the corrections on the unstripped version and go through the stripping process again.
- If you are using a disk, enter the following command: `POKE 25, &H0E: POKE 26, &H1: POKE &H0E00, 0`.

This will let you load the stripped program at the lowest possible point in memory without destroying some of Disk Basic.

If you are using a cassette, enter the following command before loading the stripped program: `POKE 25, 6: NEW`.

HOW MUCH ROOM? Gradebook will let you store the information necessary for one good-sized class. When you initially set up the class information you will be asked for the number of students, the number of grading categories, the maximum number of grades you expect to need for the marking period, and the number of marking periods you have in the year. The magic number to remember when entering these variables is 71.

When entering these four initial numbers, don't let their combined total exceed the magic number. For example, you could have a class size of 35 students, three grade categories, 29 grades for the marking period, and four marking periods (for a total of 71). The total can be lower than the magic number but not higher.

One last point is that the program prepares for three additional stu-

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dents and their grades. If you initially set up the program for 25 students, you will find you actually have room for 28. This feature is not absolutely necessary (any of these numbers can be changed when you first load the class file), but it gives you some additional flexibility when using the program.

DOCUMENTATION. Once you have a stripped copy of the program loaded and running, you will be presented with an initial menu. Your selections are:

1. LOAD EXISTING FILE
2. START NEW

If you haven't saved any class files yet, enter 2. You will be asked for some general information — the date, name of the class, and a number for the current marking period.

The number you enter will tell the computer where the current marking period grades are to be stored. If you are just starting to use this program and it's your third marking period, don't worry. You can enter the first two marking period grades later.

You will then be asked to enter the number of students in the class; number of grade categories; maximum number of grades you think you will need for the marking period; maximum number of marking periods in the school year; weight of the marking period grades toward the final average; and the weight of the final exam grade toward the final average.

When entering the answers to the first four questions, remember the magic number, and remember there are three extra students built in. You can enter from one to nine marking periods and from one to nine grade categories.



Kip Brundage

Although you enter the weights for marking period grades and final exams now, these figures are only used at the end of the year. For example, in my district when we calculate final averages, the marking period grades equal 66.6 percent of the student's final average and the final exam equals 33.4 percent. Enter these numbers in decimal form, without a percent sign.

You will be asked to type and enter a heading for each of the grading categories. For example, if you want four categories you might call them homework, tests, labs, and quizzes.

The next step is to enter the student's names. Use the Add command, and enter them one at a time. If you make a mistake, just use the Delete or *Change command* and follow the prompts. The Add command can also be used to insert a name between previously entered names.

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**FREE
GIFT**

The initial commands (A, D, C, R, M, and the Up Arrow) are Inkey strings and do not require use of the Enter key. The next menu responses are input statements and each response must be followed by pressing the Enter key.

Once the students have been entered, press M for menu. You will then enter the weight percentages you want each category to count towards the marking period grade. You may choose to give all students the same weight per category, or weight each student separately. Weights are entered as a percent (without the percentage sign).

When you later enter grades into the appropriate categories, the grades per category will be totaled, averaged, and multiplied by the weight you designated. Each average will then be added together, giving you the student's current average.

I have found that most of my students require the same weighting, but I will want to weight one or two students differently. To do this, first weight all students equally, then select the second menu option for weighting selected students separately. The program will ask the name of the student you wish to weight separately. Enter the student's name, and then enter the weights you want to use for that student.

If you don't want a category to count for a student, enter a 0 (zero) weight for that category. You should be aware that the weights do not have to total 100 percent, letting you curve the weighted grades if you desire.

Once you have the category weights entered, you will be taken to the main menu.

LOAD EXISTING FILE. Once you have run the program and saved a file of information, you can use this option to start the program.

You will first be asked to enter the name of file one and the name of file two. For each class you will actually be making two separate files. The first file contains only the initial information (date, class name, marking period, number of students, number of grade categories, number of grades, number of marking periods, marking period weight and final exam weight). This file controls the size of the arrays that store the student grades. It is loaded first so you may increase the size of these arrays if necessary.

Once file one is loaded, the parameters you initially entered will be shown. You will be asked if you want to increase any. You can make corrections (but remember the *magic number*). The computer will then construct a new, larger array in which to store student grades, etc. The program will then load file two.

Once the second file is loaded, the computer will rearrange the old information to fit the new size of the array. Because there is not enough room to load a big array into a smaller one, you can only increase the number variables.

When the computer has made the necessary rearrangements, you will be at the main menu screen.

THE MAIN MENU. Photo 1 shows the ten options available on the main menu. These options allow you maximum flexibility when using The Gradebook.

The cursor in all the photos is actually an orange block with a black square that rotates clockwise. This is the INKEY\$ cursor; it is used heavily throughout the program for fast information entry.

• **Student Names** — Photo 2 shows the screen that lets the user manipulate student names. The options, shown toward the bottom of the screen, are Add, Delete, Change, Rest, and Menu. These options are activated by pressing the letters A, D, C, R, or M. They are INKEY\$ commands, so you need not press the Enter key. If you have more than 20 names, and so are on the next screen, you will also see the Up Arrow option, to let you scroll backwards one screen.

You can add a student name by pressing the A key. The program will ask you where you wish to add the name. The name can be added to the bottom of your list or anywhere within the listing.

To delete a name, press the D key. A prompt will ask you for the number of the student you wish deleted. Type the number and press Enter.

To change a name, press the C key. A prompt will ask you for the number of the name to change. Type the number and press Enter. Another prompt will ask you how you want the name to appear. Type the correct name and press Enter.

The Rest option lets you flip to the next screen if there are more than 20 students in the class. The Up Arrow option appears only if you are on the second screen (or beyond), and lets you flip back through the names.

The Menu option always returns you to the main menu or to a student selection menu.

• **Category Percents** — As explained earlier, the grade category weights can be determined for all students at once, each student *individually*, or a combination. See the section titled "Documentation" for directions.

• **Daily Grades** — Photo 3 shows the Daily Grades screen. The options available are Add, Delete, and Change a grade. The Next option will take you to the next student or to the next screen of grades for the student you are working on (if that student has more than 30 grades). There are also the Up Arrow and Menu options.

As you enter daily grades, you might have a data screen that looks like this:

```
1. HOMEWORK
2. 95
3. 88
4. 92
5. 75
6. TESTS
7. 87
8. 90
9.
```

To add another homework grade after number 5 (or in position number 6), enter A for add, the number 6 when prompted by: ADD WHERE, and the grade when prompted by: GRADE TO ADD. The word *tests* in position 6 will be moved down one position, as will the two test grades.

You cannot add a grade into position 1, as that always contains the name of the first category. You can add a grade into any other position shown on the screen, until you run out of positions. The computer will show you where the last grade may be located if you are close to filling the array.

The average shown on this screen is updated whenever the screen is constructed. This new average is also stored every time the student's entry is updated.

• **Marking Period Grades** — Photo 4 shows the marking period screen. You can change a marking period grade, flip back to a previous student's grades, go to the next student's grades, or return to the menu.

All marking period grades (average) for each student are shown on the screen. A zero designates a marking period that has not yet been calculated. If you are starting this program during the third marking period, the first two marking periods will show a zero, and the third marking period will show the current grade.

To update the first two marking periods use the Change command, and simply change the zeros to their appropriate averages. You can also change the current marking period grade.

You should note that the current marking period grade is updated whenever you use the Daily Grades option. In other words, I suggest you not change any current marking period grades until you have finished entering the daily grades.

• **Finals** — Photo 5 shows the screen where the final exam is entered and the final average is calculated and displayed. The final average is determined from weights entered in the Start New section. The options let you change the input of the final exam grade, or go back to the last student, forward to the next student, or return to the menu.

• **Print-Outs** — Take a look at the three examples of print-outs (Figures 1 – 3). Figure 1, below, shows the student's name, his average in each of the categories, his overall average, and the various individual grades earned in each category.

CATEGORY CODE:	[1]	[2]	[3]
[1] HOMEWORK	[2] LAB EXP.	[3] TESTS	
NAME	[1]	[2]	[3] AVE
ARCHIMEDES	86	83	91 88
HOMWORK	88	92 90 74	LAB EXP. 87 79 TESTS 90 92
BROWN	71	78 57	66
HOMWORK	75	65 73	LAB EXP. 73 83 TESTS 45 68

Figure 1.

Figure 2, below, lists the students, their current marking period grades, a place for comments, and all the marking period grades to date. I use this print-out when filling out report cards. The current grade located next the name ensures a quick and error-free transfer of grades onto the report card. The space for a written comment lets me refresh my memory as to why a student scored as he did.

NAME	MP 3	COMMENTS	MP1	MP2	MP3	MP4
ARCHIMEDES	88	.....	80	85	88	
BROWN	66	.....	50	65	66	
CURIE	96	.....	98	93	96	
DOPPLER	91	.....	88	94	91	
EINSTEIN	67	.....	62	71	67	
FRANKLIN	92	.....	90	90	92	
GODDARD	75	.....	75	80	75	
HUBBLE	90	.....	94	88	90	
IRAS	97	.....	99	94	97	
JOULE	88	.....	94	83	88	
KEPLER	89	.....	90	78	89	

Figure 2.

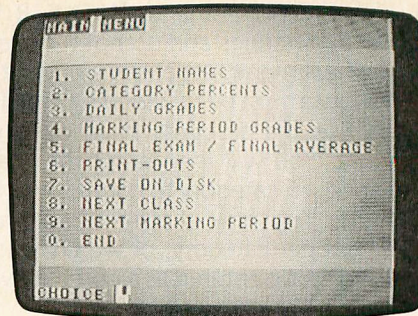


Photo 1.
The Main Menu

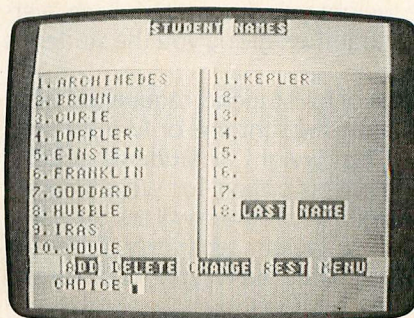


Photo 2.
Options for Adding and Editing Names

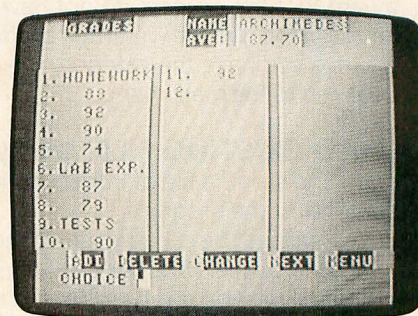


Photo 3.
Daily Grade Screen

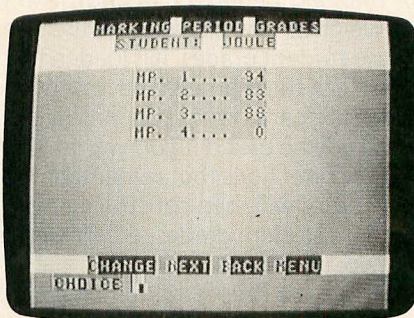


Photo 4.
All Grades In Marking Period

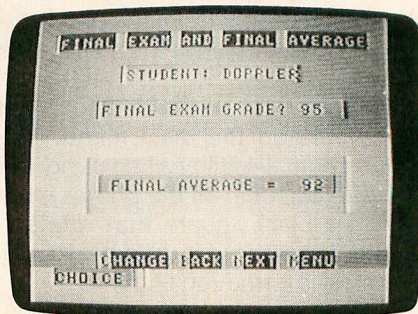


Photo 5.
Input Screen for Final Exam Grade

NEW!

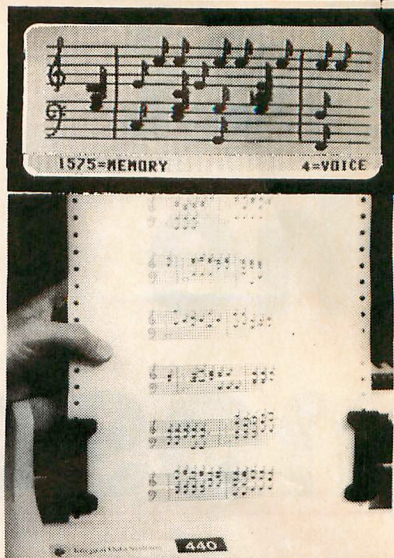
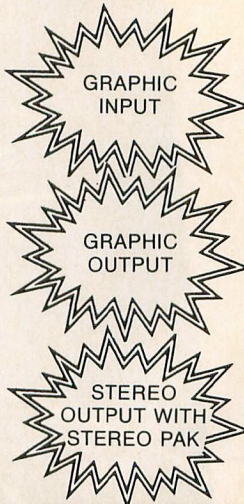
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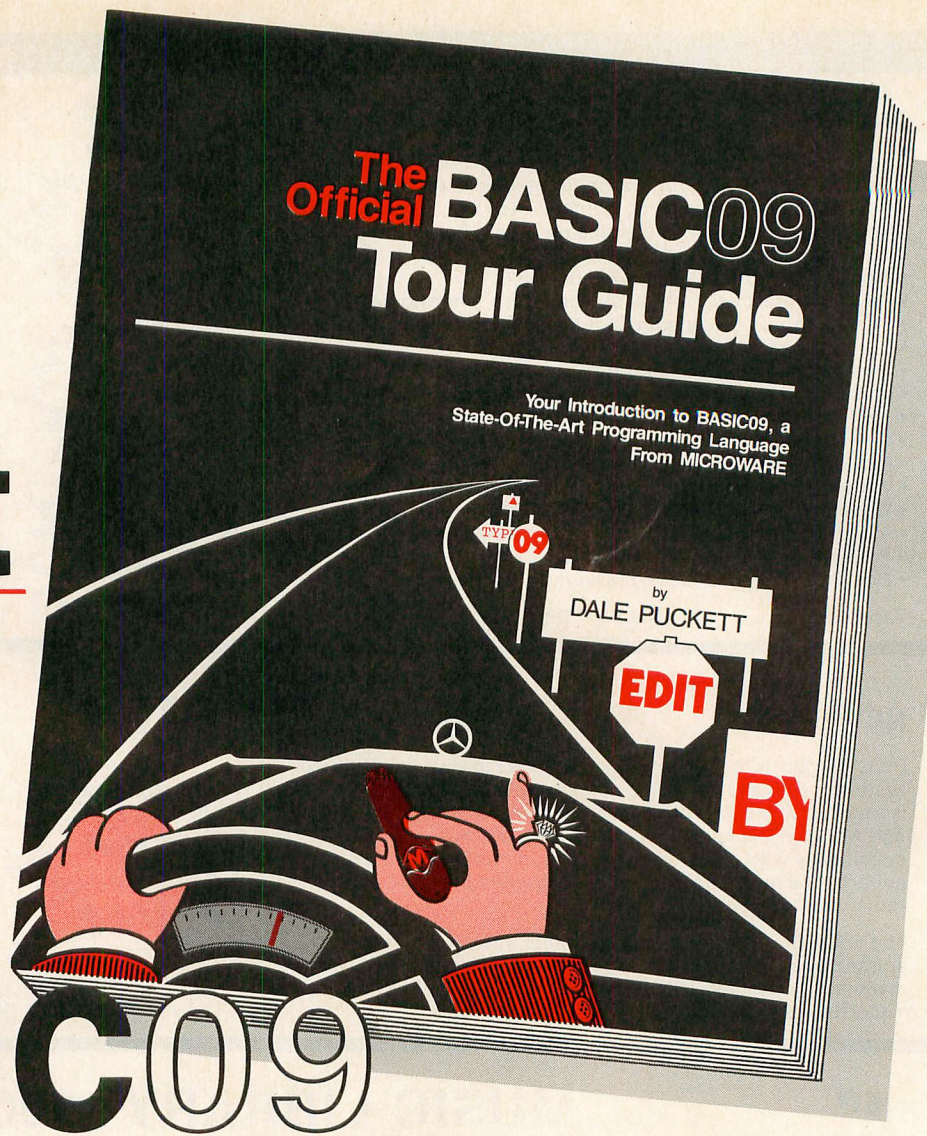
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Figure 3 shows the students, their marking period grades to date, the final exam grade and final average (if it's that time of year), and an average of each grade column.

Camillus Junior High Mr. L. Davis 4th Period Class March 6, 1984 MARKING PERIOD 3						
NAME	MP1	MP2	MP3	MP4	F.E.	F.A.
ARCHIMEDES	80	85	88	0	0	0
BROWN	50	65	66	0	0	0
CURIE	98	93	96	0	0	0
DOPPLER	88	94	91	0	0	0
EINSTEIN	62	71	67	0	0	0
FRANKLIN	90	90	92	0	0	0
GODDARD	75	80	75	0	0	0
HUBBLE	94	88	90	0	0	0
IRAS	99	94	97	0	0	0
JOULE	94	83	88	0	0	0
KEPLER	90	78	89	0	0	0
.....						
CLASS AVERAGE	84	84	85	0	0	0

Figure 3.

● **Saving Files** — As I explained earlier, you will be saving two files. Remember to give them different names.

● **Next Class** — This option lets you load the next class of students into the computer. If you choose this option, remember to save your current information before executing the Next Class option.

● **Next Marking Period** — This option removes all the daily grades from memory and restructures the arrays to their original form. The new daily grades you enter are used to calculate the average for the next marking period.

● **End** — As the heading implies, this option ends your work on the program. Do not use this option until you have saved your current work.

MODIFICATIONS. To make modifications, please refer to Tables 1 and 2. Those wishing to store files on cassette tape should refer to Table 3.

The Gradebook is set up for a percentage grading system. If you use a point system, the necessary modifications are available on this month's Tape Loader, along with the original Gradebook.

If you use letter grades and want modifications to make the program work for your grading system, write to me and explain how your system works. If there is enough interest, I will see what I can do. ■

◆ more

Table 1. Location of Major Program Sections

40 – 330	Initial menu and main menu
340 – 1350	Student names
350 – 580	Screen set-up
590 – 710	Option choices
720 – 1350	Add, Delete, and Change a name
1360 – 1880	Category percentages
1370 – 1510	Menu
1520 – 1690	Setting all weights the same
1700 – 1880	Setting weights for specific students
1890 – 3360	Daily Grades
1900 – 2160	Menu
2170 – 2740	Screen set-up and option choices
2750 – 3110	Add, Delete or Change a grade
3120 – 3360	Calculate marking period average
3370 – 3990	Marking Period Grades
3380 – 3540	Menu
3550 – 3690	All or selected students
3700 – 3990	Screen set-up and options
4000 – 4580	Final Exam and Final Average
4010 – 4320	Menu, choosing all or selected students
4330 – 4580	Screen set-up, final exam, final average, options
4590 – 5990	The Three Print-outs
4600 – 4870	Menus and options
4880 – 4990	Page heading print-out
5000 – 5170	All or selected students option
5180 – 5320	Print-out 1 explanation
5330 – 5390	Print-out 2 explanation
5400 – 5470	Print-out 3 explanation
5480 – 5770	Print-out 1 grades
5780 – 5860	Print-out 2 grades
5870 – 5990	Print-out 3 grades
6000 – 6120	Next Class option
6130 – 6380	Next Marking Period Option
6390 – 6470	End option
6480 – 7780	Load and update files
7790 – 8220	Save files and back-ups
8230 – 8910	Starting New
8920 – 8980	INKEY\$ routine for all INKEY commands
8990 – 9010	Set-up of solid colored lines
9020 – 9110	Calculation of column averages
9120 – 9260	Introductory title page

Table 2. The Arrays

There are five major arrays used to store information. These arrays are:

- NA\$(X) — stores the student names.
- NC(X) — stores the numbers used to establish the size of the arrays, the marking period weight, and the final exam weight.
 - NC(1) — number of students
 - NC(2) — number of grade categories
 - NC(3) — maximum number of daily grades

- NC(4) — number of marking periods
- NC(5) — marking period weight
- NC(6) — final exam weight
- CN\$(X) — stores the names of the grade categories.
- PC(X,Y) — stores the percentages used for each category for each student.
- GR(X,Y) — stores the daily grades, flags used to designate one category of grades from another (flags are numbered from -1 to -9), flag used to indicate the last daily grade entered (-10), marking period grades, final exam, and final average. Note: Because the flags are negative numbers, you cannot give students a grade lower than zero.

Table 3. Modifications for Cassette File Storage

```

240 PRINT" 7. SAVE ON TAPE"
6490 CLS:PRINT"load from tape"
6540 PRINT:INPUT"READY TAPE AND PRESS <ENTER>";EN$
6550 OPEN"I",#-1,F1$
6560 INPUT#-1,LC$(1).
6570 INPUT#-1,LC$(2)
6580 INPUT#-1,L1
6600 INPUT#-1,NC(X)
6630 INPUT#-1,CN$(X)
6640 IF EOF(-1) THEN 6660
6660 CLOSE #-1
7270 PRINT:INPUT"READY TAPE AND PRESS <ENTER>";EN$
7280 OPEN"I",#-1,F2$
7300 INPUT#-1,NA$(X)
7340 INPUT#-1,GR(X,Y)
7380 INPUT#-1,PC(X,Y)

```

```

7390 IF EOF(-1) THEN 7410
7410 CLOSE #-1
7800 CLS:PRINT"tape storage section"
7840 PRINT:PRINT"READY TAPE AND PRESS <ENTER>"
7880 PRINT:PRINT"saving "F1$" on tape"
7890 OPEN"O",#-1,F1$
7900 PRINT#-1,LC$(1)
7910 PRINT#-1,LC$(2)
7920 PRINT#-1,L1
7940 PRINT#-1,NC(X)
7970 PRINT#-1,CN$(X)
7990 CLOSE #-1
8000 PRINT:PRINT"saving "F2$" on tape"
8010 OPEN"O",#-1,F2$
8030 PRINT#-1,NA$(X)
8070 PRINT#-1,GR(ER,ES)
8120 PRINT#-1,PC(ER,ES)
8140 CLOSE #-1

```

PROGRAM LISTING GRADEBOOK

32K Disk Extended Color Basic Tape Loader



or

```

10 CLEAR 900
20 GOSUB 9120
30 GOSUB 8990
40 REM initial menu
50 CLS:PRINT"initial menu"
60 PRINT@64,L3$;
70 PRINT"WHICH WOULD YOU LIKE:"
80 PRINT" 1. LOAD EXISTING FILE
"
90 PRINT" 2. START NEW"
100 PRINT@192,L3$
110 PRINT@256,"CHOICE";:PP=263;G
OSUB8920
120 AN=VAL(CK$)
130 IF AN<1 OR AN>2 THEN 110
140 ON AN GOSUB 6490,8240
150 REM main menu
160 CLS:PRINT"main menu"
170 PRINT@64,L4$;
180 PRINT" 1. STUDENT NAMES"
190 PRINT" 2. CATEGORY PERCENTS"
200 PRINT" 3. DAILY GRADES"
210 PRINT" 4. MARKING PERIOD GRA
DES"
220 PRINT" 5. FINAL EXAM / FINAL
AVERAGE"
230 PRINT" 6. PRINT-OUTS"
240 PRINT" 7. SAVE ON DISK"
250 PRINT" 8. NEXT CLASS"
260 PRINT" 9. NEXT MARKING PERIO
D"
270 PRINT" 0. END"
280 PRINT@416,L4$
290 PRINT@480,"CHOICE";:PP=487;G
OSUB 8920
300 IF CK$="0" THEN 6400
310 AN=VAL(CK$)
320 ON AN GOTO 350,1370,1900,338
0,4010,4600,7800,6010,6140
330 SOUND200,5;GOTO 290

```

```

340 REM student names
350 CA=1
360 CLS:CB=63;CC=79
370 IF CA=1 THEN D=1:E=11
380 IF CA=2 THEN D=21:E=31
390 IF CA=3 THEN D=41:E=51
400 IF CA=4 THEN D=61:E=71
410 IF CA=5 THEN D=81:E=91
420 FOR X=D TO D+9
430 X$=STR$(X):CB=CB+32
440 PRINT@CB,X$;". ";NA$(X);
450 IF NA$(X)="last name" THEN 5
40
460 IF X=NC(1)+3 THEN 540
470 NEXT X
480 FOR Y=E TO E+9
490 Y$=STR$(Y):CC=CC+32
500 PRINT@CC,Y$;". ";NA$(Y);
510 IF NA$(Y)="last name" THEN 5
40
520 IF X=NC(1)+3 THEN 540
530 NEXT Y
540 PRINT@0,L4$;:PRINT@10,"stude
nt";:PRINT@18,"names";
550 PRINT@32,L4$;:PRINT@64,L4$;
560 FOR X=111 TO 399 STEP 32:PRI
NTE$X,CHR$(191);:NEXT X
570 PRINT@416,L4$;:IF CA=1 THEN
PRINT@419,"Add Delete Change Res
t Menu"; ELSE PRINT@417,"Add Del
ete Change ^ Rest Menu";
580 PRINT@450,"CHOICE";:PP=457;G
OSUB 8920
590 IF CK$="A" THEN 720
600 IF CK$="D" THEN 1030
610 IF CK$="C" THEN 1290
620 IF CK$="M" AND P5=1 THEN RET
URN
630 IF CK$="M" THEN 160
640 IF CK$="^" THEN CA=CA-1
650 IF CK$="^" AND CA=0 THEN CA=
1
660 IF CK$="^" THEN 360
670 IF CK$="R" AND Y-1=E+9 THEN
700
680 IF CK$="R" AND Y-1<>E+9 THEN
360
690 SOUND 200,5;GOTO 580
700 IF NA$(E+9)="last name" THEN
360
710 CA=CA+1;GOTO 360
720 PRINT@42," ADD A NAME ";
730 PRINT@450,"ADD NAME WHERE";:
INPUT ND
740 IF ND<1 OR ND>NC(1)+3 THEN S
OUND 200,5;GOTO 360
750 IF NA$(NC(1)+3)>"last name"
THEN SOUND 200,5;GOTO 360

```

```

760 PRINT@482,"NAME TO ADD";:INP
UT NE$:CLS
770 FOR X=1 TO NC(1)+3
780 IF NA$(X)=" " OR NA$(X)="last
name" THEN 800
790 NEXT X
800 IF ND<X THEN 830
810 IF ND=X THEN NA$(ND)=NE$:GOT
O 360
820 IF ND>X THEN SOUND 200,5;CLS
:GOTO 360
830 FOR Y=X TO ND STEP-1
840 NA$(Y)=NA$(Y-1)
850 NEXT Y
860 FOR Y=X TO ND STEP-1
870 FOR Z=1 TO (NC(2)+NC(3)+NC(4
)+2)
880 GR(Y,Z)=GR(Y-1,Z)
890 NEXT Z,Y
900 FOR Y=X TO ND STEP-1
910 FOR Z=1 TO NC(2)
920 PC(Y,Z)=PC(Y-1,Z)
930 NEXT Z,Y
940 NA$(ND)=NE$
950 FOR Z1=0 TO NC(2)+NC(3)+NC(4
)+2
960 GR(ND,Z1)=0
970 NEXT Z1
980 FOR Z1=1 TO NC(2)+1
990 IF Z1=NC(2)+1 THEN GR(ND,Z1)
=-10;GOTO 1020
1000 GR(ND,Z1)=-Z1
1010 NEXT Z1
1020 GOTO 360
1030 PRINT@42,"DELETE A NAME";
1040 PRINT@450,"NUMBER OF NAME T
O DELETE";:INPUT ND:CLS
1050 IF ND<1 OR ND>NC(1)+3 THEN
SOUND 200,5;GOTO 360
1060 FOR X=1 TO NC(1)+3
1070 IF NA$(X)=" " OR NA$(X)="las
t name" THEN 1100
1080 IF X=NC(1)+3 THEN 1100
1090 NEXT X
1100 FOR Y=ND TO X
1110 IF ND=NC(1)+3 THEN NA$(ND)=
"last name";GOTO 1150
1120 IF Y=NC(1)+3 THEN NA$(Y)="l
ast name";GOTO 1150
1130 NA$(Y)=NA$(Y+1)
1140 NEXT Y
1150 IF NA$(NC(1)+2)="last name"
THEN NA$(NC(1)+2)=" ":NA$(NC(1)+
3)="last name"
1160 FOR Y=ND TO X
1170 FOR Z=1 TO (NC(2)+NC(3)+NC(
4)+2)

```


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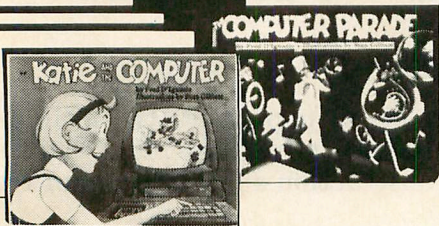
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PROGRAM LISTING (CONT.)

```

1180 IF ND=NC(1)+3 THEN GR(Y,Z)=
-10:GOTO 1210
1190 IF Y=NC(1)+3 THEN GR(Y,Z)=-
10:GOTO 1210
1200 GR(Y,Z)=GR(Y+1,Z)
1210 NEXT Z,Y
1220 FOR Y=ND TO X
1230 FOR Z=1 TO NC(2)
1240 IF ND=NC(1)+3 THEN PC(Y,Z)=
0:GOTO 1270
1250 IF Y=NC(1)+3 THEN PC(Y,Z)=0
:GOTO 1270
1260 PC(Y,Z)=PC(Y+1,Z)
1270 NEXT Z,Y
1280 GOTO 360
1290 PRINT@42,"CHANGE A NAME";
1300 PRINT@450,"NUMBER OF NAME T
O CHANGE";:INPUT ND
1310 IF ND<1 OR ND>NC(1)+3 THEN
SOUND 200,5:GOTO 360
1320 IF NA$(ND)=" " OR NA$(ND)="1
ast name" THEN 360
1330 PRINT@482,"CHANGE NAME TO";
:INPUT NES
1340 NA$(ND)=NES
1350 GOTO 360
1360 REM percentages
1370 CLS:PRINT"category percenta
ges"
1380 PRINT@64,L5$;
1390 PRINT"WHICH WOULD YOU PREFER:
R:"
1400 PRINT" 1. DO ALL STUDENTS T
HE SAME"
1410 PRINT" 2. DO SELECTED STUDE
NTS"
1420 PRINT" 3. MAIN MENU"
1430 PRINT@224,L5$
1440 PRINT@288,"CHOICE":PP=295:G
OSUB 8920
1450 PT=VAL(CK$)
1460 IF PT<1 OR PT>3 THEN 1440
1470 IF PT=1 THEN GOSUB 1520
1480 IF PT=2 THEN GOSUB 1700
1490 IF PT=3 AND F6=1 THEN RETUR
N
1500 IF PT=3 THEN 160
1510 GOTO 1370
1520 CLS:PRINT"category weights"
1530 PRINT"FOR EACH CATEGORY OF
GRADES"
1540 PRINT"ENTER IN THE PERCENTA
GE WEIGHT."
1550 TW=0
1560 FOR X=1 TO NC(2)
1570 X$=STR$(X)
1580 PRINT X$;". ";CN$(X);:INPUT
WT(X)
1590 TW=WT(X)+TW
1600 NEXT X
1610 PRINT:PRINT" total weight
="TW
1620 PRINT@480,"IS INFO CORRECT
<Y OR N>";:PP=505:GOSUB 8920
1630 IF CK$="N" THEN 1520
1640 IF CK$="Y" THEN 1650 ELSE 1
620
1650 FOR X=1 TO NC(1)+3
1660 FOR Y=1 TO NC(2)
1670 PC(X,Y)=WT(Y)
1680 NEXT Y,X
1690 RETURN
1700 CLS:PRINT"selected student
percents"
1710 PRINT:PRINT"<XXX> FOR MENU"
1720 INPUT"NAME OF STUDENT";SN$
1730 IF SN$="" OR SN$="last name
" THEN 1720
1740 IF SN$="XXX" THEN 1370
1750 FOR X=1 TO NC(1)+3
1760 IF NA$(X)=SN$ THEN 1790
1770 NEXT X
1780 PRINT"name not found":GOTO
1720
1790 CLS:GT=0:PRINT"STUDENT NAME
:";NA$(X)
1800 PRINT:PRINT"CATEGORY OL
    
```



```

D% NEW%
1810 FOR Y=1 TO NC(2)
1820 PRINTUSING"% % ###
      ";CN$(Y);PC(X,Y);:INPUT PC(X,Y
)
1830 GT=PC(X,Y)+GT
1840 NEXT Y
1850 PRINT:PRINT"TOTAL ="GT
1860 PRINT@480,"ANOTHER STUDENT
<Y OR N>";:PP=505:GOSUB 8920
1870 IF CK$="N" THEN RETURN
1880 IF CK$="Y" THEN 1700 ELSE 1
860
1890 REM student grades
1900 CLS:PRINT"daily grades"
1910 PRINT@64,L2$;
1920 PRINT"WHICH WOULD YOU PREFER:
":
1930 PRINT" 1. ALL STUDENTS"
1940 PRINT" 2. SELECTED STUDENTS
"
1950 PRINT" 3. MAIN MENU"
1960 PRINT@224,L2$
1970 PRINT@288,"CHOICE";:PP=295:
GOSUB8920
1980 CK=VAL(CK$)
1990 IF CK=1 THEN 2030
2000 IF CK=2 THEN 2080
2010 IF CK=3 THEN 160
2020 GOTO 1970
2030 FOR X=1 TO NC(1)+3
2040 IF NA$(X)=" " OR NA$(X)="las
t name" THEN 1900
2050 GOSUB 2170
2060 NEXT X
2070 GOTO 1900
2080 PRINT@448,"ENTER NAME OF ST
UDENT OR"
2090 PRINT@480,"<XXX> FOR MENU";
:INPUT NF$
2100 IF NF$="XXX" THEN 1900
2110 FOR X=1 TO NC(1)+3
2120 IF NA$(X)=" " OR NA$(X)="las
t name" THEN 2160
2130 IF NA$(X)=NF$ THEN GOSUB 21
70
2140 IF NA$(X)=NF$ THEN 2080
2150 NEXT X
2160 PRINT@416,"name not found";
GOTO 2080
2170 CLS
2180 W3$=CHR$(175)
2190 CD=1
2200 CLS:CE=63:CF=74:CG=85
2210 IF CD<1 THEN CD=1
2220 IF CD=1 THEN P=1:Q=11:R=21
2230 IF CD=2 THEN P=31:Q=41:R=51
2240 IF CD=3 THEN P=61:Q=71:R=81
2250 IF CD=4 THEN P=91:Q=101:R=1
11
2260 FOR Y=P TO P+9
2270 Y$=STR$(Y):CE=CE+32
2280 IF Y=NC(2)+NC(3) AND GR(X,Y
)=-10 THEN PRINT@CE,Y$;". ";CHR$(
191)+"last"+CHR$(191);:GOTO 2530
2290 IF Y=NC(2)+NC(3)+1 THEN 253
0
2300 IF GR(X,Y)=-10 THEN PRINT@C
E,Y$;". ";:GOTO 2530
2310 IF GR(X,Y)<0 THEN GOSUB 312
0 ELSE 2330
2320 PRINT@CE,Y$;". ";CP$;
2330 IF GR(X,Y)=>0 THEN PRINT@CE
,Y$;". ";GR(X,Y)
2340 NEXT Y
2350 FOR Y=Q TO Q+9
2360 Y$=STR$(Y):CF=CF+32
2370 IF Y=NC(2)+NC(3) AND GR(X,Y
)=-10 THEN PRINT@CF,Y$;". ";CHR$(
191)+"last"+CHR$(191);:GOTO 2530
2380 IF Y=NC(2)+NC(3)+1 THEN 253
0
2390 IF GR(X,Y)=-10 THEN PRINT@C
F,Y$;". ";:GOTO 2530
2400 IF GR(X,Y)<0 THEN GOSUB 312
0 ELSE 2420

```

```

2410 PRINT@CF,Y$;". ";CP$;
2420 IF GR(X,Y)=>0 THEN PRINT@CF
,Y$;". ";GR(X,Y)
2430 NEXT Y
2440 FOR Y=R TO R+9
2450 Y$=STR$(Y):CG=CG+32
2460 IF Y=NC(2)+NC(3) AND GR(X,Y
)=-10 THEN PRINT@CG,Y$;". ";CHR$(
191)+"last"+CHR$(191);:GOTO 2530
2470 IF Y=NC(2)+NC(3)+1 THEN 253
0
2480 IF GR(X,Y)=-10 THEN PRINT@C
G,Y$;". ";:GOTO 2530
2490 IF GR(X,Y)<0 THEN GOSUB 312
0 ELSE 2510
2500 PRINT@CG,Y$;". ";CP$;
2510 IF GR(X,Y)=>0 THEN PRINT@CG
,Y$;". ";GR(X,Y)
2520 NEXT Y
2530 PRINT@0,L3$;:PRINT@32,L3$;:
PRINT@64,L3$;
2540 PRINT@2,"grades";:PRINT@13,
"name";:PRINT@45,"ave";
2550 PRINT@416,L3$;:IF CD=1 THEN
PRINT@419,"Add Delete Change Ne
xt Menu"; ELSE PRINT@417,"Add De
lete Change ^ Next Menu";
2560 FOR W4=106 TO 394 STEP 32:P
RINT@W4,W3$;:NEXT W4
2570 FOR W5=117 TO 405 STEP 32:P
RINT@W5,W3$;:NEXT W5
2580 GOSUB 3160
2590 PRINT@50,USING"###.##";GA;
2600 PRINT@18,NA$(X);
2610 PRINT@450,"CHOICE";:PP=457:
GOSUB8920
2620 IF CK$="A" THEN 2750
2630 IF CK$="D" THEN 2910
2640 IF CK$="C" THEN 3030
2650 IF CK$="M" THEN 1900
2660 IF CK$="^" THEN CD=CD-1
2670 IF CK$="^" AND CD=0 THEN CD
=1
2680 IF CK$="^" THEN 2200
2690 IF CK$="N" AND Y-1=R+9 THEN
2720
2700 IF CK$="N" AND Y-1<>R+9 THEN
N RETURN
2710 SOUND 200,5:GOTO 2610
2720 IF GR(X,Y)=-10 THEN RETURN
2730 CD=CD+1:GOTO 2200
2740 SOUND 200,5:GOTO 2200
2750 PRINT@34," ADD ";
2760 PRINT@450,"ADD WHERE";:INPU
T ND
2770 IF ND<1 OR ND>NC(2)+NC(3)+1
THEN SOUND 200,5:GOTO 2200
2780 IF ND>Y THEN SOUND 200,5:GO
TO 2200
2790 IF ND=1 THEN SOUND 200,5:GO
TO 2200
2800 PRINT@482,"GRADE";:INPUTNE:
CLS
2810 IF NE<0 THEN SOUND 200,5:GO
TO 2200
2820 FOR Z=1 TO NC(2)+NC(3)+1
2830 IF GR(X,Z)=-10 THEN 2850
2840 NEXT Z
2850 IF GR(X,NC(2)+NC(3)+1)=-10
THEN SOUND 200,5:GOTO 2200
2860 FOR Z1=Z TO ND STEP-1
2870 GR(X,Z1+1)=GR(X,Z1)
2880 NEXT Z1
2890 GR(X,ND)=NE
2900 GOTO 2200
2910 PRINT@34,"DELETE";
2920 PRINT@450,"DELETE WHERE";:I
NPUT ND
2930 IF ND<1 OR ND>NC(2)+NC(3) T
HEN SOUND 200,5:GOTO 2200
2940 IF GR(X,ND)<0 THEN SOUND 20
0,5:GOTO 2200
2950 IF ND>Y THEN SOUND 200,5:GO
TO 2200
2960 FOR Z=1 TO NC(2)+NC(3)+1
2970 IF GR(X,Z)=-10 THEN 2990

```

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PROGRAM LISTING (CONT.)

```

2980 NEXT Z
2990 FOR Z1=ND TO Y
3000 GR(X,Z1)=GR(X,Z1+1)
3010 NEXT Z1
3020 GOTO 2200
3030 PRINT@34,"CHANGE";
3040 PRINT@450,"NUMBER OF GRADE
TO CHANGE";:INPUT ND
3050 IF ND<1 OR ND>NC(2)+NC(3) T
HEN SOUND 200,5: GOTO 2200
3060 IF GR(X,ND)<0 THEN SOUND 20
0,5:GOTO 2200
3070 IF ND>Y THEN SOUND 200,5:GO
TO 2200
3080 PRINT@482,"CHANGE GRADE TO"
;:INPUT NE
3090 IF NE<0 THEN SOUND 200,5:GO
TO 2200
3100 GR(X,ND)=NE
3110 GOTO 2200
3120 FOR ZA=1 TO NC(2)
3130 IF GR(X,Y)=- (ZA) AND Y<10 T
HEN CP$=LEFT$(CN$(ZA),8) ELSE CP
$=LEFT$(CN$(ZA),7)
3140 IF GR(X,Y)=- (ZA) THEN RETUR
N
3150 NEXT ZA
3160 GA=0:FOR I=1 TO 9:GT(I)=0:N
EXT I
3170 FOR ZB=1 TO NC(2)+NC(3)+1
3180 IF GR(X,ZB)=-10 THEN 3310
3190 IF GR(X,ZB)<0 THEN GOSUB 32
20
3200 IF GR(X,ZB)=>0 THEN GOSUB 3
270
3210 NEXT ZB
3220 CS=0
3230 FOR ZC=1 TO NC(2)
3240 IF GR(X,ZB)=- (ZC) THEN PT(Z
C)=PC(X,ZC):GOTO 3260
3250 NEXT ZC
3260 RETURN
3270 GT(ZC)=GR(X,ZB)+GT(ZC)
3280 CS=CS+1
3290 CT(ZC)=CS
3300 RETURN
3310 FOR ZD=1 TO 9
3320 IF CT(ZD)=0 THEN 3340
3330 GA=(GT(ZD)/CT(ZD))*(PT(ZD)/
100)+GA
3340 NEXT ZD
3350 GR(X,NC(2)+NC(3)+1+L1)=GA
3360 RETURN
3370 REM marking period grades
3380 CLS
3390 PRINT"marking period grades
"
3400 PRINT@64,L6$;
3410 PRINT"WHICH WOULD YOU PREFER?"
3420 PRINT" 1. GRADES FOR ALL ST
UDENTS"
3430 PRINT" 2. SELECTED STUDENTS
"
3440 PRINT" 3. CLASS AVERAGE"
3450 PRINT" 4. MAIN MENU"
3460 PRINT@256,L6$
3470 PRINT@320,"CHOICE":PP=328:G
OSUB8920
3480 CH=VAL(CK$)
3490 IF CH=1 THEN 3550
3500 IF CH=2 THEN 3600
3510 IF CH=3 THEN GOSUB 9020
3520 IF CH=3 THEN 3950
3530 IF CH=4 THEN 160
3540 SOUND 200,5:GOTO 3470
3550 FOR X=1 TO NC(1)+3
3560 IF NA$(X)="last name" OR NA
$(X)="" OR X=NC(1)+4 THEN 3380
3570 GOSUB 3700
3580 NEXT X
3590 GOTO 3380
3600 CLS
3610 PRINT"selected students"
3620 PRINT:PRINT"ENTER <XXX> FOR
MENU"
3630 PRINT:INPUT"NAME OF STUDENT
";NB$

```

```

3640 IF NB$="XXX" THEN 3390
3650 FOR X=1 TO NC(1)+3
3660 IF NA$(X)=NB$ THEN GOSUB 37
00
3670 IF NA$(X)=NB$ THEN 3600
3680 NEXT X
3690 PRINT:PRINT"name not in fil
e":GOTO 3610
3700 CLS(6):PM=0
3710 PRINT@0,L5$;
3720 PRINT@5,"marking";:PRINT@13
,"period";:PRINT@20,"grades";
3730 PRINT@32,L5$;
3740 PRINT@39,"STUDENT: ";:PRINT@
49,NA$(X);
3750 PRINT@64,L5$;
3760 PM=73
3770 FOR Y=1 TO NC(4)
3780 PM=PM+32
3790 PRINT@PM,USING"% %###% %###
";"MP.";Y; "...":GR(X,NC(2)+NC(3
)+1+Y);
3800 NEXT Y
3810 PRINT@416,L5$;:PRINT@421,"C
hange Next Back Menu";
3820 PRINT@450,"CHOICE";:PP=457:
GOSUB 8920
3830 IF CK$="C" THEN 3900
3840 IF CK$="N" THEN RETURN
3850 IF CK$="B" THEN X=X-1
3860 IF CK$="B" AND X=0 THEN X=1
3870 IF CK$="B" THEN 3700
3880 IF CK$="M" THEN 3380
3890 SOUND 200,5:GOTO 3820
3900 PRINT@450,"NUMBER OF MP TO
CHANGE";:INPUT YY
3910 IF YY<1 OR YY>NC(4) THEN SO
UND 200,5:GOTO 3900
3920 PRINT@482,"CHANGE GRADE TO"
;:INPUT GN
3930 GR(X,NC(2)+NC(3)+1+YY)=GN
3940 GOTO 3700
3950 CLS:PRINT@0,L2$+L2$+L2$;
3960 PRINT@2,"class";:PRINT@8,"m
arking";:PRINT@16,"period";:PRIN
T@23,"average";
3970 PRINT@133,"CLASS AVERAGE ="
;:PRINT@149,USING"###.#";AV(L1)/
TS
3980 PRINT@ 192,L2$
3990 PRINT@260,"PRESS <ENTER> FO
R MENU";:INPUT EN$:GOTO 3380
4000 REM final exam and final av
erage
4010 B1$=STRING$(23,255)
4020 B2$=CHR$(255)
4030 B3$=STRING$(4,191)
4040 CLS
4050 PRINT"final exam and final
average"
4060 PRINT@64,L7$;
4070 PRINT"WHICH WOULD YOU PREFER?"
4080 PRINT" 1. DO ALL STUDENTS"
4090 PRINT" 2. SELECTED STUDENTS
"
4100 PRINT" 3. MAIN MENU"
4110 PRINT@224,L7$
4120 PRINT@288,"CHOICE":PP=295:G
OSUB 8920
4130 CH=VAL(CK$)
4140 IF CH<1 OR CH>3 THEN 4120
4150 IF CH=1 THEN 4180
4160 IF CH=2 THEN 4230
4170 IF CH=3 THEN 160
4180 FOR X=1 TO NC(1)+3
4190 IF NA$(X)="last name" OR NA
$(X)="" OR X=NC(1)+4 THEN 4040
4200 GOSUB 4330
4210 NEXT X
4220 GOTO 4040
4230 CLS
4240 PRINT"selected students"
4250 PRINT:PRINT"ENTER <XXX> FOR
MENU"
4260 PRINT:INPUT"NAME OF STUDENT
";NB$
4270 IF NB$="XXX" THEN 4040
4280 FOR X=1 TO NC(1)+3

```

```

4290 IF NA$(X)=NB$ THEN GOSUB 43
30
4300 IF NA$(X)=NB$ THEN 4230
4310 NEXT X
4320 PRINT:PRINT"name not in fil
e":PRINT:GOTO 4240
4330 CLS(2)
4340 FOR Z3=0 TO 192 STEP 32:PRI
NT@Z3,L4$;:NEXT Z3:PRINT@416,L4$
;
4350 PRINT@34,"final";:PRINT@40,
"exam";:PRINT@45,"and";:PRINT@49
,"final";:PRINT@55,"average";
4360 PRINT@104,"STUDENT: ";:PRIN
T@113,NA$(X);
4370 PRINT@166,"FINAL EXAM GRADE
";:INPUT FX
4380 PRINT@188,B3$;
4390 PRINT@261,B1$;:PRINT@293,B2
$;:PRINT@315,B2$;:PRINT@325,B1$;
4400 Z1=0
4410 FOR Z=1 TO NC(4)
4420 Z1=GR(X,NC(2)+NC(3)+1+Z)+Z1
4430 NEXT Z
4440 Z2=Z1/NC(4)
4450 FA=((Z2)*NC(5)/100)+((FX)*N
C(6)/100)
4460 PRINT@294,USING"%
%###%" FINAL AVERAGE =" ;F
A;
4470 GR(X,NC(2)+NC(3)+NC(4)+2)=F
X
4480 GR(X,0)=FA
4490 PRINT@422,"Change Back Next
Menu";
4500 PRINT@450,"CHOICE ";:PP=457
:GOSUB8920
4510 IF CK$="C" THEN 4330
4520 IF CK$="B" THEN 4560
4530 IF CK$="N" THEN RETURN
4540 IF CK$="M" THEN 4040
4550 SOUND200,5:GOTO 4500
4560 IF X=1 THEN 4330
4570 IF X>1 THEN X=X-1
4580 GOTO 4330
4590 REM print-out
4600 CLS:PRINT"print-out"
4610 PRINT@64,L8$;
4620 PRINT"WHICH WOULD YOU PREFER?"
4630 PRINT" 1. SUMMARY OF DAILY
GRADES"
4640 PRINT" 2. MARKING PERIOD GR
ADES ONLY"
4650 PRINT" 3. MARKING PERIODS,
FINAL EXAM AND FINAL AVERAGE
"
4660 PRINT" 4. MAIN MENU"
4670 PRINT@288,L8$
4680 PRINT@352,"CHOICE":PP=359:G
OSUB 8920
4690 CH=VAL(CK$)
4700 IF CH=4 THEN 160
4710 IF CH<1 OR CH>5 THEN 4680
4720 CLS:PRINT"print-out"
4730 PRINT:PRINT"WHICH WOULD YOU
PREFER?"
4740 PRINT" 1. PRINT ALL STUDENT
S"
4750 PRINT" 2. PRINT SELECTED ST
UDENTS"
4760 PRINT" 3. MENU"
4770 PRINT@224,"CHOICE":PP=231:G
OSUB 8920
4780 CI=VAL(CK$)
4790 IF CI<1 OR CI>3 THEN 4770
4800 IF CI=3 THEN 4600
4810 CLS
4820 PRINT"general heading infor
mation"
4830 PRINT:LINEINPUT"TEACHERS NA
ME: ";TN$
4840 LINEINPUT"NAME OF SCHOOL: "
;SN$
4850 PRINT@320,"IS THIS CORRECT
<Y OR N>":PP=345:GOSUB 8920
4860 IF CK$="N" THEN 4810

```




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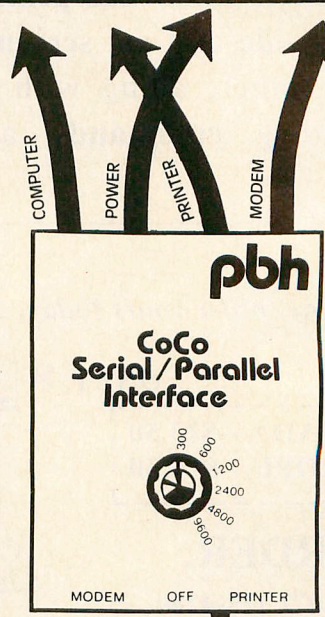
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PROGRAM LISTING (CONT.)

```

4870 IF CK$="Y" THEN 4880 ELSE 4
850
4880 CLS(6)
4890 PRINT@160,"MAKE SURE THAT P
RINTER AND"
4900 PRINT"PAPER ARE READY. PRE
SS <ENTER>"
4910 PRINT"WHEN SET OR <XXX> FOR
MENU.";
4920 INPUT RDS
4930 IF RDS="XXX" THEN 4600
4940 PRINT#-2,CHR$(10)
4950 PRINT#-2,SN$
4960 PRINT#-2,TN$
4970 PRINT#-2,LC$(2)
4980 PRINT#-2,LC$(1)
4990 PRINT#-2,"MARKING PERIOD "L
1
5000 ON CH GOSUB 5180,5330,5400
5010 IF CI=1 THEN 5020 ELSE 5090
5020 FOR X=1 TO NC(1)+3
5030 IF NA$(X)="last name" OR NA
$(X)=" OR X=NC(1)+4 THEN 5070
5040 IF CH=1 THEN CLS:PRINT@32,"
PRESS <ENTER> WHEN READY";:INPUT
RDS
5050 ON CH GOSUB 5480,5780,5870
5060 NEXT X
5070 IF CH=3 THEN GOSUB 5930
5080 GOTO 4600
5090 CLS:PRINT"selected students
"
5100 PRINT:PRINT"ENTER <XXX> FOR
MENU"
5110 PRINT:INPUT"NAME OF STUDENT
";NB$
5120 IF NB$="XXX" THEN 4600
5130 FOR X=1 TO NC(1)+3
5140 IF NA$(X)=NB$ THEN ON CH GO
SUB 5480,5780,5870
5150 IF NA$(X)=NB$ THEN 5090
5160 NEXT X
5170 PRINT:PRINT"name not in fil
e":GOTO 5110
5180 PRINT#-2,CHR$(10)
5190 PRINT#-2,"CATEGORY CODE:"
5200 FOR Z=1 TO NC(2)
5210 IF Z=4 OR Z=7 THEN PRINT#-2
,CHR$(13)
5220 PRINT#-2,USING"###% %
% %";["Z;"];CN$(Z);" "
;
5230 NEXT Z
5240 PRINT#-2,CHR$(10)
5250 PRINT#-2,USING" %
";"NAME";
5260 FOR Z=1 TO NC(2)
5270 PRINT#-2,USING"###% %";["Z;
";"1";
5280 NEXT Z
5290 PRINT#-2,USING" % %";"AVE";
5300 PRINT#-2,CHR$(10)
5310 PRINT#-2,STRING$(80,46)
5320 RETURN
5330 PRINT#-2,CHR$(10)
5340 PRINT#-2,"NAME
MP";L1;" COMMENTS ";
5350 FOR Z=1 TO NC(4)
5360 PRINT#-2,USING"###
";"MP";
Z;
5370 NEXT Z
5380 PRINT#-2,CHR$(10)
5390 RETURN
5400 PRINT#-2,CHR$(10)
5410 PRINT#-2,"NAME
";
;
5420 FOR Z=1 TO NC(4)
5430 PRINT#-2,USING"###
";"MP";
Z;
5440 NEXT Z
5450 PRINT#-2," F.E. F.A.";
5460 PRINT#-2,CHR$(10)
5470 RETURN
5480 GA=0:FOR I=1 TO 9:GT(I)=0:N
EXT I
5490 FOR ZB=1 TO NC(2)+NC(3)+1
5500 IF GR(X,ZB)=-10 THEN 5630

```

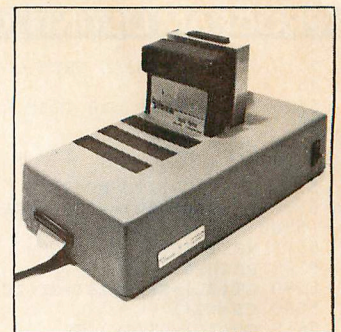
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PROGRAM LISTING (CONT.)

```

5510 IF GR(X,ZB)<0 THEN GOSUB 55
40
5520 IF GR(X,ZB)=>0 THEN GOSUB 5
590
5530 NEXT ZB
5540 CS=0
5550 FOR ZC=1 TO NC(2)
5560 IF GR(X,ZB)=- (ZC) THEN GOTO
5580
5570 NEXT ZC
5580 RETURN
5590 GT(ZC)=GR(X,ZB)+GT(ZC)
5600 CS=CS+1
5610 GU(ZC)=GT(ZC)/CS
5620 RETURN
5630 PRINT#-2,USING" %
";NA$(X);
5640 FOR Z=1 TO NC(2)
5650 PRINT#-2,USING" ###";GU(Z)
;
5660 NEXT Z
5670 PRINT#-2,USING" ###";GR(X,
NC(2)+NC(3)+1+L1)
5680 PRINT#-2
5690 FOR Z=1 TO NC(2)+NC(3)+1
5700 IF GR(X,Z)=-10 THEN 5770
5710 IF GR(X,Z)<0 THEN 5730
5720 IF GR(X,Z)=>0 THEN 5750
5730 IF GR(X,Z+1)=-10 THEN PRINT
#-2,USING" %
";CN$(-(GR
(X,Z))) ELSE PRINT#-2,USING" %
";CN$(-(GR(X,Z)));
5740 GOTO 5760
5750 IF GR(X,Z+1)=-10 THEN PRINT
#-2,USING" ###";GR(X,Z) ELSE PRI
NT#-2,USING" ###";GR(X,Z);
5760 NEXT Z
5770 PRINT#-2,STRING$(80,46):RET
URN
5780 PRINT#-2,USING" %
### %
";NA$(X);GR
(X,NC(2)+NC(3)+1+L1);".....
";
5790 FOR Z=1 TO L1
5800 IF Z=L1 THEN PRINT#-2,USING
"### ";GR(X,NC(2)+NC(3)+1+Z):GO
TO 5860
5810 IF Z<L1 THEN PRINT#-2,USING
"### ";GR(X,NC(2)+NC(3)+1+Z);
5820 NEXT Z
5860 RETURN
5870 PRINT#-2,USING" %
";NA$(X);
5880 FOR Z=1 TO NC(4)
5890 PRINT#-2,USING" ### ";GR(X,
NC(2)+NC(3)+1+Z);
5900 NEXT Z
5910 PRINT#-2,USING" ### ###";
GR(X,NC(2)+NC(3)+NC(4)+2);GR(X,0
)
5920 RETURN
5930 GOSUB 9020:PRINT#-2,STRING$(
70,46)
5940 PRINT#-2,USING" %
";"CLASS AVERAGE";
5950 FOR Z=1 TO NC(4)
5960 PRINT#-2,USING" ### ";AV(Z)
/TS;
5970 NEXTZ
5980 PRINT#-2,USING" ### ###";
AV(NC(4)+1)/TS;AV(0)/TS
5990 RETURN
6000 REM next class
6010 CLS:PRINT"next class"
6020 PRINT@64,L4$;
6030 PRINT"THIS ACTION REMOVES A
LL RECORDS"
6040 PRINT"FROM COMPUTER MEMORY."
6050 PRINT@160,L4$;
6060 PRINT:PRINT"ENTER <NC> FOR
NEXT CLASS"
6070 PRINT"ENTER <MM> FOR MAIN M
ENU"
6080 PRINT:PRINT"note: <MM> WILL
NOT DELETE CURRENT RECORDS
"
6090 PRINT:INPUT"CHOICE";NJ$
6100 IF NJ$="MM" THEN 160

```

```

6110 IF NJ$="NC" THEN RUN
6120 GOTO 6090
6130 REM next marking period
6140 CLS:PRINT"next marking peri
od"
6150 PRINT@64,L5$;
6160 PRINT"THIS ACTION REMOVES A
LL DAILY"
6170 PRINT"GRADES FROM COMPUTER
MEMORY."
6180 PRINT@160,L5$;
6190 PRINT:PRINT"ENTER <NMP> FOR
NEXT MARKING PD.";
6200 PRINT"ENTER <MM> FOR MAIN M
ENU"
6210 PRINT:PRINT"note: <MM> WILL
NOT DELETE CURRENT RECORDS
"
6220 PRINT:INPUT"CHOICE";NJ$
6230 IF NJ$="MM" THEN 160
6240 IF NJ$="NMP" THEN 6250 ELSE
6220
6250 FOR X5=1 TO NC(1)+3
6260 FOR Y5=1 TO NC(2)+NC(3)+1
6270 GR(X5,Y5)=0
6280 NEXT Y5,X5
6290 FOR X5=1 TO NC(1)+3
6300 FOR Y5=1 TO NC(2)
6310 GR(X5,Y5)--Y5
6320 NEXT Y5
6330 NEXT X5
6340 FOR X5=1 TO NC(1)+3
6350 GR(X5,NC(2)+1)--10
6360 NEXT X5
6370 L1=L1+1
6380 GOTO 160
6390 REM end
6400 CLS:PRINT"end program"
6410 PRINT@64,L8$;
6420 PRINT"DO YOU WISH TO END YO
UR WORK"
6430 PRINT"ON THIS PROGRAM?"
6440 PRINT@160,L8$;
6450 PRINT@224,"END PROGRAM <Y O
R N>";PP=245:GOSUB 8920
6460 IF CK$="Y" THEN CLS:END
6470 IF CK$="N" THEN 160 ELSE 64
50
6480 REM load existing file
6490 CLS:PRINT"load from disk"
6500 PRINT@64,L4$;
6510 INPUT"NAME OF FILE ONE";F1$
6520 INPUT"NAME OF FILE TWO";F2$
6530 PRINT@160,L4$;
6540 PRINT:INPUT"READY DISK AND
PRESS <ENTER>";EN$
6550 OPEN"1",#1,F1$
6560 INPUT#1,LC$(1)
6570 INPUT#1,LC$(2)
6580 INPUT#1,L1
6590 FOR X=1 TO 6
6600 INPUT#1, NC(X)
6610 NEXT X
6620 FOR X=1 TO NC(2)
6630 INPUT#1, CN$(X)
6640 IF EOF(1)=-1 THEN 6660
6650 NEXT X
6660 CLOSE #1
6670 CLS:PRINT F1$" LOADED":FOR
X=1 TO 500:NEXT X
6680 CLS:PRINT"update for file t
wo"
6690 PRINT@64,L6$;
6700 PRINT"DATE.....":LC$(1)
6710 PRINT"CLASS NAME":LC$(2)
6720 PRINT"MARKING PD":"L1
6730 PRINT@192,L6$
6740 PRINT@256,"UPDATE NEEDED <Y
OR N>";PP=279:GOSUB 8920
6750 IF CK$="N" THEN 6830
6760 IF CK$="Y" THEN 6770 ELSE 6
740
6770 PRINT:LINEINPUT"DATE":";LC$(
1)
6780 LINEINPUT"CLASS NAME":";LC$(
2)
6790 PRINT"MARKING PERIOD";L1
6800 PRINT"no update now on mark
ing period"

```

```

6810 PRINT:INPUT"PRESS <ENTER> W
HEN READY";EN$
6820 GOTO 6680
6830 FOR X=1 TO 6:MC(X)=NC(X):NE
XT X
6840 CLS:PRINT"update continued"
6850 PRINT@64,L6$;
6860 PRINT"1. NUMBER OF STUDENTS
....";MC(1)
6870 PRINT"2. GRADE CATEGORIES (
1-9)";MC(2)
6880 PRINT"3. MAX. NUMBER OF GRA
DES.";MC(3)
6890 PRINT"4. NO. OF MARKING PER
IODS";MC(4)
6900 PRINT"5. MARKING PERIOD WEI
GHT.";MC(5)
6910 PRINT"6. FINAL EXAM WEIGHT.
....";MC(6)
6920 PRINT@288,L6$
6930 PRINT@352,"increase ANY <Y
OR N>";PP=374:GOSUB 8920
6940 IF CK$="N" THEN 7030
6950 IF CK$="Y" THEN 6960 ELSE 6
930
6960 PRINT:INPUT"CHANGE WHICH CA
TAGORY NUMBER";NU:A2=1
6970 IF NU<1 OR NU>6 THEN SOUND
200,5:GOTO 6960
6980 INPUT"CHANGE TO WHAT";MC(NU
)
6990 IF MC(NU)<NC(NU) THEN MC(NU
)=NC(NU):SOUND 200,5
7000 IF MC(2)<1 OR MC(2)>9 THEN
MC(2)=NC(2):SOUND 200,5
7010 IF MC(4)>9 THEN MC(4)=NC(4)
:SOUND 200,5
7020 GOTO 6840
7030 FOR X=1 TO MC(2):DN$(X)=CN$(
X):NEXT X
7040 CLS:PRINT"update continued"
7050 PRINT@32,L6$;
7060 PRINT"CATEGORY NAMES"
7070 FOR X=1 TO MC(2)
7080 X$=STR$(X)
7090 PRINTX$;". ";DN$(X)
7100 NEXT X
7110 PRINT@416,"CHANGE ANY <Y OR
N>";PP=436:GOSUB 8920
7120 IF CK$="N" THEN 7170
7130 IF CK$="Y" THEN 7140 ELSE 7
110
7140 PRINT:INPUT"CHANGE WHAT NUM
BER";NU
7150 INPUT"CHANGE TO WHAT";DN$(N
U):A3=1
7160 GOTO 7040
7170 DIM NA$(MC(1)+3)
7180 DIM GR(MC(1)+3,MC(2)+MC(3)+
MC(4)+2)
7190 DIM PC(MC(1)+3,MC(2))
7200 FOR X=1 TO MC(1)+3:GR(X,MC(
2)+1)=-10:NEXT X
7210 FOR X=1 TO MC(1)+3
7220 FOR Y=1 TO MC(2)
7230 GR(X,Y)--Y
7240 NEXT Y
7250 NEXT X
7260 CLS:PRINT"ready to load fil
e" F2$
7270 PRINT:INPUT"READY DISK AND
PRESS <ENTER>";EN$
7280 OPEN"1",#1,F2$
7290 FOR X=1 TO (NC(1)+3)
7300 INPUT#1,NA$(X)
7310 NEXT X
7320 FOR X=1 TO NC(1)+3
7330 FOR Y=0 TO (NC(2)+NC(3)+NC(
4)+2)
7340 INPUT #1, GR(X,Y)
7350 NEXT Y,X
7360 FOR X=1 TO NC(1)
7370 FOR Y=1 TO NC(2)
7380 INPUT#1, PC(X,Y)
7390 IF EOF(1)=-1 THEN 7410
7400 NEXT Y,X
7410 CLOSE #1
7420 CLS:PRINT"file loaded":FOR

```


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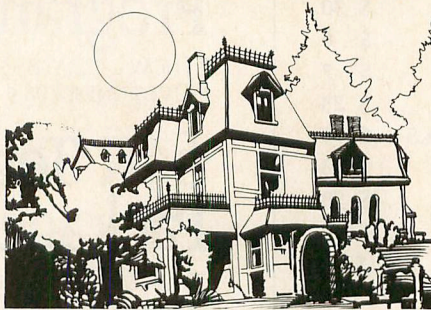
M.S., California

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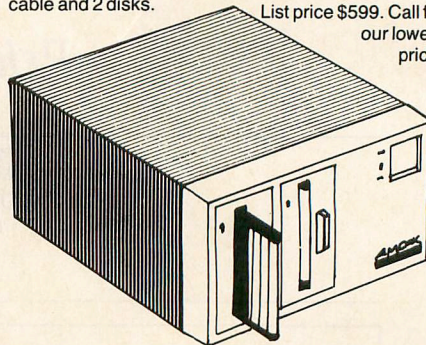
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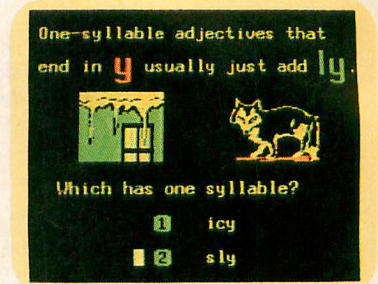
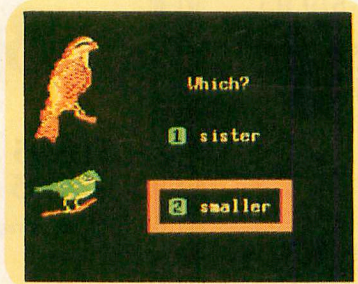
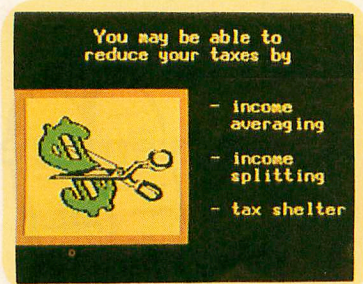
```
T=1 TO 1000:NEXT T
7430 TR=MC(2)-NC(2)
7440 IF MC(2)>NC(2) THEN 7450 EL
SE 7570
7450 FOR X=1 TO NC(1)+3
7460 FOR Y=1 TO NC(2)+NC(3)
7470 IF GR(X,Y)=-10 THEN 7480 EL
SE 7550
7480 GR(X,Y)=-NC(2)+1)
7490 IF MC(2)=NC(2)+1 THEN 7500
ELSE 7510
7500 GR(X,Y+1)=-10:GOTO 7560
7510 FOR Z=1 TO TR-1
7520 GR(X,Y+Z)=-NC(2)+Z+1)
7530 NEXT Z
7540 GR(X,Y+TR)=-10:GOTO 7560
7550 NEXT Y
7560 NEXT X
7570 IF MC(2)+MC(3)+MC(4)>NC(2)+
NC(3)+NC(4) THEN 7580 ELSE 7710
7580 TR=(MC(2)+MC(3)+MC(4))-NC(
2)+NC(3)+NC(4))
7590 FOR X=1 TO MC(1)+3:CB=0
7600 FOR AA=(MC(2)+MC(3)+MC(4)+2
) TO (NC(4)+NC(3)) STEP-1
7610 IF GR(X,AA-TR)=-10 THEN 770
0
7620 GR(X,AA)=GR(X,AA-TR):GR(X,A
A-TR)=0
7630 NEXT AA
7640 K=MC(4)-NC(4)
7650 IF K>0 THEN 7660 ELSE 7700
7660 FOR AB=1 TO NC(4)
7670 GR(X,MC(2)+MC(3)+AB+1-K)=GR
(X,MC(2)+MC(3)+1+AB)
7680 GR(X,MC(2)+MC(3)+1+AB)=0
7690 NEXT AB
7700 NEXT X
7710 IF A2=1 THEN 7720 ELSE 7730
7720 FOR X=1 TO 6:NC(X)=MC(X):NE
XT X
7730 IF A3=1 THEN 7740 ELSE 7750
7740 FOR X=1 TO NC(2):CN$(X)=DN$(
```

```
(X):NEXT X
7750 FOR X=1 TO (MC(1)+3)
7760 IF NA$(X)="last name" THEN
NA$(X)=" "
7770 NEXT X
7780 NA$(MC(1)+3)="last name":RE
TURN
7790 REM save on disk
7800 CLS:PRINT"disk storage sect
ion"
7810 PRINT@64,L3$;
7820 INPUT"NAME OF FILE ONE";F1$
7830 INPUT"NAME OF FILE TWO";F2$
7840 PRINT:PRINT"READY DISK AND
PRESS <ENTER>"
7850 INPUT"OR <XXX> FOR MENU";EN
$
7860 IF EN$="XXX" THEN 160
7870 PRINT@256,L4$
7880 PRINT:PRINT"saving "F1$" on
disk"
7890 OPEN"O",#1,F1$
7900 WRITE#1,LC$(1)
7910 WRITE#1,LC$(2)
7920 WRITE#1,L1
7930 FOR X=1 TO 6
7940 WRITE#1,NC(X)
7950 NEXT X
7960 FOR X=1 TO NC(2)
7970 WRITE#1,CN$(X)
7980 NEXT X
7990 CLOSE #1
8000 PRINT:PRINT"saving "F2$" on
disk"
8010 OPEN"O",#1,F2$
8020 FOR X=1 TO (NC(1)+3)
8030 WRITE#1,NA$(X)
8040 NEXT X
8050 FOR ER=1 TO NC(1)+3
8060 FOR ES=0 TO (NC(2)+NC(3)+NC
(4)+2)
8070 WRITE #1,GR(ER,ES)
8080 NEXT ES
```

```
8090 NEXT ER
8100 FOR ER=1 TO NC(1)
8110 FOR ES=1 TO NC(2)
8120 WRITE#1, PC(ER,ES)
8130 NEXT ES,ER
8140 CLOSE #1
8150 CLS:PRINT"file names"
8160 PRINT@64,L2$;
8170 PRINT"name of file one "F1$
8180 PRINT"name of file two "F2$
8190 PRINT@160,L2$
8200 PRINT@224,"BACK-UP FILES <Y
OR N>";PP=247:GOSUB 8920
8210 IF CK$="Y" THEN 7800
8220 IF CK$="N" THEN 160 ELSE 82
00
8230 REM starting new
8240 CLS:PRINT"general informati
on"
8250 PRINT@64,L7$;
8260 LINEINPUT"1. DATE ? ";LC$(
1)
8270 LINEINPUT"2. CLASS NAME? ";
LC$(2)
8280 INPUT"3. CURRENT MARKING PE
RIOD";L1
8290 PRINT@192,L7$
8300 PRINT@256,"IS INFO CORRECT
<Y OR N>";PP=281:GOSUB 8920
8310 IF CK$="N" THEN 8240
8320 IF CK$="Y" THEN 8330 ELSE 8
300
8330 CLS:PRINT"gradebook set-up"
8340 PRINT@64,L8$;
8350 INPUT"1. NUMBER OF STUDENTS
";NC(1)
8360 INPUT"2. GRADE CATEGORIES (
1-9)";NC(2)
8370 IF NC(2)<1 OR NC(2)>9 THEN
8360
8380 INPUT"3. MAX. NUMBER OF GRA
DES ";NC(3)
```

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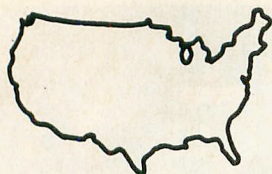
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PROGRAM LISTING (CONT.)

```

8390 INPUT"4. NO. OF MARKING PER
IODS";NC(4)
8400 IF NC(4)>9 THEN SOUND 200,5
:GOTO 8390
8410 INPUT"5. MARKING PERIOD WEI
GHT";NC(5)
8420 INPUT"6. FINAL EXAM WEIGHT
";NC(6)
8430 PRINT@288,L8$;
8440 PRINT@326,"total weights ="
NC(5)+NC(6);
8450 PRINT@352,L8$;
8460 PRINT@416,"IS INFO CORRECT
<Y OR N>";PP=441:GOSUB 8920
8470 IF CK$="N" THEN 8330
8480 IF CK$="Y" THEN 8490 ELSE 8
460
8490 DIM NA$(NC(1)+3):NA$(NC(1)+
3)="last name"
8500 DIM GR(NC(1)+3,NC(2)+NC(3)+
NC(4)+2)
8510 DIM PC(NC(1)+3,NC(2))
8520 FOR X=1 TO NC(1)+3
8530 FOR Y=1 TO NC(2)
8540 GR(X,Y)=- (Y)
8550 NEXT Y,X
8560 FOR X=1 TO NC(1)+3:GR(X,NC(
2)+1)=-10:NEXT X
8570 CLS:PRINT"grade categories"
8580 PRINT@64,L2$;
8590 PRINT" TYPE IN THE NAMES F
OR EACH OF"
8600 PRINT"THE"NC(2)"CATEGORIES
OF GRADES."
8610 PRINT" note: NAMES OF CATE
GORIES"
8620 PRINT"SHOULD BE DIFFERENT."
:PRINT
8630 FOR X=1 TO NC(2)
8640 X$=STR$(X)
8650 PRINT X$;". ";:INPUT"CATEGO
RY NAME";CN$(X)
8660 NEXT X

```

```

8670 CLS:PRINT"category names"
8680 PRINT@64,L2$;
8690 PRINT"ARE THE FOLLOWING CAT
EGORY"
8700 PRINT"names correct?"
8710 FOR X=1 TO NC(2)
8720 X$=STR$(X)
8730 PRINT X$;". ";CN$(X)
8740 NEXT X
8750 PRINT@448,"IS INFO CORRECT
<Y OR N>";PP=473:GOSUB 8920
8760 IF CK$="N" THEN 8570
8770 IF CK$="Y" THEN 8780 ELSE 8
750
8780 CLS
8790 PRINT"student names"
8800 PRINT:PRINT"YOU WILL NOW TY
PE IN THE NAMES"
8810 PRINT"OF YOUR STUDENTS."
8820 PRINT:INPUT"PRESS <ENTER> W
HEN READY";EN$
8830 F5=1:GOSUB 350
8840 F5=0
8850 CLS:PRINT"category percents
"
8860 PRINT:PRINT"YOU WILL NOW BE
TYPING IN THE"
8870 PRINT"CATEGORY PERCENTAGES."
"
8880 PRINT:INPUT"PRESS <ENTER> W
HEN READY";EN$
8890 F6=1:GOSUB 1370
8900 F6=0
8910 RETURN
8920 CK$=INKEY$
8930 IF CK$="" THEN 8940 ELSE RE
TURN
8940 PRINT@PP,CHR$(247);:FOR X6=
1 TO 40:NEXT X6
8950 PRINT@PP,CHR$(251);:FOR X6=
1 TO 40:NEXT X6
8960 PRINT@PP,CHR$(254);:FOR X6=
1 TO 40:NEXT X6

```

```

8970 PRINT@PP,CHR$(253);:FOR X6=
1 TO 40:NEXT X6
8980 GOTO 8920
8990 L2$=STRING$(32,159):L3$=STR
ING$(32,175):L4$=STRING$(32,191)
:L5$=STRING$(32,207)
9000 L6$=STRING$(32,223):L7$=STR
ING$(32,239):L8$=STRING$(32,255)
9010 RETURN
9020 FOR Z=0 TO NC(4)+1:AV(Z)=0:
NEXT Z:TS=0
9030 FOR X=1 TO NC(1)+3
9040 IF NA$(X)="" OR NA$(X)="las
t name" OR X=NC(1)+4 THEN 9110
9050 FOR Y=1 TO NC(4)+1
9060 AV(Y)=GR(X,NC(2)+NC(3)+1+Y)
+AV(Y)
9070 NEXT Y
9080 AV(0)=GR(X,0)+AV(0)
9090 TS=TS+1
9100 NEXT X
9110 RETURN
9120 CLS(0):R=RND(-TIMER)
9130 G2=RND(7)+9:G2=(G2*16)-1
9140 M1=1023:M2=1536
9150 M1=M1+1:M2=M2-1
9160 G1=RND(7)+9
9170 G1=(G1*16)-10
9180 IF M1<1184 THEN POKE M1,G1
ELSE POKE M1,G2
9190 IF M1<1184 THEN POKE M2,G1
ELSE POKE M2,G2
9200 IF M1<1279 THEN 9150
9210 FOR T=1 TO 500:NEXT T
9220 PRINT@201,"the";:PRINT@205,
"gradebook";
9230 FOR T=1 TO 500:NEXT T
9240 PRINT@296,"by";:POKE1322,58
:PRINT@301,"lynn";:PRINT@306,"da
vis";
9250 FOR T=1 TO 2000:NEXT T
9260 RETURN

```



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***The information age is coming —
what your kids need to survive.***

Tools For Home

BY J. CRAIG DICKENSON

It took awhile. The results of a 1979 Gallup Poll on education have finally hit: for the first time in history, adults considered themselves better-educated than young people. A 1980 report by the U.S. Department of Education and the National Science Foundation stated that most Americans are moving toward "virtual scientific and technological illiteracy." In April of 1983 the National Commission on Excellence in Education, in its report "A Nation at Risk," described the "rising tide of mediocrity" in our educational system.

There is a big, black cloud hovering over the usual back-to-school activity this fall. No one in the United States can have failed to notice that the nation is unhappy with its public education.

At the same time the discontent over school performance has been rising, the arrival of microcomputers as a permanent feature of society has become solid. In his best-selling book *Megatrends*, author John Naisbitt presents convincing evidence that our future economy will be based on *information*, because of the advent of the microprocessor. By one estimate, 75 percent of all jobs by 1985 will involve computers in some way — and people who don't know how to use them will be disadvantaged. "In the new information society, being without computer skills is like wandering around a collection the size of the Library of Congress with all the books arranged at random with no Dewey Decimal System, no card catalogue — and of course no friendly librarian to serve your information needs."

The situation between the "computerate" and the "noncomputerate" could become as serious as the gulf between the literate and the illiterate, we are told. Since it is the responsibility of the schools to prepare children to function in the society in which they live, educators must address this problem. One way to help meet this additional burden is by capitalizing on another trend: increased support for home education.

More money is spent annually in America on educational games and home educational equipment for children than is spent directly on institutionalized instruction. Parents have rushed by the thousands to purchase home computers so their offspring would not be left in the dust. Teachers can aid in the transition to an information society by working hand-in-hand with parents to choose computer software suitable for educational use in the home. In preparation for the changes ahead, the software we choose is likely to be application software, which turns the computer into a tool for manipulating information.

THE INFORMATION AGE. The information age is making new kinds of classroom activities possible. It is also making changes in the types of things students need to know.

Vast amounts of information are available to the public through telephone (there are over 1450 databases in the U.S. accessible by telephone), cable, and satellite communications. Even elementary school students have better access to rich information sources than ever before. Some educators are worried that students are being overwhelmed with the quantity of information available. The days of

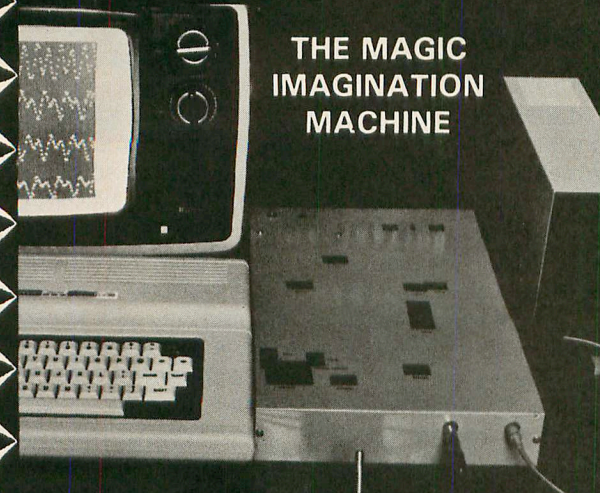
looking for information in the (only) school encyclopedia will soon be gone forever.

The quality of the information that is so readily available may be of great concern. Students of the Information Age will need to develop a built-in filter system to sort through the oceans of unnecessary information they receive constantly. Successful students will be those who can effectively organize, access, manipulate, and evaluate informa-

"Some educators are worried that students are being overwhelmed with the quantity of information available."

tion. Plans to use and develop software (at school and home) should incorporate the need for excellent information management skills.

One of the most highly valued accomplishments of the early and middle school years is learning to understand and work with information from various sources. If children develop strategies for reading, comprehending, and sorting appropriate information from books and other materials, their chances of long-term educational success increase tremendously. Kids need opportunities to play with information. They need to shuffle it and rearrange it in ways which make sense to them. Letting a child manipulate information contributes to his or her understand-



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ing of the material and expands the child's knowledge. Utility programs, sometimes referred to as "tool software," have great potential when used to train children for the coming Information Age.

TOOL SOFTWARE. *Tools* are pieces of software that help users access, organize, manipulate, and communicate about information. These programs are less constrained than the computer assisted instruction (CAI) or games children are accustomed to. In games and CAI, the content of the program is completely specified and the user's role is to respond to it. The activity is controlled by the program. The child must provide correct answers or make moves that will score points. While under some circumstances such software (commonly drill and practice oriented) may improve children's factual learning, it does not appear to help them acquire and use strategies for managing instruction.

If you are specifically looking for educational software for your children, consider the following three tools.

• **Word Processing** — My first choice is also the most expensive. The program is reasonably priced, however, for what it does. Radio Shack's "Color Scripsit" is only \$34.95 in a ROMpak (if you can get it) and \$49.95 on disk. Many other comparable word processing packages are on the market. However, the one significant item necessary to fully use a word processor is a printer. Although the cost of the Color Computer has been spiraling downward the past two years, the cost of printers has not followed the same path. Expect to pay more for your printer than for your computer.

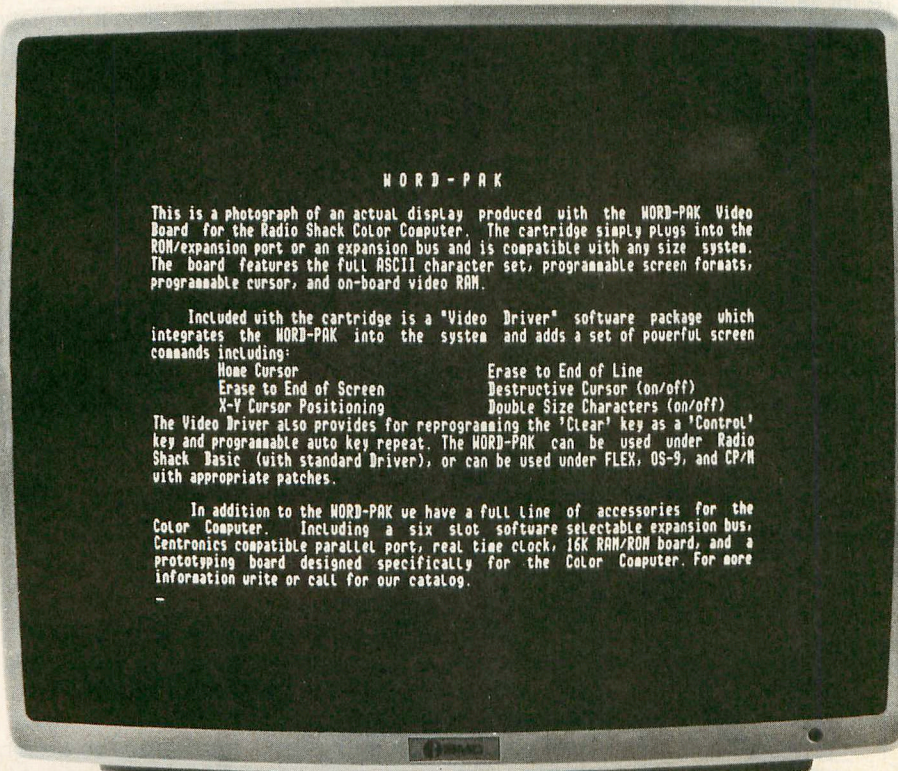
A word processing program lets the user type letters or other documents on the computer screen and to easily alter words and move paragraphs around. No matter how much rearranging and editing is done on the screen, the final page appears perfect. For children, this is an end in itself. Every sixth grader at my school receives instruction in Scripsit. The results have been longer stories and more revisions performed by the youthful writer.

"Letting a child manipulate information contributes to his or her understanding . . . and expands the child's knowledge."

Imagine the freedom of being able to go back over every word and consider the alternatives. The question, "Is there a better way to express this?" is more frequently asked and more easily answered with a word processing package. Even after only a brief exposure to word processing, the writer realizes that the constraints that have so long hampered creativity no longer apply. For a child, this introduces the concept of critical analysis at an early age. Even quite young children are prepared to go back and revise their compositions.

Tools such as word processing not only facilitate typical classroom activities such as essay writing, but also make possible new activities. For instance, students can use a

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word processor for group writing projects where students jointly compose and successfully edit one piece of work. Each sixth grade homeroom in my school produces a quarterly newspaper. Writing, editing, and revising is done on Scripsit. The extensive work this project requires is handled with greater ease thanks to word processing.

The word processor opens doors for talented students. I recently watched in amazement as two sixth graders worked side by side on an article they submitted to **The Color Computer Magazine**. Thanks to two school computers and Scripsit, the would-be authors wrote, discussed, and revised each other's work. At last they were ready for the printed copy. The computer joined their separate efforts and produced a final piece of some nine pages. Both students agreed that Scripsit made a production of such length possible.

"Our children must learn to be comfortable with computers . . . they should be an integral part of their school and home education."

You may find some resistance from teachers who claim that the idea of word processing will interfere with handwriting. If your child has a teacher who worries more about handwriting than creative writing, encourage your child to create the essay on a word processor and then copy it out longhand. Both copies could be submitted for marking. The time saved doing the composition on the computer would allow the task to be completed both ways within a reasonable time.

• **Database Management Systems** — The second tool that offers students practice in handling information is a database management system. Radio Shack offers "Color Profile" on a ROMpak for \$24.95 and the more sophisticated Color Profile on disk for \$59.95. Numerous other companies also offer this type of program at a reasonable price.

Database management systems are programs that let users create multiple files (like traditional 3 x 5 notecards) containing information on a certain topic. Unlike the old 3 x 5 cards, however, once the files are entered into the database they can be sorted, reorganized, edited, updated, and printed out. These systems are flexible organizers of information which can be used for note-taking, outlining, and other prewriting activities. Databases let people shuffle the information and look at it in a different way.

In the spring of 1984 I was involved in a scheduling nightmare called Olympics of the Mind. Running this worthwhile problem-solving activity for 1800 Maine kids competing in regional tournaments seemed overwhelming. Because students chose one of five problems in one of three divisions to compete in, it would be easy to incorrectly schedule a team. Also, I wanted to keep track of everyone's name (including each coach) for the awards assemblies.

I asked computer enthusiast Chris Halsted to design a data file and then enter the information as it arrived. After

a lesson in database use that lasted less than fifteen minutes, Chris was off and running. By tournament time he had a large file that was easily printed out under the category I needed. I got one copy of everything, another with the teams arranged by problem, and a third with the teams arranged by problems and division. It was so successful that Chris designed another file for the state tournament that followed.

Chris Halsted is ten years old.

Parents should have little trouble finding useful database projects for the home. Favorite recipes, important phone numbers, Christmas card lists, monthly birthdays, addresses of relatives — all are appropriate for practice in information organization. Your kids will also devise their own databases. Be prepared to buy a few data disks once your child begins recording his baseball card collection on the computer. Older students collecting notes for a term paper will find this exercise much less painful on a data file.

• **Spreadsheets** — The same financial spreadsheets that businesses use to manage their figures can be immensely valuable to kids. Using a popular commercial program such as Visicalc, kids can create an imaginary business, complete with all its overhead and production costs. Sales figures and related expenses can be entered and figured. Kids quickly get a feel for the term "bottom line" when using a spreadsheet.

Spreadsheets are completely interactive programs. If only one data factor is altered (the number of goods sold in a month for instance), the effect such a change has on profitability is instantly visible. With the spreadsheet program the student is able to "play" endlessly with the model of a business. The result is that he or she gains a very thorough understanding of the vital elements that combine to produce a profit — or a loss.

I have watched sixth graders gain valuable business instinct by playing with figures and formulas on the computer. Outside my classroom is a fruit juice machine the sixth grade runs as a small business each year. They order the juice, open and fill the machine daily, count and roll the money, deposit the money in the bank, and write checks. Recently, a small group has been introduced to Visicalc, and now they keep the business records on the program.

Disturbed by a small profit margin, one student suggested we raise the price of juice from 30 to 35 cents. By changing only one variable in the program we were able to instantly learn what this would mean in increased revenue. Another student remembered that last year the price was only 25 cents. By plugging in some figures from last year we learned that after the price rise our weekly volume was reduced by over 30 percent. The students became engrossed in analyzing the figures of the juice business. With a spreadsheet, they can ask "what if?" and the computer will answer immediately.

THE FUTURE. Whatever your view of the future, you can be sure computers will play a central role. Our children must learn to be comfortable with computers and learn how to use them to help sort through the mountains of information available. Computers should be an integral part of their education at school *and* at home. Young people need to learn how to apply computer technology so that turning to a computer for assistance will be as routine as taking a book off a library shelf. ■

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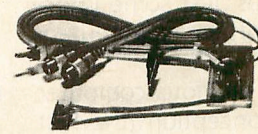
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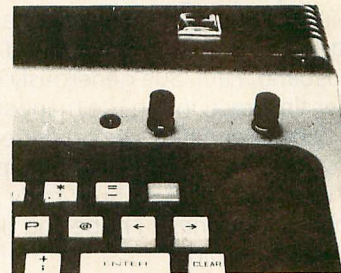
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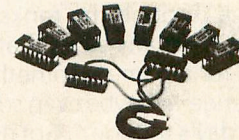
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Color Computing for Kids

In July we discussed software piracy, the illegal copying of computer software. If you're still not convinced it's wrong and can affect many people, I hope this article will convince you. Wait! Don't stop reading! There will be no lectures, just some information on how software is manufactured.

We'll follow a fictitious computer game from its conception (the first idea) to the packaged product. We'll look at the time and effort the people involved add to it, and we'll examine some of the costs of production. I think you'll be surprised at how much is involved in the average game you enjoy on your Color Computer. I hope you'll develop a sense of respect and loyalty for those software packages, and the people who make them, as a result.

I got a lot of help writing this article from Sue Searby of Computerware, a Southern California-based software manufacturing business that is owned and operated by Sue and her husband, Paul. Sue generously gave me several hours of her time recounting the many steps involved in producing a computer game. We often generalized because company practices vary, but the steps, time, and costs involved are, according to Sue, fairly standard for the average software business. I hope you find the information as interesting as I did.

AN IDEA. Just having a desire to write a game program isn't enough. A *unique* idea that will eventually lead to an exciting and challenging game that uses clever and colorful graphics is actually the first step in this creative process. An idea can result from a sudden burst of imagination, or it can take several days, weeks, or even months to develop.

Let's take an idea through the ranks of publishing so you can experience the many steps that can be involved. Let's see... an idea for a game... something fun with lots of action and challenge... maybe even something that can relieve some of the day's tension... Got it! Something with bugs! I hate bugs, and though I'd rather stay away from them if they should happen to tread into my territory: SWAT...STOMP...SQUISH! Get the idea?

THE GRAPHICS. The next step in the idea process may be to develop the game characters or scenery and, of course, to determine the object of the game. A programmer might now start sketching bugs in different shapes and sizes... bugs with lots of legs, or wings, or big eyes, antenna, stingers, and of different colors. Or the programmer may begin at the keyboard, translating his or her

Here's
how an idea
becomes
a piece of
published software!

ideas into computer code. In either case, many, many hours will be spent writing and rewriting test routines to move the graphics, change the scenery, calculate scores, and add special sound effects. This process can span weeks before a working game is complete.

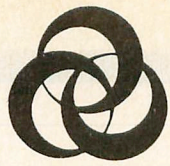
THE PROTOTYPE. At this point we would have completed a first

draft of our game. It may or may not have a name yet, but we'll call ours "Bug Battle." We've designed several kinds of bugs, the kind of scenery where you would expect to find them, and a game requiring perhaps two levels of skill. Level one might have flying bugs, and the joystick could control a swatter. Splat! Squish! Swosh! As you make your way through the scenery's pitfalls (all games have those), you score points for each hit and lose your swatter each time you miss (will three swatters be enough?). In level two, your joystick may control a bug spray as you encounter flying and crawling bugs. Lots of bugs will be coming from all directions, and you have only a limited number of sprays per can! I like the idea, how about you? Let's take it to a publisher and see what they think.

SWATTING THE REAL BUGS. Programmers often mail a cassette or disk of their programs to software publishers, with a letter and program documentation (explanations and instructions), but we'll go in person to a company like Computerware. I'll call and set up an appointment for a meeting to introduce and explain my project.

At the meeting the object of the game, strategy, scoring and special routines are discussed. The game is played and further ideas and suggestions are tossed around. If the publishers are interested in the game, they may suggest improvements in graphic details, scoring, game plot, or just in the name of the game or characters. This session could go on for several hours before a marketing decision is made. Of course, all the games submitted to software companies are not published (in fact, only a small percentage really are), but we'll assume that "Bug Battle" is: after all — it's a pretty good idea!

The programmer will almost always have to return to the keyboard after this meeting. Whether the necessary changes to the game are minor or major changes, many more hours will go into the final programming, and usually the programmer will write at least a rough draft of the instructions that will accompany the game.



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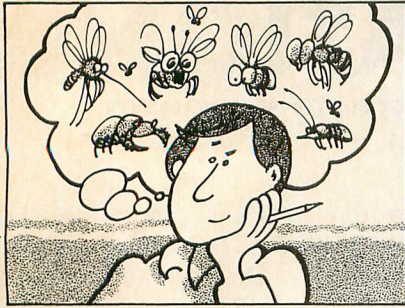
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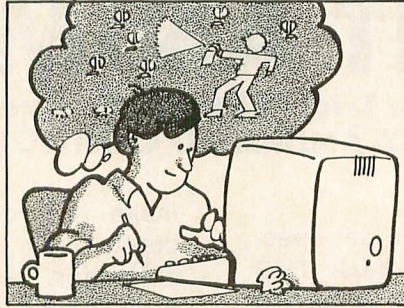
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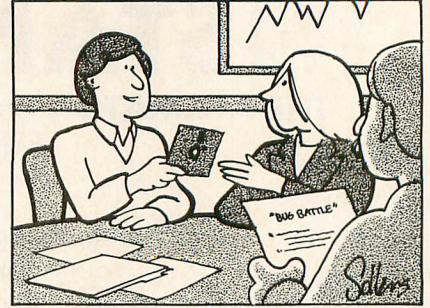
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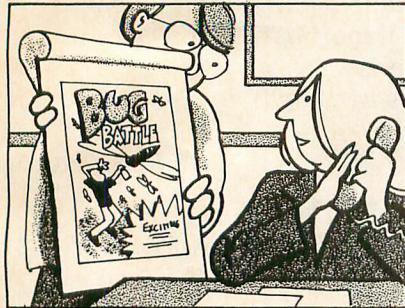
First... The idea.



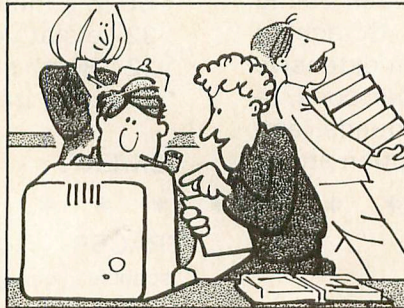
Second... Working the idea out on paper.



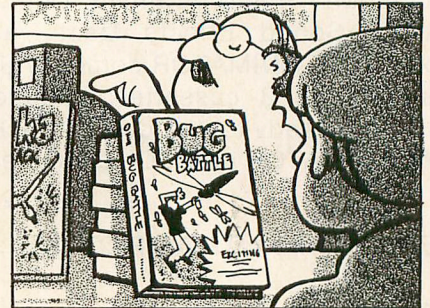
Third... Presenting the game to a publisher.



Fourth... Creating the design for the package.



Fifth... Duplicating and testing the game.



Finally... In the stores at last!

DOLLARS AND CENTS. The decision to publish computer software, just like anything else, is based on consumer acceptance, product demand, and competition — will people buy it? Software manufacturing is a business like any other, and operating costs, salaries, supplies, advertising, and profit, of course, are a considered factor in any business decision.

Many months may pass before "Bug Battle" is ready for sale, and a lot of money would be spent during the manufacturing process. If our game becomes a marketing success all the money spent on manufacturing and operating costs will return to the company, and the programmer will then earn *royalties*, (a percentage of the profits), but if our game fails, a great loss of the publisher's money, as well as the programmer's and the publisher's time, will result.

When Sue considers marketing a computer game, she must rely on her experience, marketing knowledge, and sometimes her instinct. Paul and Sue have more than seven employees whose job security is also affected by major company decisions. And, while there are some guidelines that Sue uses for decision-making, all new company ventures carry a certain amount of risk.

Sue considers the marketing life of the average game to be nine to eighteen months. This means that the major portion of sales will occur during that time. This same game will take from six to nine months of work before it is ready for the stores, and during that working time business expenses, salaries, and development costs must be paid.

A Computerware game sells for an average of \$24.95. Approximately 1,000 games must be sold for Sue to consider the venture an average success. At this point the company has regained its monetary investment, some

profit has been made and the author has received expected royalties (about \$5 per game, or 20 percent). If fewer games are sold, Computerware would lose money and the programmer would have worked many long and hard hours for little or no money. You can see that the decision to publish a game is based on far more than thinking "This looks like a fun game, let's get it in stores and see what people think of it." If a game doesn't sell because people don't like it, or it becomes a favorite of software pirates, it can mean disaster in many ways.

THE MANUFACTURING STEPS. Besides a catchy name, a game needs a nifty package that will catch your eye and tell you something about the game. Sue calls in an artist at this point and they discuss the game in detail and decide on the image they want to project to potential buyers.

The artist makes some sketches for the package and advertising photos, then prepares finished drawings for Sue's approval. The artist will also work with a professional printer to select colors and give final artistic approval to the package. This is an important step, because this will be the first impression a game player will get of the game, from a magazine ad or a rack in a store. If the package art doesn't interest us we may pass over the product completely. The artist spends several days on this project, and a standard fee may be \$400 or \$500 per drawing.

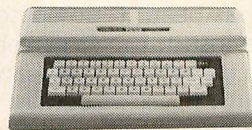
Advertising can cost about \$1.25 per game (5 percent of the cost), and it is not only important to the sale of a product but also to computerists. Magazine advertising fees are based on magazine production costs, so that quality articles, programs and reviews can be available to

From Computer Plus to YOU ...

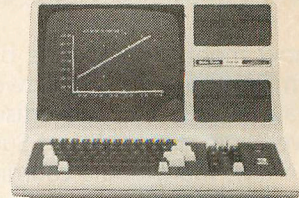
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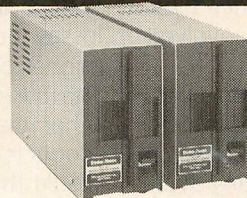
Color Computer II
w/16K Ext. Basic \$165
w/64K Ext. Basic \$210



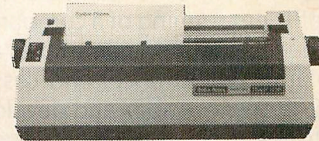
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By now months have gone by. The game has been tested many times, the final artwork is complete, instructions have been printed, advertising layouts and packaging have been approved, and Sue and Paul Searby have put in many, many hours coordinating projects and organizing production.

The office staff is now ready to take over to duplicate and test the game. A high speed duplicator is used to produce game cassettes, but disks are copied on a disk drive directly from the computer's memory. Members of the staff package the product, fill shipping orders, answer product inquiries, manage records and customer files, and see to many other valuable duties that are involved in the efficient running of a company.

The packaging for a game costs about 75¢ each (3 percent of the selling price) and cassettes cost about 50¢ each (2 percent). Labor and development time costs will come to about \$1 (4 percent of the cost); company overhead (office rent, utilities, supplies, and other operating expenses) will amount to about \$3.74 (15 percent); and Computerware will perhaps realize about \$1.48 profit on each game sold.

THE RETAIL OUTLET. The last step in the process is getting the product into your hands. While companies like Computerware do some retail business through mail order, the majority of sales are wholesale orders to soft-

ware dealers. *Wholesale* means that a discount is given so that the software dealer can also earn enough money to pay employee salaries, operating expenses, advertising costs, overhead expenses and a profit, or owner's income. Computerware's discount, in our example, is \$11.23 or 45 percent of the cost of the game.

Perhaps you now have a better understanding of discount or wholesale prices and I hope you can also understand the many costs of operating a business. Wherever people work, operating costs and salaries are incurred, and the fee for the service offered, or the cost of the product sold, must be enough to provide the money for these expenses or employees will lose their jobs and businesses will fail.

If a piece of software is frequently pirated, or if the software is a marketing failure, it will cause great business losses. Business losses must be made up in future sales (higher prices) or possibly employee or quality cutbacks. The businesses of your parents, aunts and uncles, and other relatives and friends are no different, so protect the products of the computer industry in the same way you would the products or services of those people you love and count on. Discourage and inform would-be software pirates, copy materials only for your personal use, and let people in the industry know what you like, expect, and don't like — you have much more control than you know.

I hope you've enjoyed our break from programming, but feel as anxious as I am to get back to the keyboard. We'll go back to school with a handy lesson on cassette files. ■

It's New and It's Just for You!

Kid's Bits Kid's Bits Kid's Bits Kid's Bits Kid's Bits Kid's Bits

December is always an exciting month, but this December is really something to look forward to — **The Color Computer Magazine** will introduce a kid's page. I'll be the editor, and *you* can be one of the authors, programmers, or artists. Just imagine, your name and contribution in print for all the world to see!

"Kid's Bits" will offer responses to a monthly topic. December's will be: What do you most use your Color Computer for that you'd like to share with others? As well as three other areas: programming

hints and tricks, quickie programs and print-outs, plus drawings and creations. I'm betting that every one of you has something to contribute, so think about it (but not for long), then send in your contributions.

Please send a listing of any program you submit plus a description of the program and a cassette copy. All materials will become the property of **The Color Computer Magazine** and cannot be returned. When your submission is used you will receive a certificate of recognition that will be the envy of everyone you know. And, since a maga-

zine needs time to make each issue perfect, get your submissions in as soon as possible. Just pick a department or topic and let us see your stuff!

Write your name and address clearly on all your pages or cassettes (if it's a picture, write on the back). Questions and programming problems are also good to send. Mail everything to me: Jean Plesser, Kid's Bits Editor, **The Color Computer Magazine**, Highland Mill, Camden, ME, 04843. I'm waiting to hear from you!

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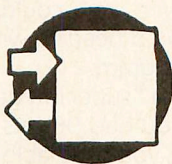
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BIG NUMBERS

Wherein Bill discovers "Fibonacci" isn't a new type of pasta . . .

"Computers are no good for Fibonacci buffs!" the voice on the other end of the phone screamed.

"Now just calm down," I crooned, wondering why I get all the Color Computer crank callers. "First of all, tell me what a Fibonacci buff is," I queried, while visions of various kinds of pasta raced across my mind's eye. Was there an Italian dish called Fibonacci Alfredo?

"Unbelievable!" the voice went on. "You're a computer writer and you've never heard of Leonardo of Pisa, better known as Fibonacci?"

"Uh..."

"Fibonacci investigated the number series formed by adding together the previous two terms in a series. If you start with 0 and 1, the next term is 0 plus 1, or 1. The next is 1 plus 1 or 2. The next is 1 plus 2 or 3. You've got the series: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, and so on."

"Fascinating," I replied in my best Spock imitation. "Is it any good for anything?" I asked.

"Turns out that there are practical applications in genetics, horticulture, and data processing, believe it or not," the voice went on. "The trouble is, the Color Computer and all other computers I've looked at can only handle up to nine decimal digits or so. After that you get a kind of "floating-point" representation where numbers are expressed as a mixed number and a power of ten."

"That's true," I admitted.

"Well, our Fibonacci group and my other mathematical friends want to be able to work with *exact* numbers, not something with only nine digits of precision. Isn't there some way to express hundreds of decimal digits in computers?"

"Let me think about it, and I'll call you back," I promised.

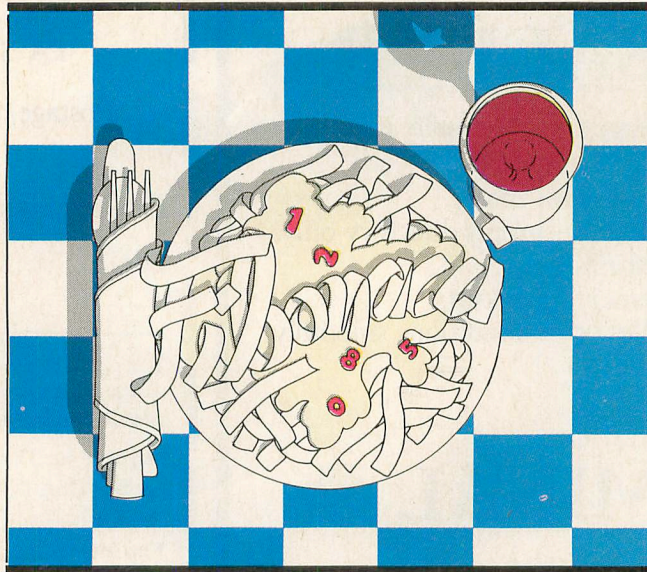
I saw the caller's problem. The Color Computer Basic provides only nine digits of precision, although it can represent approximations to a wide range of numbers from about $1E - 38$ through $1E + 38$, where E stands for a

power of ten. There's no way Basic can add, say, 123,888,641,896,356 and 981,456,555,091,491 and get absolute accuracy with the answer of 1,105,345,196,987,847. The best you can get is the approximate result of $1.1053452E + 15$.

Basic handles all mixed numbers (integer and fraction)

and integers larger than 999,999,999 as "floating-point" numbers. Floating-point numbers are held in five bytes, as shown in Figure 1. The floating-point number is made up of two parts, a fraction and a power of two, with a "floating" binary point. (There's a description of this format in my Howard W. Sams book, *Microcomputer Math*.)

Numbers smaller than $1E + 09$ are *integer* numbers, as they can be held without a power of two. Integer numbers express integer values exactly, but only values between $-999,999,999$ and $+999,999,999$ can be held this way.



EXPRESSING LARGER NUMBERS. Isn't there some way to get more digits of precision in the Color Computer?

One obvious way would be to make the size of the fractional part of the floating-point number larger. It takes about 3.5 bits (if you can imagine half a bit) to hold every decimal digit. (Four bits hold values up to 15, three bits up to seven, so you can see that 3.5 bits appears a good approximation.) If, for example, you extended the number of fractional bits in a floating point number from 32 to 48, you'd have another 16 bits and could get four or five additional decimal digits. However, you couldn't modify the Basic ROM to do this — you'd need to write your own Basic or assembly language program.

Another way might be simply to go to a "super integer" mode, without the power of two. If you had 96 bits to hold integer values instead of 32 bits, you'd be able to work with about 27 decimal digits, but couldn't have fractional numbers. Again, you'd need to implement this in your own program.

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As with all good Professional programs, **Ultra Term +** is **all machine code**. This program has been tested by those both familiar and unfamiliar with communications programs. And when you call for some technical support, you **won't** get an answering machine during our business hours (10-5 CST M-Sat.) under normal circumstances. Technical help is usually available all day.

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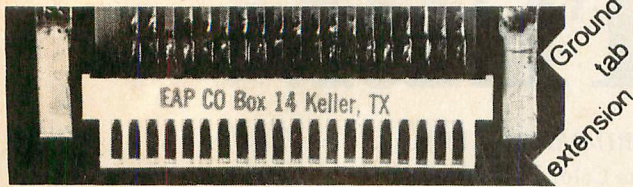
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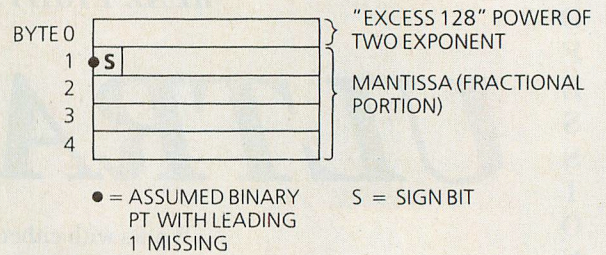


Figure 1. Floating Point Format

BINARY-CODED DECIMAL NUMBERS. I came up with a third alternative, however, one that's been around for a long time. It's called "binary-coded-decimal."

When digital computers were first designed, the engineers were loath to work in binary. They wanted to retain decimal representation even in the internal representation of numbers. The scheme used in some early machines is shown in Figure 2, adapted for the 8-bit bytes of the Color Computer.

In binary-coded-decimal, an 8-bit byte is divided into two 4-bit nibbles (sometimes spelled nybbles). Each 4-bit nibble holds one binary-coded-decimal digit. (We'll call binary-coded-decimal by the shortened form *bcd* from here on.)

Each bcd digit represents a decimal digit of 0 through 9 as follows:

0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9

The 4-bit values of 1010 through 1111 are not allowed — they're invalid bcd digits.

A byte holding the value 01001001 in bcd form is the value of 49 in bcd format. This is quite different than normal binary format where the value of 01001001 would represent 73 ($1 \times 64 + 1 \times 8 + 1 \times 1$).

These bcd digits could be strung out over many bytes to make up larger numbers, just as binary could be strung out over many bytes. The four bytes 01001001 01111000 00110000 00001000 would represent the bcd number 49,783,008. The same representation in binary would be 1011110111 10100000 11100000.

One disadvantage of bcd is obvious from the above — it's fairly inefficient in storage. It takes 32 bits to hold bcd 49,783,008, but only 26 bits in binary. Another disadvan-

tage is that current computers are geared to binary operations and not bcd operations. As a result, it takes more time to process bcd numbers.

On the other hand, bcd numbers are easy to convert from strings and to reconvert the bcd values into strings. String numeric values use ASCII representation for the digits 0 through 9, representing the digits as \$30 through \$39, where the \$ stands for hexadecimal (hex). To change hex into bcd format, it's only necessary to subtract \$30 from the ASCII value to get the bcd digit. As an example, suppose that you've got the ASCII string A\$ = "1234."

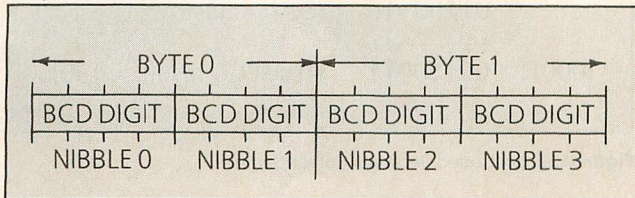


Figure 2. BCD Format

If you looked at the internal form of A\$, you'd see \$31, \$32, \$33, \$34. Subtracting \$30 from each of these values would give you 1,2,3,4, the equivalent bcd values. To convert back into ASCII, it's only necessary to add \$30 to a bcd value. To convert into binary, you'd have to go through a long, laborious process of changing the string into binary digits and then multiplying each by the equivalent binary power of ten.

In mulling over the phone caller's problem, I began to think that maybe bcd format was the answer. Bcd representation is not used much in computers any more, most users being satisfied with the seven to 14 digits of precision (in typical microcomputers) that floating-point offers, and with the more efficient storage of binary. There is one hook, however, in most microprocessor instruction sets that still shows the bcd heritage of computers. It's usually called the DAA instruction, or Decimal Adjust Accumulator. It helps in bcd addition.

To see why this is necessary, take a look at the addition of the two bcd numbers 56 and 77 (Figure 3).

The answer for a binary addition is as it should be — 86 plus 119 is 205 in an unsigned addition. For bcd, however, the result is wrong. The digits 1100 and 1101 are not valid bcd digits!

01010110	(Binary = 86, BCD = 56)
01110111	(Binary = 119, BCD = 77)
<hr/>	
11001101	(Binary = 205, BCD = XX)

Figure 3. Binary Addition Sample

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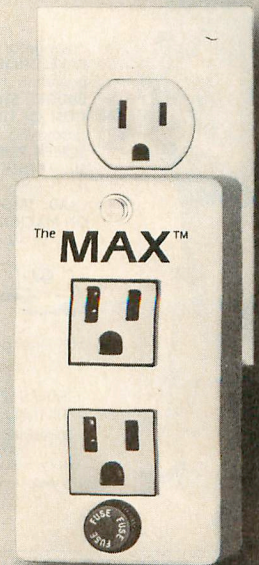
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The DAA instruction adjusts the results of a binary add to make the result a valid bcd addition. It does it based on the assumption that there were valid bcd digits to start with, and then looks at the carry from each nibble and the result itself. If necessary, a 0110 is added to a nibble to correct the result. In the above case we'd have Figure 4.

01010110	(Binary = 86, BCD = 56)
01110111	(Binary = 119, BCD = 77)
<hr/>	
11001101	(Binary = 205, BCD = XX)
01100110	(DAA Adjustment)
<hr/>	
(000)1 00110011	(True BCD result = 133)

Figure 4. Binary Coded Decimal Addition Sample

A BCD PROGRAM. I thought bcd might be a good approach for a couple of reasons. First, the conversion would be easy. It would be a simple matter to convert Basic strings into bcd format numbers by subtracting \$30 and then packing two bcd digits into each byte. Secondly, if Basic strings were used, up to 254 bcd digits could be handled with the standard Basic string.

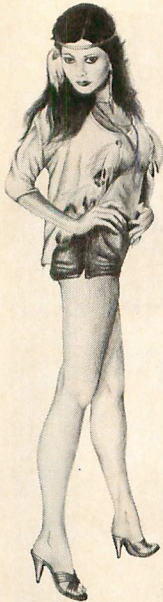
If bcd numbers were to be used, however, the code would have to be in 6809 assembly language. Basic would be just too slow for the inherent inefficiency of bcd (or of multi-digit binary operations, for that matter).

The result of my design effort is shown in Program Listings 1 and 2. Listing 1 is a 6809 assembly language program that does the actual addition, subtraction, and other operations for bcd numbers. Listing 2 is a Basic driver program that interfaces to the assembly language code. You don't have to know anything about assembly language to use the code, but you must know something about the Basic functions.

The entire package will allow you to do these operations with large numbers:

- Work with integer values from 2 to 254 decimal digits long.
- Convert a Basic numeric string into a bcd number and store that number in a special bcd accumulator.
- Add two bcd numbers together.
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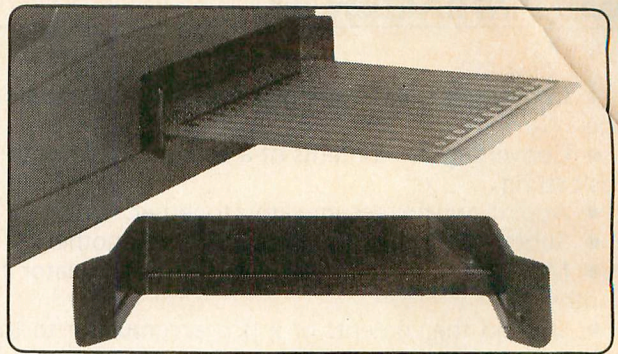


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MEMORY LAYOUT. The memory layout of the program is shown in Figure 5.

The heart of the program is a set of eight *bcd accumulators*. Each *bcd accumulator* is 128 bytes long (\$80 in hexadecimal). The accumulator area in the program starts at \$3A00 and ends at \$3DFF. The accumulators are numbered 0 through 7.

As each accumulator is 128 bytes long, and as normal *bcd* representation packs two *bcd* digits into each byte, each *bcd accumulator* can store up to 256 *bcd* digits. Because Basic strings can only be 254 characters long, however, the maximum size number of *bcd* digits can only be 254. Although the accumulators can hold 254 *bcd* digits, they can also be used to hold fewer digits if desired, and all operations work with from two through 254 digits.

Directly after the accumulator area is a seven-byte *parameter block*. This block is used to pass information from the Basic portion of the program to the assembly language portion of the program.

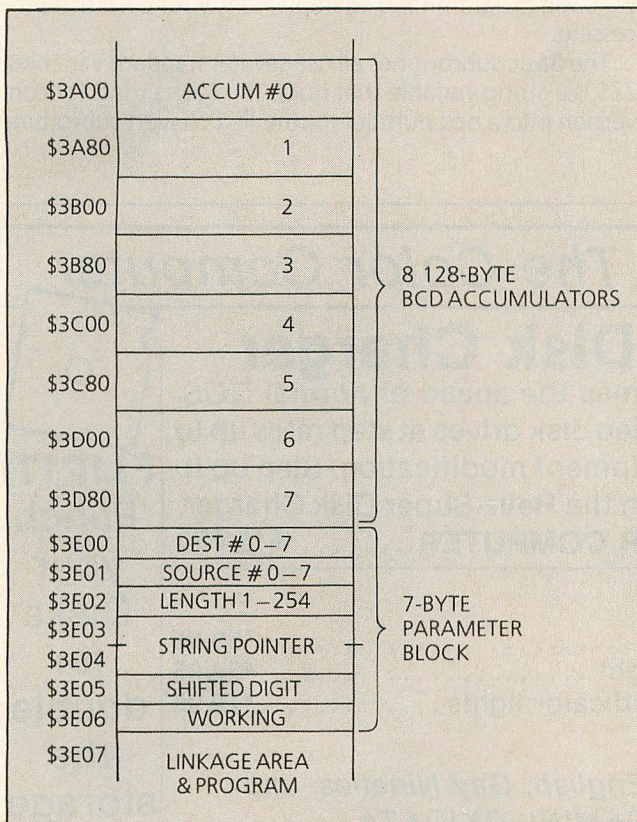


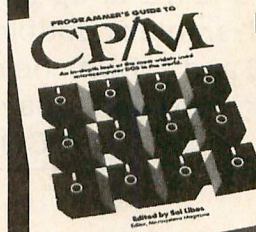
Figure 5. Program Memory Layout

Following the parameter block area are seven links to the assembly language program. These are defined in the Basic program with DEFUSR commands, and define the seven functions that can be performed by the assembly language program:

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- Converting a Basic string to bcd accumulator storage.
- Converting the contents of a bcd accumulator to a Basic string.
 - Adding two bcd accumulators together.
 - Subtracting one bcd accumulator from another.
 - Moving the contents of one bcd accumulator to another.
 - Shifting the contents of a bcd accumulator to the right.
 - Shifting the contents of a bcd accumulator to the left.

The assembly language portion of the program starts directly after the parameter block area. Space won't permit us to describe the assembly language code in detail, but the program is divided up into seven major segments corresponding to the seven functions above.

THE BASIC PROGRAM. The Basic program lets you easily communicate with the assembly language program. The Basic program is meant to be located from Lines 10 to 183, below any Basic program you want to use. There are eight functions in the Basic program, and these are the ones you'll be using to perform your own bcd operations. The functions are called as subroutines as follows:

- Convert string to bcd accumulator (subroutine 100).
- Convert bcd accumulator to string (subroutine 110).
- Add two bcd accumulators (subroutine 120).
- Subtract one bcd accumulator from another (subroutine 130).
- Move one bcd accumulator to another (subroutine 140).
- Shift a bcd accumulator right (subroutine 150).
- Shift a bcd accumulator left (subroutine 160).
- Multiply two bcd accumulators (subroutine 170).

With the exception of the multiply subroutine, the Basic subroutines all correspond to the assembly language functions. You'll note that there is no divide subroutine. Division and other processing is possible to implement in Basic by working with the eight functions above, but I'll leave it up to you to play with. As a matter of fact, the multiply could be made a lot more efficient than what we've implemented here. This program is meant not so much as a complete package, but as a tool for you to use via Basic programming to implement your own bcd processing.

The Basic subroutines all use several standard variables. ZZ\$ is a string variable that holds the Basic string for conversion into a bcd number for the first convert subroutine

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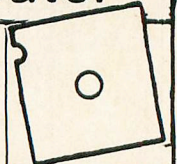
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(100). Similarly, ZZ\$ is also the string variable used when the bcd number is converted back into a string (110). ZD is a value of zero through seven, and represents the number of a destination bcd accumulator. ZS is a value of zero through seven, and represents the number of a source bcd accumulator. These are the only variables you have to work with when calling the Basic subroutines from your own Basic program. There are other variables used internally in the Basic program, and these are in the alphabetic range of ZA through ZZ, so don't use these variables in your own Basic code.

USING THE PROGRAM. To use the program, follow these steps:

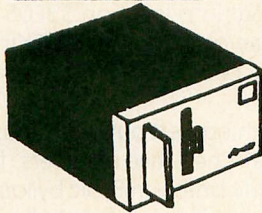
- Assemble the assembly language portion of the program and create a LOADM module on disk or a CLOADM module on cassette. An alternative approach to this is to POKE the hexadecimal values from Listing 1 and then use the CSAVEM or SAVEM command to dump out a machine code version of this. Be very careful that all the values are correct.
- Create a Basic version of the program as shown in Figure 4. SAVE or CSAVE the Basic program.
- Enter CLEAR 100,&H39FF to protect memory from locations &H3A00 on up.

- Load in the machine code portion of the program with LOADM or CLOADM.
- Load in the Basic portion of the program with LOAD or CLOAD.
- Enter RUN to start execution of the Basic program.
- The program will display: INPUT # DIGITS.
- Reply with a value from two through 254, followed by Enter. The value must be an even value.
- The program will now execute and set up the linkages to the assembly language portion of the program. It'll return with: OK.

You're now ready to try some bcd operations. The Basic program in Listing 2 provides some exercises you might try. Substitute your own code or append it to the code shown. The code starting at 1000 displays increasing powers of two by adding the contents of bcd accumulator zero to itself after it has initialized with a 1. Powers of two up to two to the 254th power can be displayed. The display for 32 digits looks like Figure 6.

The code at 1050 displays the Fibonacci series I mentioned at the beginning of the article. There's some movement between bcd accumulators taking place in the code so that the last two values can be added to one another to get the next term in the series. The display for 64 digits is shown in Figure 7.

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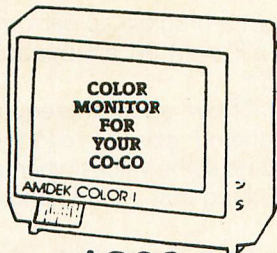


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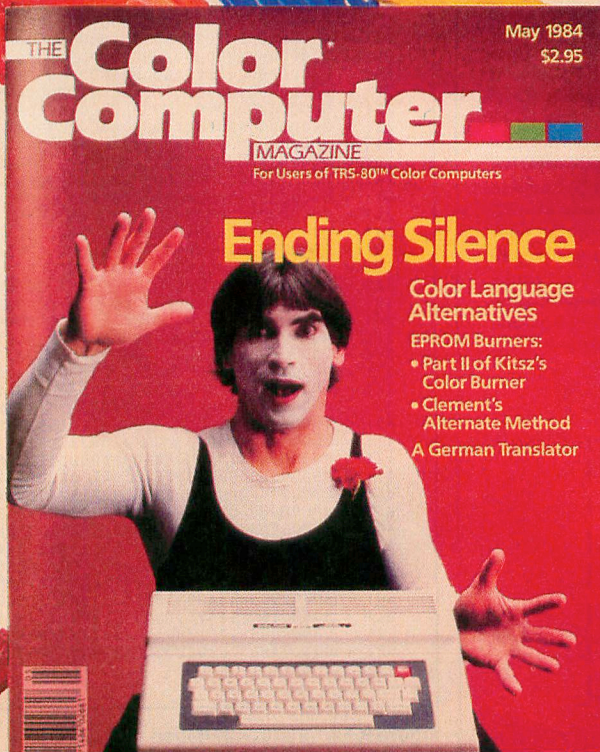
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3E2F 80 30 00320 SUBA # $30 CONVERT TO BCD
3E31 A7 A2 00330 STA , -Y STORE 1 DIGIT
3E33 5A 00340 DECB DECREMENT COUNT
3E34 27 0F 00350 BEQ STR080 GO IF CONVERTED ALL
3E36 A6 82 00360 LDA , -X GET NEXT ASCII CHAR
3E38 80 30 00370 SUBA # $30 CONVERT TO BCD
3E3A 48 00380 LSLA ALIGN
3E3B 48 00390 LSLA
3E3C 48 00400 LSLA
3E3D 48 00410 LSLA
3E3E AA A4 00420 ORA , Y MERGE WITH PREVIOUS
3E40 A7 A4 00430 STA , Y STORE 2 DIGITS
3E42 5A 00440 DECB DECREMENT COUNT
3E43 26 E8 00450 BNE STR010 GO IF NOT ALL
3E45 1F 20 00460 STR080 TFR Y, D TRANSFER ACC PNTR TO A, B
3E47 C4 7F 00470 ANDB # $7F AT START?
3E49 27 06 00480 BEQ STR090 GO IF YES
3E4B 31 3F 00490 LEAY -1, Y DECREMENT PNTR
3E4D 6F A4 00500 CLR , Y ZERO 2 DIGITS
3E4F 20 F4 00510 BRA STR080 CONTINUE
3E51 39 00520 STR090 RTS RETURN
00530 * BCD TO STRING CONVERSION - STRING MUST BE "LEN"
3E52 BD 3F38 00540 BCDSTR JSR GETSRC GET SOURCE ADDRESS
3E55 1F 01 00550 TFR D, X NOW IN X
3E57 10BE 3E03 00560 LDY $3E03 GET STRING ADDRESS
3E5B F6 3E1D 00570 LDB LEN+1 LEN OF ACC
3E5E A6 84 00580 BCD010 LDA , X GET BCD DIGITS
3E60 84 F0 00590 ANDA # $F0 GET MS DIGIT
3E62 44 00600 LSRA ALIGN
3E63 44 00610 LSRA
3E64 44 00620 LSRA
3E65 44 00630 LSRA
3E66 8B 30 00640 ADDA # $30 CONVERT TO ASCII
3E68 A7 A0 00650 STA , Y+ STORE IN STRING
3E6A A6 80 00660 LDA , X+ GET BCD DIGITS
3E6C 84 0F 00670 ANDA # $0F GET LS DIGIT
3E6E 8B 30 00680 ADDA # $30 CONVERT TO ASCII
3E70 A7 A0 00690 STA , Y+ STORE IN STRING
3E72 5A 00700 DECB DECREMENT COUNT
3E73 26 E9 00710 BNE BCD010 GO IF NOT LEN
3E75 39 00720 RTS RETURN
00730 * ADD SOURCE ACC TO DEST ACC
3E76 BD 3F2E 00740 ADDNUM JSR GETDST GET DEST ACC
3E79 F3 3E1C 00750 ADDD LEN END+1
3E7C 1F 01 00760 TFR D, X NOW IN X
3E7E BD 3F38 00770 JSR GETSRC GET SOURCE ACC
3E81 F3 3E1C 00780 ADDD LEN END+1
3E84 1F 02 00790 TFR D, Y NOW IN Y
3E86 F6 3E1D 00800 LDB LEN+1 COUNT
3E89 1C FE 00810 ANDCC # $FE RESET CARRY
3E8B A6 A2 00820 ADD010 LDA , -Y GET SOURCE
3E8D A9 82 00830 ADCA , -X ADD DEST
3E8F 19 00840 DAA DECIMAL ADJUST
3E90 A7 84 00850 STA , X STORE RESULT
3E92 5A 00860 DECB DECREMENT COUNT
3E93 26 F6 00870 BNE ADD010 GO IF NOT DONE
3E95 39 00880 RTS RETURN
00890 * SUBTRACT SOURCE ACC FROM DEST ACC
3E96 BD 3F2E 00900 SUBNUM JSR GETDST GET DEST ACC
3E99 F3 3E1C 00910 ADDD LEN END+1
3E9C 1F 01 00920 TFR D, X NOW IN X
3E9E BD 3F38 00930 JSR GETSRC GET SOURCE ACC
3EA1 F3 3E1C 00940 ADDD LEN END+1
3EA4 1F 02 00950 TFR D, Y NOW IN Y
3EA6 F6 3E1D 00960 LDB LEN+1 COUNT
3EA9 1A 01 00970 ORCC # $01 SET CARRY
3EAB 34 01 00980 SUB010 PSHS CC SAVE CARRY
3EAD 86 99 00990 LDA # $99 FOR NINES COMPLEMENT
3EAF A0 A2 01000 SUBA , -Y SUBTRACT SOURCE
3EB1 35 01 01010 PULS CC GET CARRY
3EB3 A9 82 01020 ADCA , -X ADD DEST
3EB5 19 01030 DAA DECIMAL ADJUST
3EB6 A7 84 01040 STA , X STORE IN DEST
3EB8 5A 01050 DECB DECREMENT COUNT
3EB9 26 F0 01060 BNE SUB010 GO IF NOT DONE
3EBB 39 01070 RTS RETURN
01080 * MOVE SOURCE ACC TO DEST ACC
3EBC BD 3F2E 01090 MOVE JSR GETDST GET DEST ACC
3EBF 1F 01 01100 TFR D, X NOW IN X
3EC1 BD 3F38 01110 JSR GETSRC GET SOURCE ACC
3EC4 1F 02 01120 TFR D, Y NOW IN Y
3EC6 F6 3E1D 01130 LDB LEN+1 COUNT
3EC9 A6 A0 01140 MOV010 LDA , Y+ GET SOURCE

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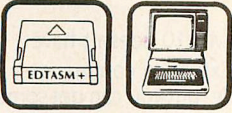
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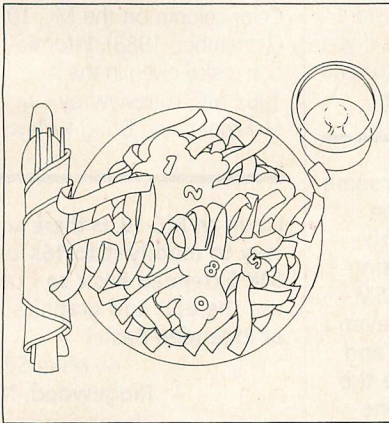
3ECB A7 80 01150 STA ,X+ MOVE TO DEST
3ECD 5A 01160 DECB DECREMENT COUNT
3ECE 26 F9 01170 BNE MOV010 GO IF NOT 256
3ED0 39 01180 RTS RETURN
01190 * SHIF1 SOURCE ACC RIGHT ONE BCD DIGIT
3ED1 BD 3F38 01200 SHFRGT JSR GETSRC GET SOURCE ACC
3ED4 F3 3E1C 01210 ADDD LEN END+1
3ED7 1F 01 01220 TFR D,X NOW IN X
3ED9 A6 1F 01230 LDA -1,X GET LS 2 DIGITS
3EDB 84 0F 01240 ANDA #30F GET LS DIGIT
3EDD B7 3E05 01250 STA $3E05 STORE IN BCD WORKING
3EE0 F6 3E1D 01260 LDB LEN+1 COUNT
3EE3 A6 82 01270 SHR010 LDA ,-X GET 2 DIGITS
3EE5 44 01280 LSRA SHIFT RIGHT
3EE6 44 01290 LSRA
3EE7 44 01300 LSRA
3EE8 44 01310 LSRA
3EE9 34 02 01320 PSHS A SAVE ON STACK
3EEB A6 1F 01330 LDA -1,X GET NEXT HIGHER
3EED 48 01340 LSLA ALIGN LEFT
3EEE 48 01350 LSLA
3EEF 48 01360 LSLA
3EF0 48 01370 LSLA
3EF1 AA E0 01380 ORA ,S+ MERGE TWO DIGITS
3EF3 A7 84 01390 STA ,X STORE SHIFTED RESULT
3EF5 5A 01400 DECB DECREMENT COUNT
3EF6 26 EB 01410 BNE SHR010 GO IF NOT DONE
3EF8 A6 84 01420 LDA ,X GET MS 2 DIGITS
3EFA 84 0F 01430 ANDA #30F RESET GARBAGE
3EFC A7 84 01440 STA ,X STORE
3EFE 39 01450 RTS
01460 * SHIF1 SOURCE ACC LEFT ONE BCD DIGIT
3EFF BD 3F38 01470 SHLFT JSR GETSRC GET SOURCE ACC
3F02 1F 01 01480 TFR D,X NOW IN X
3F04 A6 84 01490 LDA ,X GET 2 MS DIGITS
3F06 84 F0 01500 ANDA #3F0 GET MS DIGIT
3F08 44 01510 LSRA ALIGN
3F09 44 01520 LSRA
3F0A 44 01530 LSRA
3F0B 44 01540 LSRA
3F0C B7 3E05 01550 STA $3E05 STORE IN BCD WORKING
3F0F F6 3E1D 01560 LDB LEN+1 COUNT
3F12 A6 80 01570 SHL010 LDA ,X+ GET 2 DIGITS
3F14 48 01580 LSLA SHIFT LEFT
3F15 48 01590 LSLA
3F16 48 01600 LSLA
3F17 48 01610 LSLA
3F18 34 02 01620 PSHS A SAVE IN STACK
3F1A A6 84 01630 LDA ,X GET NEXT LOWER DIGIT
3F1C 44 01640 LSRA ALIGN RIGHT
3F1D 44 01650 LSRA
3F1E 44 01660 LSRA
3F1F 44 01670 LSRA
3F20 AA E0 01680 ORA ,S+ MERGE TWO DIGITS
3F22 A7 1F 01690 STA -1,X STORE SHIFTED RESULT
3F24 5A 01700 DECB DECREMENT COUNT
3F25 26 EB 01710 BNE SHL010 GO IF NOT DONE
3F27 A6 1F 01720 LDA -1,X GET LS 2 DIGITS
3F29 84 F0 01730 ANDA #3F0 RESET GARBAGE
3F2B A7 1F 01740 STA -1,X STORE
3F2D 39 01750 RTS RETURN
01760 * GET DESTINATION ACC ADDRESS
3F2E B6 3E00 01770 GETDST LDA $3E00 GET DEST #
3F31 C6 80 01780 GET010 LDB #380 128
3F33 3D 01790 MUL DISPLACEMENT
3F34 C3 3A00 01800 ADDD #ACCUM START OF ACCUMS
3F37 39 01810 RTS RETURN
01820 * GET SOURCE ACC ADDRESS
3F38 B6 3E01 01830 GETSRC LDA $3E01 GET SRCE #
3F3B 20 F4 01840 BRA GET010 CONTINUE
0000 0000 01850 END
00000 TOTAL ERRORS
ACCUM 3A00 GET010 3F31 MOVE 3EBC SHL010 3F12 STR090 3E51
ADD010 3E8B GETDST 3F2E PARAM 3E00 SHR010 3EE3 STRBCD 3E1E
ADDNUM 3E76 GETSRC 3F38 SHFLPT 3EFF STR010 3E2D SUB010 3EAB
BCD010 3E5E LEN 3E1C SHFRGT 3ED1 STR080 3E45 SUBNUM 3E9E
BCDSTR 3E52 MOV010 3EC9

```


PROGRAM LISTING 2 BASIC DRIVER



16K Extended Color Basic
Tape Loader



```

10 'BCD Subroutine BASIC driver
11 CLEAR 1000,&H39FF
12 ZZ$=STRING$(254,"0")
13 ZA=0: ZI=0: ZJ=0: ZK=0: ZL=0:
  ZM=0: ZD=0: ZS=0
14 INPUT"HOW MANY DIGITS";ZN: ZN
  =ZN+(LANDZN)
15 IF ZN<2 OR ZN>254 THEN 14
16 POKE &H3E1D,INT(ZN/2)
17 POKE &H3E06,INT(ZN/2)*2
18 DEFUSR0=&H3E07 'String to BCD
19 DEFUSR1=&H3E0A 'BCD to Strng
20 DEFUSR2=&H3E0D 'BCD addition
21 DEFUSR3=&H3E10 'BCD subtrctn
22 DEFUSR4=&H3E13 'BCD Acc move
23 DEFUSR5=&H3E16 'BCD Acc ShRt
24 DEFUSR6=&H3E19 'BCD Acc ShLf
25 END
100 'String to BCD conversion.
101 'Entry: numeric String in ZZ
  $, Acc Nr in ZD
102 POKE &H3E00,ZD
103 POKE &H3E02,LEN(ZZ$)
104 ZA=VARPTR(ZZ$): POKE &H3E03,
  PEEK(ZA+2): POKE &H3E04,PEEK(ZA+
  3)
105 ZZ=USR0(0)
106 RETURN
110 'BCD to String conversion.
111 'Entry: Acc Nr in ZS
112 ZN=PEEK(&H3E06)
113 ZZ$=STRING$(ZN,"0")
114 POKE &H3E01,ZS
115 ZA=VARPTR(ZZ$): POKE &H3E03,
  PEEK(ZA+2): POKE &H3E04,PEEK(ZA+
  3)
116 ZZ=USR1(0)
117 RETURN
120 'BCD Acc Addition subrtn.
121 'Entry: Destinatr Acc Nr in
  ZD, Source Acc Nr in ZS
122 POKE &H3E00,ZD: POKE &H3E01,
  ZS
123 ZZ=USR2(0)
124 RETURN
130 'BCD Acc Subtraction subrtn.
131 'Entry: Destinatr Acc Nr in
  ZD, Source Acc Nr in ZS

```

```

132 POKE &H3E00,ZD: POKE &H3E01,
  ZS
133 ZZ=USR3(0)
134 RETURN
140 'BCD Acc Move (Copy) subrtn.
141 'Entry: Destinatr Acc Nr in
  ZD, Source Acc Nr in ZS
142 POKE &H3E00,ZD: POKE &H3E01,
  ZS
143 ZZ=USR4(0)
144 RETURN
150 'Shft Acc Rght 1 BCD Digit.
151 'Entry: Acc Nr in ZS
152 POKE &H3E01,ZS
153 ZZ=USR5(0)
154 RETURN
160 'Shft Acc Left 1 BCD Digit.
161 'Entry: Acc Nr in ZS
162 POKE &H3E01,ZS
163 ZZ=USR6(0)
164 RETURN
170 'BCD Multiply subroutine.**
  NOTE-BOTH ARGUMENTS DESTROYED**
171 'Entry: Acc Nr of Multiplier
  in ZS, Acc Nr of Multiplicand
  in ZD.
172 'Exit: Acc 7 holds product.
173 ZJ=ZD: ZK=ZS
174 ZZ$="0":ZD=7:GOSUB102
175 FOR ZI=1 TO PEEK(&H3E05)
176 ZS=ZK:GOSUB150
177 ZM=PEEK(&H3E05): IF ZM=0 THE
  N GOTO 181
178 FOR ZL=1 TO ZM
179 ZS=ZJ:ZD=7:GOSUB120
180 NEXT ZL
181 ZS=ZJ:GOSUB160
182 NEXT ZI
183 RETURN
1000 '* SAMPLE: Powers of 2
1010 ZZ$="1":ZD=0:GOSUB102:CLS:P
  =0
1020 ZS=0:GOSUB110
1030 PRINT@33,"2 TO THE POWER OF
  "P" IS",ZZ$
1040 ZS=0:ZD=0:GOSUB120:P=P+1:GO
  TO1020
1050 '* SAMPLE: Fibonacci Nrs.
1060 ZZ$="0":ZD=0:GOSUB102:CLS
1070 ZZ$="1":ZD=1:GOSUB102:I=0
1080 ZS=1:ZD=2:GOSUB140
1090 ZS=0:ZD=1:GOSUB140
1100 ZS=2:ZD=0:GOSUB120
1110 ZS=0:GOSUB110:I=I+1
1120 PRINT@33,"FIBONACCI SERIES
  NR."I" IS",ZZ$
1130 GOTO 1080
1140 '* SAMPLE: Multiply
1150 ZZ$="1928374655":ZD=0:GOSUB
  102:ZS=0:GOSUB110:CLS:PRINT@32,Z
  Z$
1160 ZZ$="45":ZD=1:GOSUB102:ZS=1
  :GOSUB110:PRINT,"TIMES",ZZ$
1170 ZS=0:ZD=1:GOSUB170
1180 ZS=7:GOSUB110:PRINT,"EQUALS
  ",ZZ$
1185 PRINT#-2,, "EQUALS":PRINT#-2
  ,ZZ$
1190 STOP
1200 '* SAMPLE: Factorials
1210 ZZ$="1":ZD=0:GOSUB102:CLS
1220 ZZ$="1":ZD=2:GOSUB102:F=1
1230 ZZ$="1":ZD=3:GOSUB102
1240 ZS=0:GOSUB110
1250 PRINT@32,F"FACTORIAL ("STR$(
  F)"! ) EQUALS",ZZ$
1260 ZS=3:ZD=2:GOSUB120:F=F+1
1270 ZS=2:ZD=1:GOSUB140
1280 ZS=1:ZD=0:GOSUB170
1290 ZS=7:ZD=0:GOSUB140
1300 GOTO1240

```

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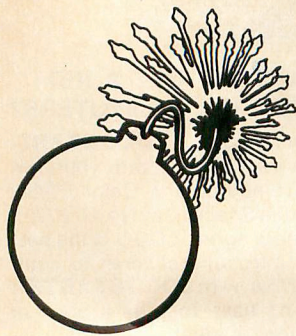
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Circle No. 7 on Reader Service Card

BY TERRY KEPNER



I'm trying to send data to a robotic arm. I would like to send zero to five volts to the arm to control it. I experimented without success with the joystick ports. Is it possible to do this? Could I use the cassette port? Or the RS-232 port?

— Jeff Strong,
Milford, MA

Yes, you can do this. Your best bet is the cassette port, which has a special register controlling voltage sent through the digital-to-analog converter. The output is in 64 discrete steps from zero to five volts (from 0/64's to 63/64's of five volts). Information on this is in the *Color Computer Technical Manual* (get the one for your version computer). You can order the manual at Radio Shack stores by asking them to order from Radio Shack National Parts Division.

You can access the register in Basic, with POKEs, or directly, with machine code.

A year ago I bought a copy of *Color Computer Graphics*. This well-written, easy-to-read book has helped me many times. I then bought an editor/assembler to aid

me in assembly language programming.

How do I disable the Break key; how do I make programs auto-start; can I use more than 23K RAM; and how do I make multi-sound routines for my programs? (To put it differently, how do I write songs with more than one simultaneous tone?)

— Luis Paulet,
Dayton, OH

The only way to disable the Break key is to write your own keyboard driver routine to replace the one used in ROM, and ignore the Break key. For more information, refer to last month's column.

For information on auto-starting a program, see the following letter.

If you have a 32K computer, you already have a 64K computer, unless you used the piggy-back technique to upgrade from 16K. For more information, check last month's column.

And last, the December, 1983 and January, 1984 issues of *The Color Computer Magazine* contain a two part article (Color Quaver) by Dennis Kitz on multi-voice sound production in the Color Computer. While you can't get stereo, the sound is pretty good. In fact, if you can put up with a drastic drop in sound quality, you can have up to 12 simultaneous voices.

Having recently purchased the MC-10 for \$59.95, I find it an excellent machine for the price. Are any books available that describe the ins and outs of this mini-Color Computer? Any information on the expansion port would also be of great help.

Also, is there a way to make programs auto-run when loaded from tape?

— D. Rowlands,
Burlington, Ontario

The technical information you want is in the Radio Shack

MC-10 Service Manual. You can only auto-start machine code programs: one of the best ways is to intercept the ROM Print routine so that when the computer comes back after loading the program to print OK on the screen, it jumps to your program instead. Off-hand, I don't know the address of this routine in the MC-10, so you'll have to disassemble the ROM and locate the address, which should be somewhere in the first 256 bytes of RAM. Don't forget to restore the print routine address if you intend to use the ROM to send information to the screen.

I recently tried to enter some of the programs in Don Inman's book, *Assembly Language Graphics*, using my Radio Shack EDTASM+ ROMpak. Until now I haven't had to create a table, and now when I try to use the FCB with more than one expression (i.e., FCB \$FF \$FF), as used in the book, the assembler gives me a bad opcode error message. Is something wrong with the computer or the ROMpak, or is it the way Radio Shack has programmed the ROMpak? Is there any way to fix it?

— Mark Patrick,
W. Carrollton, OH

Sorry, Radio Shack programmed the ROMpak to accept only one argument per line with the FCB command. The only "permanent cure" is to copy the ROMpak to RAM, patch it (no easy task) and save it to tape. The easier "solution" is to use multiple FCB and FDB instructions whenever more than one operand appears with these instructions in a book. They'll take up more lines, but will result in the same table. Fortunately, most of the other Editor/Assemblers aren't restricted in this way.

I purchased an MC-10 Color Computer because the salesman said it would be more convenient for programming. I now wonder if

there's a way to get routines equivalent to Extended Basic's PCLS, PMODE, and PSET. And can I get appropriate software to get equivalent functions?

— John Zook,
Tempe, AZ

The MC-10 doesn't have those Extended commands available, but you can get some higher resolution graphics by using the Basic techniques discussed in Dennis Kitz's *Custom Color* column on the MC-10 (September, 1983). Information is also given in the August, 1983 MC-10 review by Tim McFadden and Doug Kelley.

I own an MC-10. Is there any way to modify it to 16K or 64K Extended Basic so I can use the edit and graphics of Extended Basic?

— Mike Sile,
Ridgewood, NY

You can rewire the MC-10 for 64K RAM, but it's a very complex operation. Unfortunately, you would still be stuck with Standard Basic. There's no room in the memory map of the MC-10 for Extended Basic, and you can't just wire in the Extended Basic ROM because the MC-10 CPU is different from the Color Computer (6803 versus 6809) and uses different machine codes.

If you'll refer to Dennis Kitz's article on the MC-10 (September, 1983), he gives tricks you can use to achieve higher resolution graphics on the MC-10, plus some hints on increasing the MC-10 memory by 4K in a way that makes a 6K hi-res screen possible.

Information Update

In the April column a question regarding the loss of the Play function after CLOADing a program appeared. Dennis Kitz tells me the problem could be the analog multiplexer chip, MC14529B. This chip is a delicate CMOS device which can exhibit the symptoms mentioned when damaged. ■

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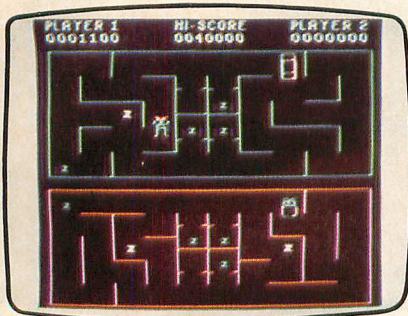
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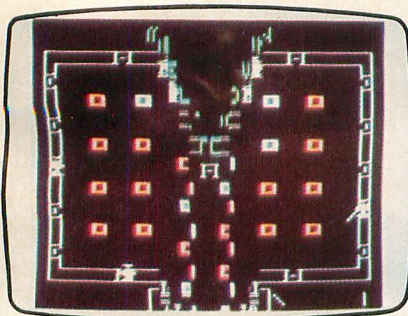


REVIEWS\$

GAMES



Grabber



Reactoid



Devil Assault

Grabber

Tom Mix Software
4285 Bradford N.E.
Grand Rapids, MI 49505
(616)364-4791
\$27.95 tape, \$30.95 disk
32K

Grabber is a fast-action arcade game from Tom Mix. The object is to maneuver your grabber around a maze, picking up objects and storing them in the center box.

Each playing board consists of two mazes. One maze uses the top half of the screen and the other maze uses the bottom half. Each maze has four objects located in the corners. You must collect these and place them in the center of the mazes. To get from one maze to the other you press the joystick button. Does this sound too easy? I haven't mentioned your enemies — they look like flashing bow ties. You can try to evade them or eat them.

So far so good, but then come the Googlies. What's a Googlie? This is a funny creature that takes your goodies out of the center and redistributes them in the maze again. If you catch this little creature you earn bonus points.

The game has a pause feature so you can answer the telephone or take a break.

Grabber is great for those cold rainy days — it'll keep the kids quiet. A good one for the collection.

— Kenn Perry

Reactoid

Radio Shack
One Tandy Center
Fort Worth, TX 76102
\$19.95, ROMpak
16K

Reactoid is a game based on a nuclear meltdown.

It is the late 1990's at an experimental power station. The reactor is controlled by a network of computers, monitored by you.

The system is down. You must manually control the system to continue to make energy, and to save the plant and surrounding communities.

There are 20 particle emission tubes which randomly emit charged particles throughout the core. Your job is to reflect these particles into the 24 energy posts in the core or into the wall, but by all means not into another tube.

Each of two players has three turns per game, with a bonus turn after three successful rounds. Once all the energy posts are lit, rather than one particle being inside the core at a time there will be two. Every time you clear a screen the game gets a bit tougher.

I found Reactoid exciting, challenging, addictive, and fun to play.

The only thing I was unhappy with was the lack of a pause button.

— Robbie Loyd Anderson

Devil Assault

Tom Mix
4285 Bradford N.E.
Grand Rapids, MI 49506
(616)957-0444
\$27.95 cassette
\$30.95 disk
Joystick
16K

Devil Assault is a fast-moving, high-resolution game. You have to fight off waves of birds, robots, bombs, wildly bouncing spongs, and fire poured by the devil.

That's about all there is to it — it's another shoot-'em-up game, but one that is devilishly difficult.

You won't quickly master or become bored with this game — and neither will your kids. Buy it!

— Robin Hudson

Icemaster

Arcade Animation, Inc.
21 The Fairway
Upper Montclair, NJ 07043
\$25.95 tape, \$27.95 disk
32K

Icemaster is the Color Computer version of Pengo, a popular arcade game. The graphics are outstanding.

You start out in the middle of the screen in a red box. You must use the right joystick to maneuver around the ice blocks. You can kick these blocks to destroy the bees that are flying around the screen.

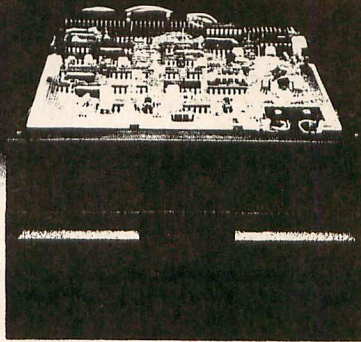
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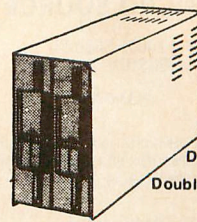
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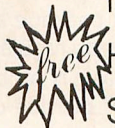


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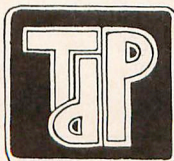
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

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REVIEWS

If you take too long to kill the bees you will run out of bonus points.

There are three levels of play. Iceman keeps track of the ten top scores.

— Chris DeSimone

LANGUAGES

Newbasic

H.L. Johnson Services
1637 Jessica Way
San Jose, CA 95121
(408)274-3062
\$25 disk

This enhancement of 64K Extended Disk Basic is a delight for any Basic programmer. The package adds about two dozen Basic commands to the Radio Shack — Microsoft set. The additional commands are listed in the table.

To use Newbasic, your Color Computer must have 64K, Color Basic ROM 1.1, Extended Basic ROM 1.0, and Disk Basic ROM 1.0. Upgrades for newer versions of ROMs are sure to follow; check with Newbasic's manufacturers if you have a question about compatibility.

Aside from the added Basic commands, Newbasic provides an improved prompt, reverse video (green letters on a black background), a nice key-click, and an automatic page-stop at 15 lines.

Word-wrap control is optional: you can set it to not split words at the end of a line. You can also control the speed at which listing and directories scroll, program keys, and echo output to your printer. And I must not neglect to mention the colored underlining of text.

Like all good programs, Newbasic has a graceful exit via a full reset, so that you need not turn the power off.

Newbasic uses the empty space on track 17 (the directory track) cleverly. Sector 1 can contain up to 250 characters holding disk ID, title, or description. Also, each file name can carry a 14-character comment (stored in the empty space on track 3). This information appears when you give the DIR command.

I think Newbasic's most valuable tools are the Back-Arrow line editing and the On Error routine. How often have you misspelled LOAD as LAOD? The Back-Arrow editing lets you correct the

spelling without wiping out anything to the right of the error.

The On Error GOTO utility allows you to trap errors without aborting the program, and without losing any data.

Newbasic also lets you use the Semi-graphics 24 mode, described in the Motorola 6883 (SAM) spec sheet. This eight-color mode arises when you effect an unconventional matching of SAM and VDG.

This "new" graphics mode works on a screen of 64 x 192 pixels, with all eight colors available. Each pixel is four clock-dots wide and one dot high — a little narrow, but interesting since it can be mixed with alphanumeric characters.

To light up the pixel at coordinates 32,100 in color 8, just put SSET (32,100,8) into your program. Very nice. All other graphic modes function as before.

The whole program takes up almost 6K of memory, but it resides above the disk ROM area in the 64K configuration. Thus it does not take away any memory from the standard 32K operation.

This is an excellent package and the price is reasonable. If you regularly program in Basic, Newbasic is probably perfect for you. It will provide utility and pleasure, even for the advanced practitioner of our craft.

— Arnold H. Kahn

INVERSE ON/OFF
CLICK ON/OFF
BREAK ON/OFF
SPEED
UNDERLINE
DUMP
WRAP ON/OFF
SSET (X, Y, C)
SPOINT (X, Y)
ECHO ON/OFF
NAME DISK
PAGE ON/OFF
FILELIST
FILEINFO
LOWER ON/OFF
RAINBOW
KEY
INIKEYS
ON ERROR GOTO
PRINT ERR
PRINT ERL
RESUME
ERROR

Newbasic's Added Commands

Programming in C

by Stephen G. Kochan
 Hayden Book Company
 10 Mulholland Drive
 Hasbrouck Heights, NJ 07604
 (800)631-0856
 (201)393-6315 in New Jersey
\$18.95
384 pages, paperback

"You should check out the power of C." I've heard this more than once over the last few years, but I've always been frustrated when I looked for a reference book. None were designed to introduce newcomers to the C language.

Now that C's getting more popular, books are written to be read and understood by the uninitiated. Hayden's new book hits the mark as a *complete* and easy-to-follow guided tour that won't leave the experienced computerist bored.

Programming in C includes many complete sample programs and their output, all illustrating the points and features discussed in the text. The chapters are intended to be read in order, as each builds on the foundation provided by earlier ones, like a course textbook.

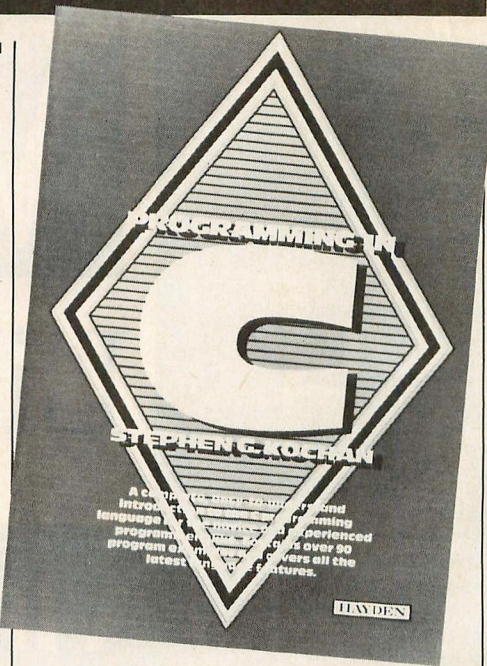
Starting with the Introduction (Chapter 1), which explains the intent of the text and some history, the world of C programming slowly develops before the reader, like an intricate, yet elegantly simple circuit design.

After Chapter 2 which covers fundamentals for both the complete novice and the newcomer to C, full-sized chapters cover each of these general topics: basics of C program structure; variables, constants, data types, and arithmetic expressions; looping; decision making; arrays; and functions.

Following these are chapters on the more uncommon features of C: structure definitions and usage; character strings; pointers; bit operations and bit fields; the preprocessor (macro definitions); enumerated data types (user defined) and type conversions; and large programs and program modules.

Completing the description of C is a detailed chapter on input and output and one covering miscellaneous features and advanced topics.

The six appendices start with a language summary (long and complete),



followed by common programming mistakes; UNIX C library overview; compiling programs under UNIX; a description of the LINT error checking program; and an ASCII character chart. A good-sized index wraps up the book.

The introduction and many of the exercises at the end of each chapter strongly suggest that you try out the examples on a computer and play around with them. Even though I ran through only a few (there are over 90), I found the text clear and uncontradictory to the end.

Of those 90-plus program examples, I detected no programming errors and only one formatting error (C would compile the code, but the indentation was misleading). That's quite an achievement over Murphy's Law in such an aggressive work.

C is installed most often on the UNIX operating system, so some special attention is given to the commands and libraries available to UNIX users. Most of the time no assumption is made about the system the user is running.

Color Computer users will find a few standard features of C missing on Radio Shack's OS-9 version of C, and a few differing in operation (such as intermediate file name conventions). Many of the features are missing (understandably) on Dugger's small C compiler.

If you are a computerist who needs a complete, concise, and readable description of C, or just want to know if C is for you, I recommend *Programming in C* enthusiastically.

— J.T. *Color Staff*

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VIP Writer™

By Tim Nelson

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The most powerful and easy-to-use word processor is available in the showpiece and workhorse of the **Library: The VIP Writer™**. Because of its undisputed superiority over all Color Computer word processors, it was selected by Dragon Data Ltd. of England and TANO in the U.S., to be the Official Word Processor for their line of Dragon microcomputers.

The result of two years of research, the **VIP Writer™** offers every feature you could desire from a word processor. It is the most powerful, fastest, most dependable and most versatile. With the hi-res display, workspace and compatibility features built into the **Library the Writer** is also the most usable.

"... Nearly every feature and option possible to implement on the Color Computer. The design of the program is excellent; the programming is flawless." October 1983 "Rainbow"

"Among word processors for the CoCo, VIP Writer stands alone as the most versatile, most professional program available." May 1984 "Computer User"

"Word processing with VIP Writer is like driving a high-performance vehicle... This Ferrari of a package has more features than Telewriter, Easywriter (for the IBM PC), or Applewriter." October 1983 "Hot CoCo"

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

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Radio Shack Catalog No. 90-0141

32K (Comes with tape & disk) \$69.95

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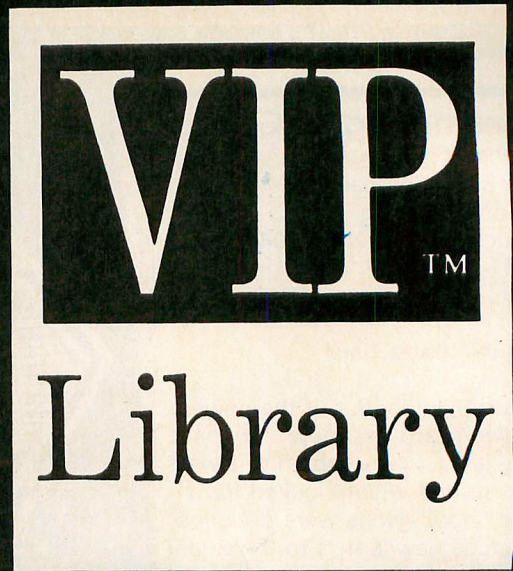
By Bill Argyros

Gone are the eyestrain, boredom and fatigue from endless proof-reading. **VIP Speller™** is the fastest and most user-friendly speller for your CoCo. It can be used to correct any ASCII file — including **VIP Library™** files and files from **Scipsit™** and **Telewriter™**. It automatically checks files for words to be corrected, marked for special attention or even added to the dictionary. You can even view the word in context, with upper and lowercase. **VIP Speller™** comes with a specially edited 50,000 word dictionary which, unlike other spellers for the CoCo, is indexed for the greatest speed. The shorter your file, the quicker the checking time. And words can be added to or deleted from the dictionary or you can create one of your own. **VIP Speller™** also comes with the **Library's** mini disk operating system.

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VIP Calc™

By Kevin Herrboldt

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Radio Shack Catalog No. 90-0143

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32K does not have hi-res displays, sort or edit.

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RATED BEST IN JANUARY 1984 "RAINBOW"

By Dan Nelson

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FEATURES: Choice of 8 hi-res lowercase displays * Memory-Sense with BANK SWITCHING for full use of workspace * Selectively print data at baud rates from 110 to 9600 * Full 128 character ASCII keyboard * Automatic graphic mode * Word mode (word wrap) for unbroken words * Send and receive **Library** files, Machine Language & BASIC programs * Set communications baud rate from 110 to 9600, Duplex: Half/Full/Echo, Word length: 7 or 8, Parity: Odd/Even or None, Stop Bits: 1-9 * Local linefeeds to screen * Save and load ASCII files, Machine Code & BASIC programs * Lowercase masking * 10 Keystroke Multiplier (MACRO) buffers to perform repetitive pre-entry log-on tasks and send short messages * Programmable prompt or delay for send next line * Selectable character trapping * Send up to ten short messages (KSMs), each up to 255 characters long, automatically, to save money when calling long distance.

All versions allow tape load and save of files and KSMs, but the disk version also has the Mini Disk Operating System.

Radio Shack Catalog No. 90-0139

32K (Comes with tape & disk) \$49.95

(Tape comes in 16K but without hi-res displays)

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VIP Database™

"ONE OF THE BEST" JULY 1984 "RAINBOW"

By Tim Nelson

This high speed MACHINE LANGUAGE program fills all your information management needs, be they for your business or home. And it does so better than any other database program for the Color Computer, featuring machine code, lowercase screens and mailmerge capabilities. Inventory, accounts, mailing lists, family histories, you name it, the **VIP Database™** will keep track of all your data, and it will merge **VIP Writer™** files.

The **VIP Database™** features the **Library** Memory Sense with BANK SWITCHING and selectable lowercase displays for maximum utility. It will handle as many records as fit on your disk or disks. It is structured in a simple and easy to understand menu system with full prompting for easy operation. Your data is stored in records of your own design. All files are fully indexed for speed and efficiency. Full sort of records is provided for easy listing of names, figures, addresses, etc., in ascending or descending alphabetic or numeric order. Records can be searched for specific entries, using multiple search criteria. With database form merge you may also combine files, sort and print mailing lists, print "boiler plate" documents, address envelopes - the list is endless. The math package even performs arithmetic operations and updates other fields. Create files compatible with the **VIP Writer™** and **VIP Terminal™**. Unlimited print format and report generation with the ability to imbed control codes for use with all printers.

As with all other **Library** programs, the **Database** features the powerful Mini Disk Operating System.

Radio Shack Catalog No. 90-0140

32K DISK \$59.95

64K Required for math package & mail merge

VIP Disk-ZAP™

RAVED ABOUT IN THE APRIL 1983 "RAINBOW!"

By Tim Nelson

Your database file disk, form letter disk, or BASIC program disk goes bad. An I/O error stops loading, or even backing up of the disk. Weeks, even months of work sit on the disk, irretrievable. Now catastrophic disk errors are repairable, quickly and with confidence, using the **VIP Disk-ZAP™**. It is the ultimate repair utility for simple and quick repair of all disk errors. Designed with the non-programmer in mind, the **VIP Disk-ZAP™** will let you retrieve all types of bashed files, BASIC and Machine Code programs.

This high-speed machine code disk utility has a special dual cursor screen display to look at the data on your disk. You are able to: Verify or modify disk sectors at will * Type right onto the disk to change unwanted program names or prompts * Send sector contents to the printer * Search the entire disk for any grouping of characters * Copy sectors * Backup tracks or entire disks * Repair directory tracks and smashed disks * Full prompting to help you every step of the way * 50-plus page Operator's Manual which teaches disk structure and repair.

Radio Shack Catalog No. 90-0144

16K DISK \$49.95

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EDUCATION

Classroom Management

Sailors System Software
1943 Garfield Ave.
Pasadena, CA 91104
(817) 798-8273

16K
\$10 demo cassette or disk
\$40 subscription to service

In any group, each teacher will probably have his or her own idea of how a grading program should be set up. Sailors Software had this in mind when the Classroom Management package was developed. It was written expecting the user to modify it, and Sailors will provide support if needed.

Richard Sailors has taken a unique approach to marketing his program. For \$10 you will receive a cassette or disk of the student information and grades program. Included is one page of general instruction. You are encouraged to experiment and learn the program's operation by using the built-in sample data files. For another \$40 you will receive a detailed manual describing program operation and program modules, as well as a subscription to the programming service. A phone help number is made available to subscribers, with a list of suggested calling times. The call is at your expense, but you'll have undivided attention and help.

A custom writing service is also available for major revisions or additions to Classroom Management. A price will be agreed upon and a custom program written after you discuss your needs with Sailors. Prices vary according to the amount of time needed to produce programs, as well as the number of people who would want the program.

The Classroom Management program has two major components — student information and grades. They are loaded and run separately. At the beginning a functions menu is available. If you are familiar with the one-letter commands, you may bypass the menu. Warning messages appear at points of the program where data could be lost, and a question prompt to continue or abort is given.

Six functions are available in the student information program. Data may be stored in five fields: name, gender, book number, address and phone number. Field length is predetermined, but user-modifiable. Any existing student information is viewed by specifying the class and student numbers. A change function lets you update student information. You may also print a copy of student information. Information may be saved and retrieved from disk or cassette.

The grades program accepts percentage or letter grades. A test feature lets you check the maximum amount of data that can be stored. To use this feature, the number of students in all your classes and the number of grades to be averaged per student is entered.

**“In any group,
each teacher will
probably have his or her
own idea of how
a grading program
should be set up.
Sailors had
this in mind . . .”**

If the REDUCE VALUES prompt appears, some adjustments may have to be made, such as averaging more frequently. Unneeded modules could be dropped to conserve memory (for example, if you don't have a printer, that module could be deleted). The test feature is more important to a 16K user than a 32K user, as 32K allows storage of about 3000 grades.

The view feature shows up to nine grades at a time for up to 13 students on the screen. The program lets you redimension grade and student records arrays. Before entering each set of grades, weights may be determined, as well as the number of possible points. The program calculates and stores this as a percentage score. A word of caution — once you are in this part of the program, escape is difficult until the number of new grades you choose to enter are complete. An average option displays the arithmetic average of all student scores and their corresponding letter grades. You may print the average function on paper and list up to 20 of the student's scores.

Grade parameters may be modified by changing data Lines 12040 — 12060.

The manual contains 39 pages of instructions, program listings and suggestions for revisions. Most major variables involved in the program are listed with comments. Liberal doses of remark statements are found throughout the program listings. The text is clearly written and easily understood by a computer novice. The only part I found that could bear more explanation was how to change grade values.

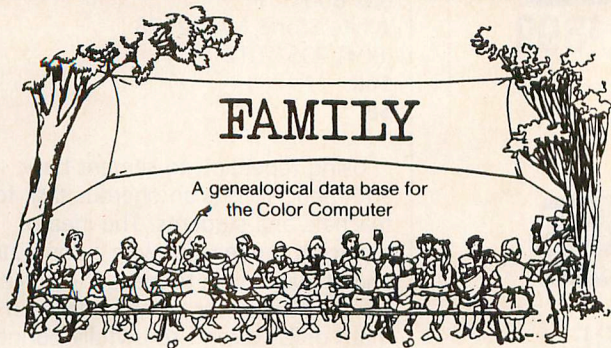
Extended Basic owners will find one annoying characteristic. Upon loading and typing RUN, you will receive a syntax error in Line 100. Delete it if you have 16K Basic, or 32K, or 64K. The line is meant to eke out the maximum memory from a 16K Extended Basic Color Computer. If you leave it in, you will have to type RUN twice to get the program started. Another error cropped up in my disk copy of the program. An RG error appeared in the student information program at Line 1200. Actually, this existed because of a mysterious variable that appeared. A call to Sailors Software provided the necessary fix, and I was assured that the bug would be corrected. The tape version worked without problems.

The programming service deserves some comment. I called twice with questions concerning the program, first as a prospective buyer, then a program user. Mr. Sailors was helpful and knowledgeable about the program package. I appreciated this personal touch. The manual states that the number of subscriptions will be limited to facilitate requests for service. I wonder what this limited number will be?

Do you need this programming service? If you're satisfied with the demonstration program as it is, no. If you're fairly proficient in Basic and can understand and modify programs to fit your needs, maybe not. If you're one of those people who'd pick up the phone and call a software company for advice and help with program operation, definitely get the full service package. My fair-to-middling knowledge of Basic was enough to understand the program, but I found the manual quite helpful on some of the finer points.

— Mark Haverstock

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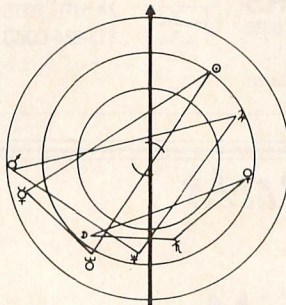
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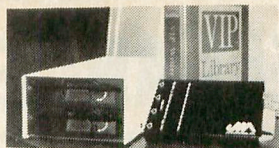
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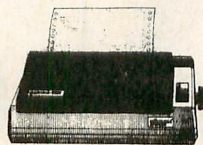


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Speed Math

West Bay Company
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White Stone, VA 22578
(804) 435-1012
16K
\$8

Using repetition to cement basic arithmetic skills is an onerous task for teachers and students. The idea of replacing the teacher with a computer and at least trying to make the process fun for students is commendable. If math drills weren't so awfully boring Speed Math would do a good job; but they are awfully boring, and Speed Math needs help.

The program has little documentation, but that's fine — all the instruction you need is presented on-screen. You are asked to pick a difficulty level (which determines how much time will be available for each problem set) and how many and what types of math problems you will be drilled on. It then generates random numbers as it entertains the troops with some musical tones.

Math problems appear one at a time. The first complaint I have regards giving the answer: if you make a mistake or happen to hit the wrong key, you can't make a correction but must continue. If you do try to make a change, the next problem's answer will also be wrong.

The time limitation is a problem, too. It's supposed to add to the challenge, but the challenge of finding the right keys also enters the picture. My seven-year-old thought it unfair that the time it took to find the right key for the answer counted against his score. He quickly lost interest.

The title page and the linear "stop watch" graphics didn't keep my little users continuously interested, either. The screen that displays results is very "busy" and hard for youngsters to read. And the pauses during new problem generation are filled with random tones that quickly get monotonous.

The inability to store performance records is a more serious problem; it means you can't leave a student alone and return later to check performance, but must stay there and look over his or her shoulder. That's no encouragement for children bent on reaching intellectual independence.

Speed Math does do everything its ad says it will do, though, and, thanks to lots of error-checking, seems crash proof. It is written in Basic and so is easily modified. I'd recommend customizing the graphics. The effort could turn Speed Math into a rewarding educational tool. If not, children may get bored with it before they truly learn their math.

— James Sanford

Vector Addition

Tandy Radio Shack Corp.
Fort Worth, TX 76102
32K, tape and disk
\$39.95

A review of vector addition may sound as exciting as watching your faucet drip, but while Vector Addition is not filled with whistles and bells, it has real interest for high school mathematicians. (The program is a re-make of a Model III/IV program of the same name.)

There are no "right answers" in this educational software. Instead, it helps students visualize vectors by putting them on the screen. A vector is a quantity with magnitude and direction. Vector addition can involve from two to twelve of these quantities. All vectors can be combined into a single force or distance, and into a single direction, called the resultant vector. Students enter magnitudes and directions to be added and see the results displayed both numerically and in a pleasing graphic screen display. Students can use the program to check their own calculations, of course, but with Vector Addition, the machine does the math.

The screen display can be of the common origin, or the tip-to-tail style so beloved of physics teachers. Other options let users see vector values listed individually. An edit mode permits users to change magnitudes and directions.

Another option returns you to the very beginning of the program; who needs to see the title, over and over, just to clear old entries, I wonder? I would prefer a "clear entries and start" option.

The Radio Shack catalog and documentation say that the program is for 32K Extended computers, but the tape label that came with my review copy said 16K. It would not load on my 16K

machine, however, even with the appropriate PMODE and PCLEAR commands. I tried renumbering the program for economy, but it still wouldn't work. Vector Addition is clearly for 32K.

The documentation says you can enter vectors from zero to 359 degrees, but the program lets you enter 360 degrees. If you do enter 360 degrees rather than its zero degree equivalent, you'll get an incorrect answer. Not only that, the wrong-answer magnitude will be in scientific notation!

The program also regards east as zero degrees, because its writers wanted the positive x-axis (the east position) to be at zero. This might be a good reference for those who want to keep a protractor on a horizontal plane, but for compass users the program should have an option that permits the north (positive y-axis) to be placed at zero.

"Vector addition may sound as exciting as watching your faucet drip, but it has real interest for high schoolers."

Even with these errors the program is worth buying because it can inspire thought. As with much Radio Shack educational software, the documentation is worth at least a portion of the price. This package teaches well, and is especially suited for visual learners. And program operation is very easy.

Selected investigations at the end of the documentation seem little more than end-of-chapter physics textbook problems, but once solved the program displays the results nicely, and in two cases helps solve the problems. While the program can't derive x- and y-components from a resultant vector, that should be the students' job. They'll likely enjoy displaying the results of their calculations. I did. On a scale of 1 to 10, give this program a 7, even with an occasional glitch.

— Dennis Peterson

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Mathmenu is an eclectic collection of programs that solves many kinds of mathematical problems. Used to supplement the capabilities of Basic, its programs can help engineers, technicians, hams, photographers, math students, and anyone who uses calculus.

The programs are easy to use. Detailed instructions are on the screen for each function; experienced users won't be hampered since the instructions appear only if requested. I used all features of the system in about 30 minutes. In my book, that's user friendly.

RPL

The first program is RPL. It is designed for calculator users who employ the Reverse Polish Logic scheme of data entry. Unfortunately, RPL supports only addition, subtraction, multiplication, division, and exponentiation. It's almost a waste to use a computer to perform calculations that can be done by a ten-dollar calculator. To its credit, the program will accept either decimal or hexadecimal data. It also continuously displays the contents of the four stack locations and three memory registers.

2D PLOT

This is a spectacular program. It plots any function of one variable, such as $f(x) = \sin(x)$.

The program menu lists each subroutine in the order it must be used to produce a two-dimensional plot. You edit the equation you want to plot into Line 10 of the program. After you've done this, type GOTO 45 and the program resumes. This is slightly awkward but you'll quickly get used to it.

Next, you can specify limits for calculation and plotting; therein lies one of the few weaknesses in the instructions. The difference between the two sets of limits which you must specify is not clearly stated. It takes some experimenting to get the picture you want.

After the function is plotted, you may change the resolution (number of points calculated and plotted), remove or replace the coordinate axes, display the plot at any time, or clear the screen.

Other features let you change the scale factor for either axis, and save to tape or disk. The program even includes a section to run your screen dump subroutine to produce a print-out of the plot.

I tried to force the program to divide by zero and crash. It trapped out some problems, but you must be careful about the functions and limits you specify to avoid divide-by-zero errors.

The inability to label plots is the worst problem with this program. Additionally, the effect of changing scaling factors is not clear without some experimenting.

3D PLOT

3DPlot plots functions of three variables. (It generates that eye-catching plot in Inter + Action's ads.) Its features and options are the same as 2DPlot's, with additions that account for the third axis and allow changing the thickness of each "slice," or the width between lines.

Interestingly, the program plots a function of the form $Y = f(X,Z)$, rather than something like $Z = f(X,Y)$. This causes no problem in operation, but can be confusing.

The program allows you to plot either a true three-dimensional function, or a figure formed by rotating a two-dimensional figure about one of the axes. The difference between the two is subtle and, unfortunately, not very well explained. As long as a closed-form equation is known for the function to be plotted, there is no problem. But neither plotting program accepts discrete data points from the keyboard or a disk file.

MATRIXOP

Matrixop performs common arithmetic functions on matrices up to eight-by-eight in dimension. The use of matrices to solve systems of simultaneous linear equations is discussed briefly, as is a step-by-step procedure to use this program. But this is such a common matrix evolution that the program would be better if it could perform this operation in one step.

A very common application of Matrix arithmetic is circuit analysis of systems like the one shown in Figure 1.

The matrices can be edited, which means you don't have to start all over thanks to one mistaken input number. The array size is limited to eight-by-eight so the program will run in 16K. For 32K machines, larger arrays are possible if you change all references to eight to 28 in Lines 25, 420, 435, 480 and 490. I used up to 28 by 28 without doing a PCLEAR1 on my 32K system.

VECTOROP

Problems in the physical sciences can often be simplified with vectors that represent physical effects, effects that have magnitude and direction. Calculating the effect of wind on structures is one possible use of Vectorop. This program lets you define, edit, and print vectors, and perform vector addition and subtraction.

Vectorop also lets you find vector dot and cross products, unit vectors in a given direction, and normal (perpendicular) vectors of any length. Vector dot and cross products are only defined if both vectors have the same number of dimensions, so the program should trap out any attempt to create a physically impossible situation. I was able to force invalid conditions into it, and it produced a meaningless output.

NUMDIFN

One of the first things a student of calculus learns is to take a derivative of a function — to differentiate it. The derivative is useful in real, physical applications.

The derivative represents the rate of change (slope, on a graph) of a function at some single point. It is defined by taking a limit,

$$\frac{dY}{dx} = \lim_{h \rightarrow 0} \frac{Y(x+h) - Y(x)}{h}$$

where Y is the function of x, and h is some small variation in the value for x. In calculus, the limit is taken as h approaches zero (see Figure 2).

Many functions can be differentiated analytically with certain basic rules. Others are too complicated and must be solved by numerical methods, which involve substituting a small value for h and actually solving the

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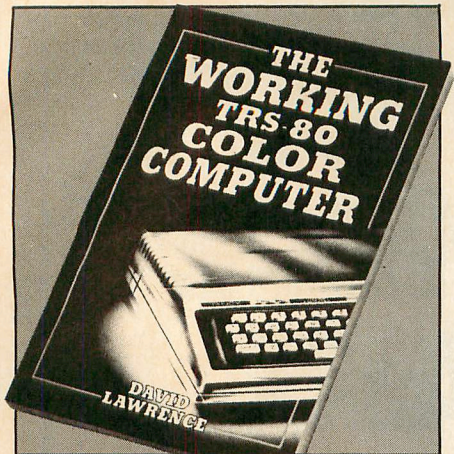
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REVIEWS

equation above. This is what Numdifn does.

Figure 2 shows an example of differentiation and how to get a numerical answer. The function to be differentiated is entered by editing a line in the program. Then the program calculates the derivative at the points you specify. The program makes an approximation for h based on the value of x . In my tests the accuracy of this method was undeniable.

This program does not screen out potential divide-by-zero situations, so you must be careful about the points you specify, or it will crash.

NUMINTEG

The converse of differentiation is integration. Like differentiation, it can be solved both analytically and numerically. Analytical solutions can get tremendously complex, so numerical methods are often more practical.

There are two kinds of integrals, *indefinite*, used to seek an analytical result which is valid at any point (see Figure 3), and *definite*, used to seek a single value for the integral when evaluated between certain limits.

Numinteg uses Simpson's Rule to approximate the value for a definite integral. Since an integral corresponds to the area under a curve, the total area is broken up into pieces. For each piece a size value is found. Then, all areas are added to give the integral's value.

The Numinteg function is entered by editing Line 10. The program asks for upper and lower limits and a number of iterations to perform. More iterations mean a more accurate solution, albeit at the expense of computing time. The documentation says 20 is a good number to start with.

I ran several tests to see if there was any way I could force the program to crash or give an invalid answer. It didn't crash, but did give some strange answers when the function $Y = 1/X$ was integrated from -2 to 4 . It would be wise to have some idea of the function's behavior to avoid situations like this.

LG#ADD and LG#LMULT

The Color Computer rounds numbers to nine significant figures when doing floating-point calculations. These two programs circumvent the

floating-point routine if you want more precision. They will add numbers containing up to 100 digits and multiply two 30-digit numbers with no round-off error.

The programs work as advertised, but I can't think of any common application that requires 100 significant figures. The absence of similar subtraction and division routines renders the idea unnecessary. They won't accept negative numbers or decimals either. You have to keep track of the decimal point in two strings of numbers 100 digits long.

QUAD EQN

This useful program finds the solutions of quadratic equations. Every algebra student learns a classic equation for solving a quadratic, but sometimes the numbers get messy. This program eliminates all the drudgery. Better yet, it automatically takes care of potential disasters that can result from trying to take the square root of a negative number.

To use it you must have your quadratic equation in the form $0 = a \times x^2 + b \times x + c$. The program asks for the values of A , B , and C , then tells you if the solutions (roots) are real, equal, or complex. Complex numbers are expressed in standard complex-number notation. With A , B , and C known, the value for X that satisfies this equation is $X = -b \pm \sqrt{b^2 - 4ac}$ (or $-$)

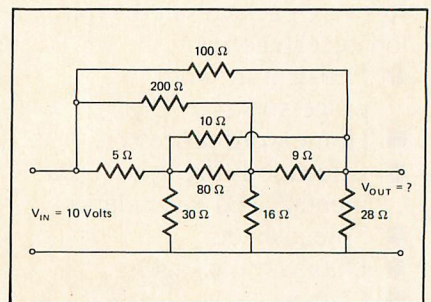


Figure 1. Circuit for a Matrix Solution

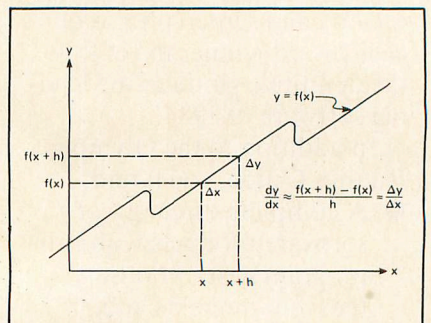


Figure 2. Differentiation Example

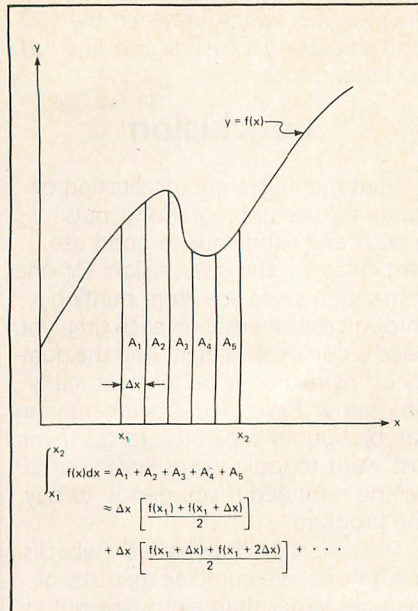


Figure 3. Example of Simpson's Rule to Evaluate a Definite Integral

SQR ($b \times b - 4 \times a \times c$) za. Quad EQN works faultlessly, but will crash if the value for A equals zero.

LSTSQRS

Lstsqrs is the most useful program in the package. It calculates a cubic, quadratic, or linear equation for a given set of data. And it finds an equation of a curve that runs so that it has the least deviation from the majority of the data. This program takes you from your measured experimental data to an equation that fits. With an equation, you can use the other programs in the Mathmenu package. The program will use the equation it calculated to find the function result at some new point, based on new data from the keyboard.

You can enter data that correspond to a quadratic equation, call it a line, and have the program fit the data to a line: all nonsense, of course, so you must have some idea of what your data will look like before you run the program. Otherwise, if you try to find the equation value for some other input, it won't be accurate. This is the only deficiency in the program, but the fix is easy.

The statistical method for calculating a least-squares fit includes calculation of a correlation factor. In-ter + Action could have included in the screen display the value of this correlation factor. That would have told you whether to have confidence in the re-

sult, or to try a quadratic or cubic equation. But as long as you're careful about interpreting the results (a graph of your original data is well worth the time required to plot it), this program can be extremely helpful in evaluating experimentally obtained data.

PRIME CK

This program tells you whether a number (up to one million) is prime. (A prime number is one that cannot be evenly divided by any number other than 1 and itself.) Calculating prime numbers is an interesting mathematical exercise, but of little practical use.

The program works by dividing your number with prime numbers. If it can be evenly divided by some other prime number, it is reported as not prime. If the number cannot be evenly divided, other prime numbers are used. This technique is fast, but uses up valuable memory.

BINOMEXP

When a binomial of the form ($a + b$) is raised to some integer power, the coefficients of each term can take a long time to calculate. Binomexp uses an algorithm called Pascal's Triangle to find and print the coefficients. It works as advertised and is very easy to use.

BASECONV

To convert a number in any base to a number in any other base, use Baseconv. It's easy and lets you use letters for bases greater than 10.

Baseconv checks to make sure all entries are valid. If you are entering a base two number, it will not accept the digit 3.

RECT-POL

Problems concerning vector resolution, such as those found in antennas and transmission lines, or even common ac circuit analysis, result in complex numbers. Basic won't manipulate them so some other method is needed. Rect-Pol handily executes the task.

When complex numbers need to be added or subtracted, Rect-Pol's rectangular notation form does the job. When multiplication or division is needed, the polar form is easier to use.

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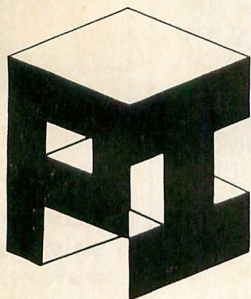
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REVIEWS

Rect-Pol can switch between the two conveniently. It's easy to use and has no hidden tricks.

Conclusion

Mathmenu is a good collection of generally useful programs. It puts menus and submenus to good use, particularly in the disk version. On-line instruction saves you from hunting through documentation each time you need a quick calculation. And the quality of instruction is better than many programs I have used. Documentation can be bought separately for \$5 if you just want to look it over first; your \$5 will be refunded if you decide to buy the program.

The collection does have drawbacks. It won't handle complex matrices or matrices larger than eight-by-eight. If those two features were implemented many electronics problems would be made easier to solve. Perhaps they're not in Mathmenu because its programs are written in Basic, not assembly language.

The most serious drawback is the lack of communication between programs. That convenience would make Mathmenu infinitely more versatile. Still, the programs work, and work easily.

— James A. Sanford

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Several companies are now selling programs that work with Spectrum Project's Voice-Pak and it's TRNSLATE routine. A trio of tutorial programs for children, Computer Island's Talking Spelling Tester, Talking Math Drill, and Talking Foreign Languages are aimed at people who use the Color Computer to help drill their kids in elementary school-level work. The spelling drill provides a ten-word spelling test. The words are pronounced and then used in a sentence. The user is supposed to enter the correct spelling and is told whether it's right. At the end of ten words, all words spelled wrong are

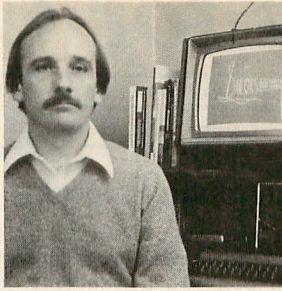
listed. The math drill is similar, but several levels of difficulty can be chosen, and at the end the percentage of correct answers is printed and spoken.

These two programs work pretty much as advertised, but there were some problems. I had the distinct feeling the programs were hastily prepared, with not enough time allowed for testing and debugging. For instance, the spelling drill prompts for "E to end, M for more" at the end of a session, but pressing E produced a partial restart of the program and eventually the message: ?RG ERROR IN 48. After listing the program I found the cause; but not everyone can or will repair what they pay for. The math drill begins by clearing the screen and printing a copyright notice, then prints a question mark (no text or voice prompt). The program wants the child's name here, as another inspection of the program showed, but I doubt many youngsters would know what to do. If something is entered at this point, the next prompt for input appears on top of the copyright notice, leaving part of the notice tacked onto the end of the new prompt. I hope and trust the review tapes were very early versions and these problems have been fixed by now.

I didn't encounter problems with the Foreign Language Drill, but there is room for improvement. The program asks for the number of words to be used and drills those words until the Break key is pressed. The speech is pretty well limited to "What does (the word) mean." There's no flagging of correctly identified words, as it's not unusual to get the same word several times in a row, even when answering correctly every time. However, a running total of right and wrong answers is displayed at the screen bottom.

The spelling and language programs are meant to be customized by the purchaser. The words and sentences involved in the drills are supplied in data statements and can be changed to make the programs apply to most any spelling lesson or language. I thought all three programs would be worthwhile for youngsters, after simple corrections and a little refinement, but I believe that their interest would wane after a short time. There's not much variety in these programs. The attraction of playing a game instead of doing a drill would relieve some of the monotony.

— W.C. Clements, Jr.



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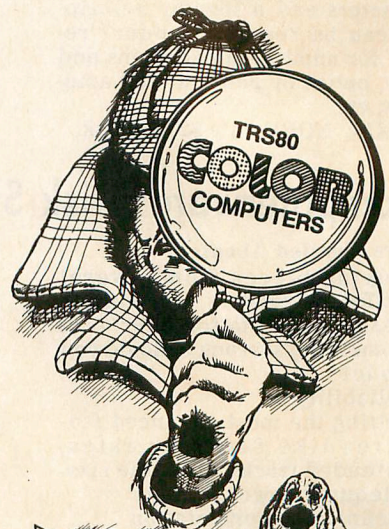
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Semigraf is a machine-language graphics editor. It lets you draw pictures on the screen and save them to tape or disk.

The name Semigraf is derived from the fact that the program uses the semigraphics modes 8, 12 and 24. The resolution of these modes is 64 pixels across the screen and 64, 96 or 192 pixels up and down the screen.

In the editing mode, you can move the cursor quickly to any place on the screen and draw horizontal or vertical lines. Lines can be drawn one pixel at a time or from the present cursor position to the next color boundary.

In addition, the program allows you to enter two types of letters on the screen. One looks like the normal text characters of Basic. The other type consists of large block letters created in the current foreground color.

“The program lets you enter two types of text: one like normal Basic text, the other consisting of large block letters.”

The commands are easy to learn and remember. For example, the Arrow keys move the cursor up and down or left and right, and shifted or unshifted single letters are used to draw or fill (F = forward, B = backward, U = up, D = down). The foreground and background colors are entered with the digits 0 – 8. There are two special commands for erasing previous pixels and for moving a block of the screen.

The disadvantage of using the semi-graphics modes is that the figures created are rather “blocky” compared to PMODE3 or PMODE4 graphics. However, the advantage of semi-graphics is that all eight normal colors of the Color Computer can be used. In these modes, adjacent pixels must be of the same color or else one or both must be black. This is similar to the Set/Reset graphics of Basic.

Semigraf comes with 12 pages of well-written documentation. The descriptions are clear, concise and accurate. A quick reference guide is included on the inside back cover. One minor beef — the resolution of semi-graphics mode 24 was incorrectly given on page six as 64 by 128 instead of 64 by 192.

The program includes a screen-dump command which reproduces the whole screen on the printer. Options are provided for printers which support the TRS-80 block graphics starting at CHR\$(128) or CHR\$(160) (for example, the Epson). You can choose the printer baud from the main menu.

— Raymond Mostellar



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Graphics System

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32K
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Salamander's Graphics System is three files: Graphics lets you draw, label, and save detailed pictures; Text and Text Copy let you incorporate text into high-resolution graphics screens in your programs.

Graphics is quite a useful system. The manual is terse, and requires you to experiment, but that's half the fun, isn't it?

All drawing is done with the right joystick, and functions are selected by single-keystroke commands. A Help menu is always available (you'll save time if you copy it on a reference card). Function commands can be entered while you're in the drawing mode.

The system can be used in all graphics modes, with all allowable color sets. You can draw in one mode and switch

to another for interesting effects. You can construct your drawing from straight line segments or from predefined circles, ellipses, arcs, and regular polygons of three to eight sides. Shapes can be moved to any position on the screen and expanded, shrunk, or (for polygons) rotated. The spacebar and the joystick Fire button serve to pin down a complete shape or the end of the current line segment.

These controls also trigger a Fill function, which works like Extended Color Basic's Paint command. You can also stipple an area with individual dots, to give a textured effect.

The joystick plays a dual role: moving a shape around the screen, and changing its size or proportions. Another command toggles between these functions. You can also draw with line segments and a short range mode is available for detailed shapes and curves.

There are more one-key command niceties. You can delete the last shape or line segment put on the screen, lift your electronic pen for drawing complex shapes, or enter the Text mode, where titles or captions can be entered from the keyboard. Your text can be

rotated and scaled just like any other piece of a drawing.

Up to ten sketches created with straight line segments can be saved in Graphics' shape library. They can also be saved on tape. This doesn't mean your sketches can be loaded into another program, but there is a compromise. Suppose you've created a complex drawing from line segments (no predefined shapes). On command, Graphics can generate a listing of the string that would have to be used in a Draw command to reproduce your sketch! Every move will show up in the format demanded by Draw.

If you're trying to create a complicated scene for a game program, for example, it may be much simpler sketching it out with Graphics and copying the string when you're satisfied than generating graphics directly with the Draw command.

This goes part way toward satisfying one of my complaints about Color Computer sketching programs: they don't lead anywhere. The most elegant drawing program in the world is a dead end unless its output can be used in other programs. While Graphics uses

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a crude approach, it is at least a start.

Text is a file containing Draw commands for all characters with ASCII codes between 32 and 126. Textcopy demonstrates how to read and write files like Text. It is also a good demonstration of how you can actually add text to your own video drawings. The best thing about Text is that it gives you complete upper- and lowercase alphabets with ease. All of Draw's abilities to rotate and scale drawings can be used to control your "writing," too.

— Scott and Beth Norman

Ed.'s note: This was written for the Dragon 32. It runs well on 32K Color Computers with one caveat: owners of machines with Extended Color Basic 1.0 ROMs should reserve sufficient graphics memory. The program contains these commands, but the older ROMs will not accept them from a running program, and will grind to a halt. A second Run command will work correctly. Graphics System requires PCLEAR 8.

PagePlus

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64K
\$27.95 cassette, \$29.95 disk

Need more room for your Basic programs? PagePlus is a short program that will let you use Basic programs that are longer than the answer to the "how much memory?" question (?MEM) would indicate is possible. To use PagePlus, you need a 64K machine.

PagePlus lets you use the upper 32K of RAM. A 64K upgrade normally leaves that area inaccessible to users. You may have noticed that a 32K computer and a 64K computer will respond to the ?MEM question with the same amount of available RAM space. (The exact value depends on whether one has Basic, Extended Basic or Disk Basic.)

Let's call the inaccessible 32K as page 2. Load PagePlus, and enter: X=USR9(0). The memory you will be using is the second page. You can now load any

program into the second page and run it. Entering X=USR9(0) once again will return you to the accessible 32K of RAM. Now you can load and run another program.

You see how PagePlus lets you load and run two different programs at once; you may switch freely between the two areas of RAM or swap the programs inside the areas. In any case, the two programs can be run independently from one another.

The main application of PagePlus is to let you tie together two halves of a very long Basic program that won't fit into 32K. To do this you must (and this is the catch) insert the Swap command in the same RAM location in both RAM areas.

The program's documentation is nicely done, and includes a description of the various memory maps available with it. A step-by-step procedure for using this program is lacking, and would be handy. Even so, it is a useful utility for the Basic programmer using long programs, or anyone who wants to alternate between two programs without having to reload.

— Rafi Rahamim

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A good, powerful editor can be one of the best time-saving devices at a programmer's disposal. The Advanced Editor for OS-9 is Computerware's alternative to the standard Microware editor, with simpler and more powerful line editing functions.

The macro feature of the Advanced Editor is useful, and the Microware Editor has a similar function. The chief differences are ease of use and general line editing power.

The Advanced Editor provides you with a default workspace of about 5K. You can enlarge or reduce that space, depending upon your memory requirements, by using the OS-9 memory modifier.

The Advanced Editor will also edit old files and save them with new

names. You may edit old files and replace them with a revised version, or you may create new files with new names. It also has many modes of operation; the Command mode, the Input mode, or the Edit mode. Command mode lets you manipulate text, move about in the file, or perform input/output operations. Each command has a number of operand options providing maximum flexibility with minimum keystrokes. Using the parameters in the proper combinations, a multitude of movement and manipulation possibilities are available. The parameters are easy to learn. Disk commands are also available from within the Command mode.

A primary drawback to the Command mode's disk set-up is that the output file path is determined at Input time. There is no easy way to save a file giving it a different name, but the Write command can, in a roundabout way, do so. The Write command writes a portion of the file being edited and prompts for the output file name. You must remember to position the current line pointer at the top of the file before

using Write, or only part of the file is saved.

The Edit mode lets you edit particular lines and contains all the usual editing features. In combination, these commands (all issued with CTL and a key-stroke) give you one of the most powerful line editing capabilities I have seen.

If you want to write your own commands you use the Advanced Editor's macro feature. You can create a macro to accomplish all the commands in one string. That macro is in place for the duration of your edit session or until you choose to redefine it. To invoke the macro, simply use a Clear Shift Up-Arrow key combination. This feature is extremely useful when slogging through repetitive operations.

The Advanced Editor also offers a couple of useful features for file manipulation. The Read command reads an additional file from disk into memory, inserting it in the file already in memory (this works only when both fit in available memory). The file is inserted immediately following the current line pointer. The handiest file manipulation feature is the Advanced

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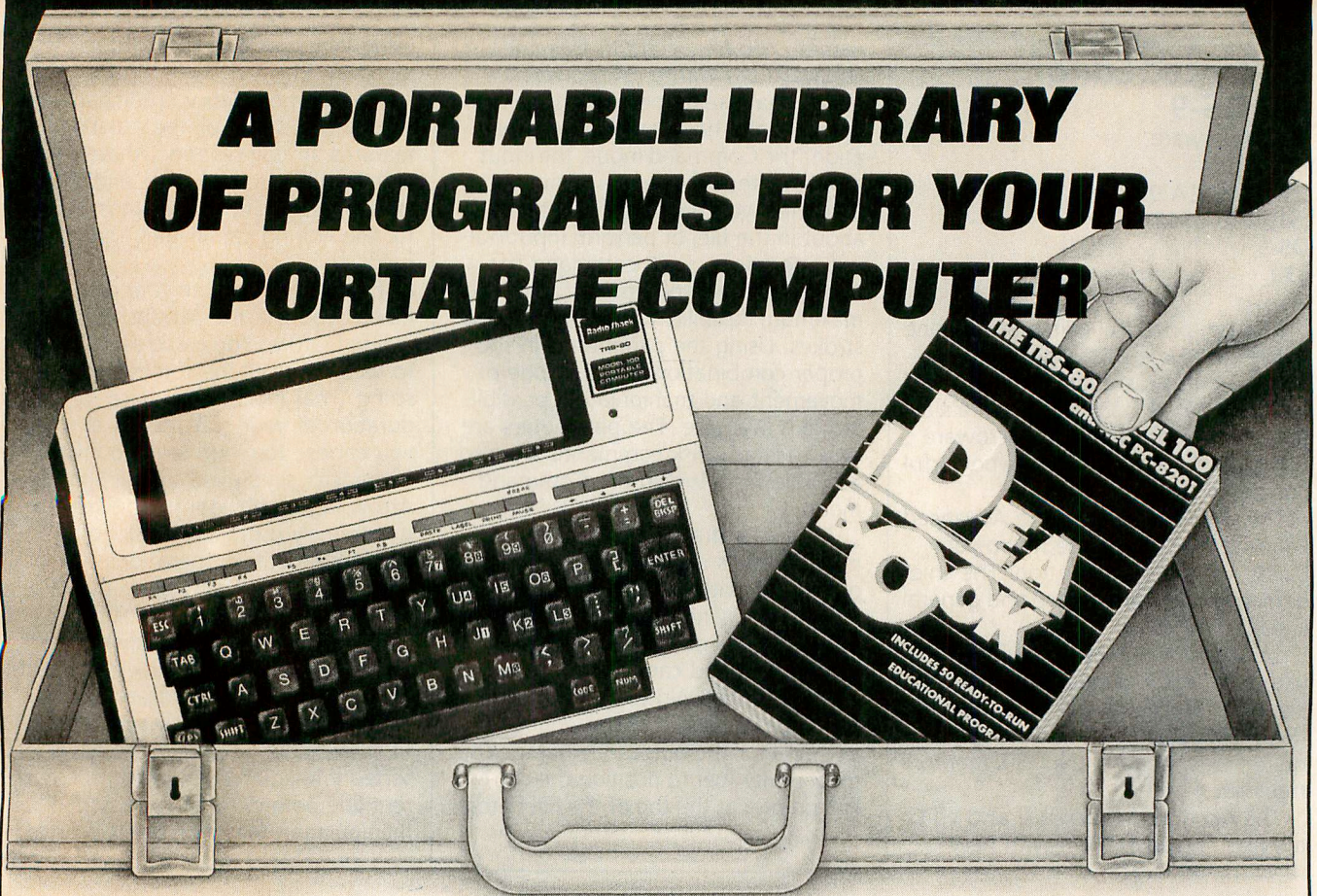
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FC9F

REVIEWS

Editor's capability to read part of a file (as much as fits into memory). If you read a file larger than available memory, you're told that only part of the file has actually been read. You may edit that portion using normal edit procedures and use the More command, which writes out the portion you have just edited, and reads in the next portion, so you can maintain large files.

Documentation is comprehensive and straightforward. Each command is outlined in detail and all operational instructions are in the 43-page manual. A tutorial takes you through a typical editing session step-by-step and is good for getting acquainted with the editor, but could be more comprehensive.

The editor is designed for use with Frank Hogg Labs' O-Pak and offers the high resolution displays necessary for advanced editing. The editor works just as well with Wordpak from PBJ, Inc. without the loss of memory O-Pak brings. Wordpak even uses less memory than native OS-9! The only feature that won't work with Wordpak is the automatic clear screen function (Wordpak uses a different code). That's a minor trade-off for extra memory. The Advanced Editor can use 32 columns too, although the limited line length is annoying.

Whether the Advanced Editor is worth \$39 when an editor is already included with OS-9 depends upon how much editing you do. If you use BASIC09, it uses the Microware Editor, so there's little advantage. But if you program in C, assembly language, or maintain text or data files, the Advanced Editor saves you enough time and effort to be worth the price and more.

— Norman Garrett

HARDWARE

Video Reverser

Dynamic Electronics Inc.
Box 896
Hartselle, AL 35640
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REVIEWS

installed the Video Reverser in 15 minutes.

The stock display shows uppercase as black on a green background and lowercase as green on a black background. The Video Reverser offers three operation modes, selected by a three-position toggle switch. The first reverses uppercase characters to the easier-to-read green-on-black, and lowercase to black-on-green. The second displays all text as green-on-black, totally eliminating the checkerboard effect of mixed upper- and lowercase, so you can read text without having to filter out the case changes in your mind. The third mode provides the standard black-on-green display.

The kit contains a fourteen pin chip. Soldered to it are a resistor, some wires, and a narrow one foot ribbon cable with a switch at the end. To install it you open the computer case (voiding your warranty), pull the VDG chip from its socket, and bend one of its pins up 90 degrees.

Four wires hanging free from the kit have eyelets soldered to their ends that you slip over four pins of the VDG, including the newly bent pin. Then the VDG is resocketed (a bit of a struggle, what with loose eyelets to keep in place), the chip is mounted to the back of the VDG with double-sided foam tape, and the switch is mounted.

This set-up left me aghast; visions of shorted pins, noisy connections, and overheated VDGs haunted me — until I completed the installation and turned the power on.

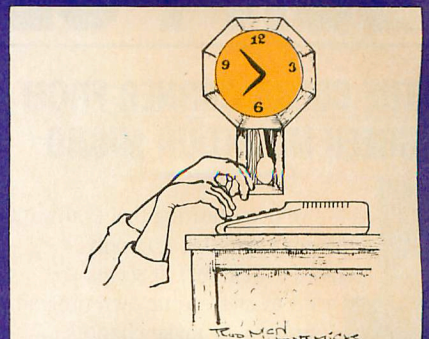
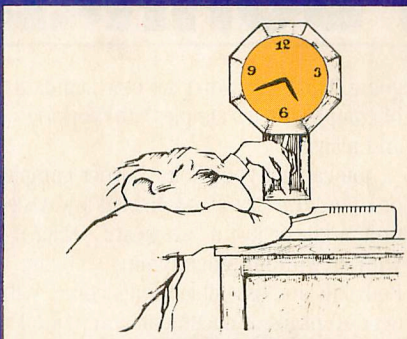
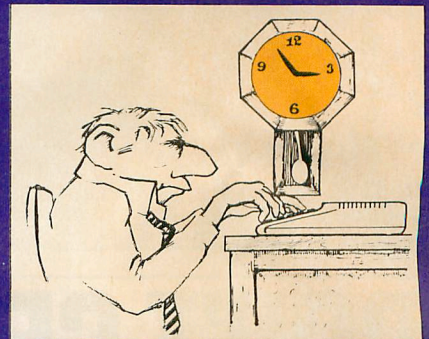
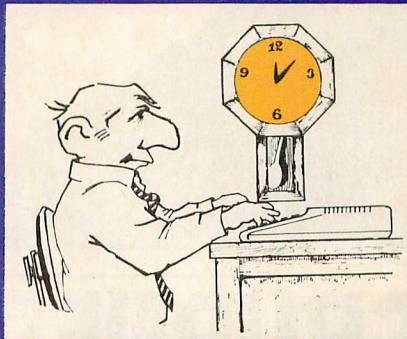
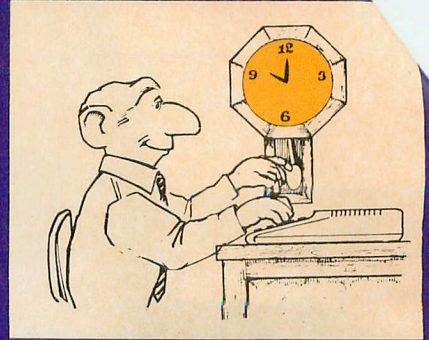
The display looked entirely normal except the expected characters appeared in reverse. The switch changed displays without glitches. My only caveat is that installation is *not* for the fat-fingered. If you like the new display options and your computer gets much physical abuse, I suggest you get a soldering iron, clip off the eyelets, and solder the wires directly to the pins.

The diagram in the documentation is for the original Color Computer. Owners of the Color Computer 2 who are not yet hackers will get confused or lost, so a little research beforehand will help them.

The price seems steep, but if you'd rather not pay someone else to do this kind of thing, Video Reverser fills the bill.

— J.T., *Color Staff*

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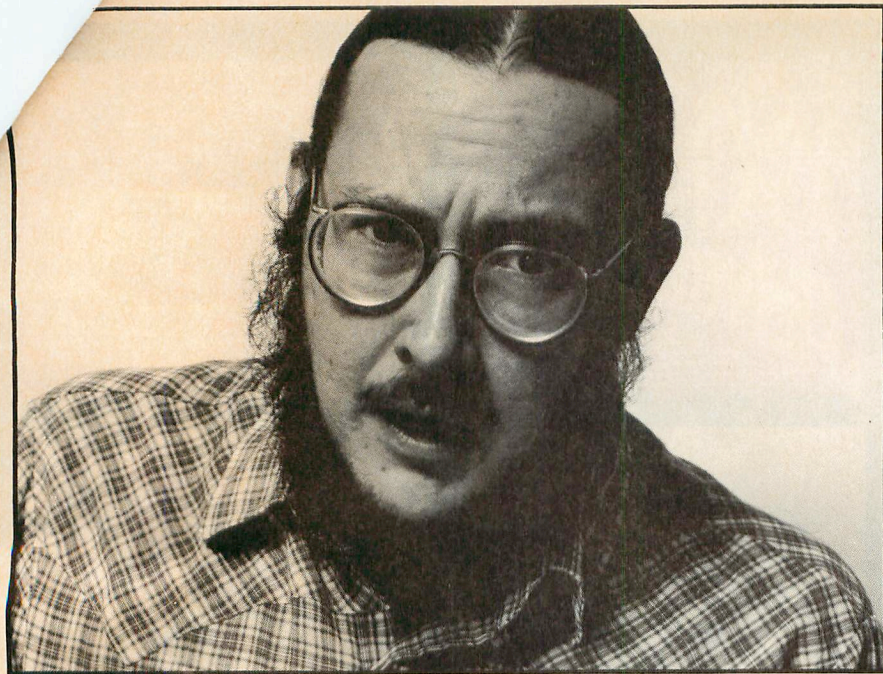
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So how can it be good if it's so inexpensive? First of all, you can only get a Color Burner from Green Mountain Micro. No dealers are adding to its price. Second, it isn't fancy. No high-tech power supplies are in sight. You've got to add three homely, low-tech 9-volt batteries to get it

going. Finally, it won't set new standards of complexity. It's simple, hardworking and reliable.

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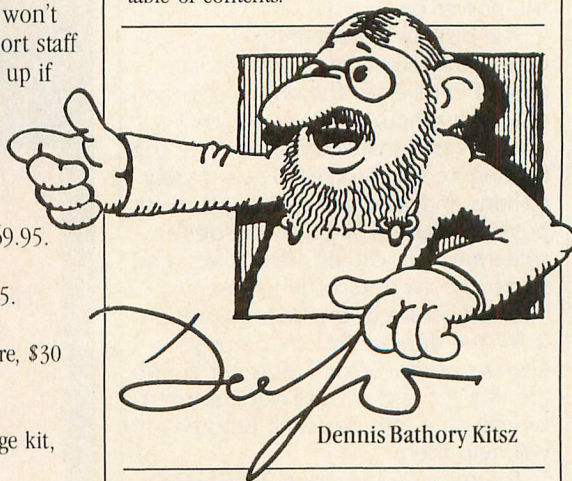
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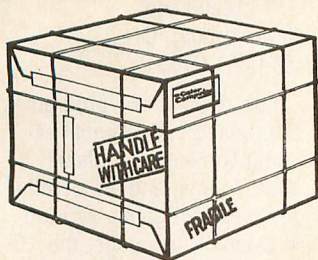
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(619)436-3512

In this real-time graphic adventure, you try to become the ruler of the Middle Kingdom, a task that requires you to return three magic rings to the Sanctuary. To get the rings you must deal with monsters in the catacombs, the temple, and the pyramid. The game requires 32K and costs \$24.95 on tape, \$27.95 on disk.

THE PEEPER

Spectrosystems
11111 N. Kendall Drive
Suite A108
Miami, FL 33176
(305)274-3899

Peeper is an interrupt-based program tracer that lets you monitor machine code programs as they run. You can watch regular output, or Peeper's trace output of registers and stack. Output appears on your screen or printer; execution speed may be variable or frozen. Peeper supports single-stepping, breakpoints, and memory examine/change. It has a movable window so you can view memory in different graphics modes. You can also watch arcade games' animation details in slow motion, inspect hidden screens, and play in unusual graphics modes. Documentation includes a tutorial on how the Basic interpreter works. It comes on tape only for \$21.95, and requires 16K. (Extended Basic is not required.) With the assembler listing the cost is \$24.95

K-BASIC COMPILER

Lloyd I/O
19535 NE Glisan
Portland, OR 97230
(503)666-1097

This compiler converts Basic programs to machine code for power and flexibility. It's got three general data types, four integer sizes (from eight to 64 bit), and 15-digit precision real numbers. It has directives, statements, and functions not found in other Basic interpreters. Debugging and error processing are included. K-Basic, for all Flex and OS-9 systems, costs \$199. The manual may be purchased separately for \$15, applicable to the full purchase price.

SPREADSHEET ZAPPER

Southern Software Systems
485 South Tropical Trail
Suite 109
Merritt Island, FL 32952
(305)452-2217

This Zapper integrates a spreadsheet with high resolution graphics and charts. It joins Radio Shack's Spectaculator and Southern Software's Pie, Bar, and Chart Zapper displays to produce graphs and charts that make your spreadsheet calculations clear to everyone. The Spreadsheet Zapper comes with a two-week money back guarantee. The tape costs \$17.95, the disk costs \$25.95. Both require 32K and Extended Color Basic.

ROM CHARACTER GENERATORS

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Melbourne, FL 32982-507

Indian River Scientific makes custom and semi-custom ROM-resident character generators for eight dot-matrix printers. The printers are the C. Itoh 8510 and 1550, the NEC 8023 and 8025, the TEC TE8510 and TE1550, the Apple DMP, and the DEC LA50-RA. No printer modifications are necessary.

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Reynoldsburg, OH 43068
(614)861-0565

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COMPOSITE VIDEO ADAPTOR

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(212)567-8493

The Composite Video Adaptor connects Color Computer 2s with high-resolution monitors. It comes assembled with instructions for a 10-minute, solderless installation. It costs \$15.

THE RS-232 SOLUTION

Sybex
2344 Sixth Street
Berkeley, CA 94710
(415)848-8233

The RS-232 Solution, by Joe Campbell, explains how to interface your computer to any RS-232 peripheral without documentation or expensive tools. It teaches how to measure logic levels and conduct other simple tests with a set of tools that costs less than \$15. It also shows how to derive a specification for a cable from the results. Case studies are used. The 225-page illustrated paperback costs \$16.95.

CODING AIDS

Associated Technology
Box 448
Estill Springs, TN 37330
(615)967-9159

Associated Technology has come out with Uniform Coding Standards for Cobol, Fortran, and Basic that can be used as they are or tailored to meet individual programming practices. The 62-page guide costs \$22.50 and includes examples of how early versions of those languages can be altered to meet today's programming rules. The Coding Standard for Basic is 42-pages long, costs \$22, and is designed to help standardize Basic coding practices. It ensures the construction of top-down programs that will be easy to maintain.

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Philadelphia, PA 19103
(215)567-5080

Over 500 software publishers are listed in this guide to the software market, but *The Software Writer's Marketplace* is more than a simple list of buyers. It's a step-by-step guide to selling programs, written by professional programmers. The 228-page paperback costs \$9.95.

PARENTS, KIDS, AND COMPUTERS

Sybex
2344 Sixth Street
Berkeley, CA 94710
(415)848-8233

Parents who want to avoid boring drills and violent games as they introduce their children to computing will be interested in *Parent's, Kids, and Computing*. The book includes information on how computers are used in schools, how best to work with children at computers, and how to select software. The 145-page paperback is illustrated and costs \$4.95.

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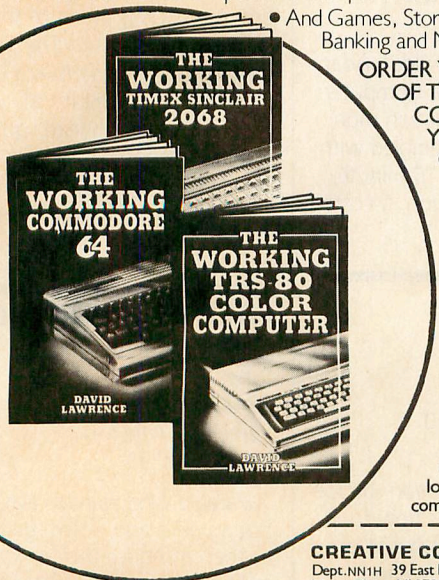
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NEW:PRODUCTS

SUPER BUG

Mark Data Products
24001 Alicia Parkway #207
Mission Viejo, CA 92691
(714)768-1551

Super Bug is a relocatable machine code monitor. Its features include hex and alpha numeric memory display, character string searching, memory testing, mini object code disassembling, up to 220 breakpoints, decimal, hex, and ASCII code conversion routines, and full printer support. On tape it costs \$29.95, on disk it's \$32.95. You'll need at least 16K.

MATH DESIGN AND LOST WORLD PINBALL

Radio Shack
One Tandy Center
Fort Worth, TX 76102
(817)390-3300

Two new programs for the MC-10 have been released by Radio Shack, each for \$9.95. Math Design contains a Minicalc program that turns the computer into a calculator, and Spirals, which lets you design and plot polygonal spirals in four colors. Lost World Pinball is a prehistoric version of pinball that requires a 16K ROMpak.

THE WIRE CUBE

Networkx
203 Harrison Place
Brooklyn, NY 11237
(212)821-7555

The Wire Cube provides voltage spike and radio frequency interference protection. It measures about one inch on a side and plugs into the wall. Your computer — or any other electronic device — then plugs into it. A silicon transient suppressor, when overloaded, opens an internal fuse in nanoseconds that breaks the circuit and lights up an LED. For radio frequency protection a filter is used. The unit costs \$39.95.

PRESIDENTS OF THE UNITED STATES

Sugar Software
2153 Leah Lane
Reynoldsburg, OH 43068
(614)861-0565

This three-in-one program is a tutorial on presidential accomplishments, a multiple choice game, and an identify-the-president game. Written in assembly language, the 16K and 32K cassette versions cost \$24.95, while the 32K disk version costs \$29.95.

FLYING TIGERS

Sugar Software
2153 Leah Lane
Reynoldsburg, OH 43068
(614)861-0565

Flying Tigers requires good reflexes and an ability to employ strategy. You are the sole protector of your pilotmates, who have been forced to eject and land on an asteroid. Aliens attack from hyperspace. The 16K cassette version costs \$24.95, the 32K disk costs \$27.95.

COCO CALLIGRAPHER

Sugar Software
2153 Leah Lane
Reynoldsburg, OH 43068
(614)861-0565

This program requires a bit-mode printer. It produces 36 point type in Old English, Gay Nineties, and Cartoon typefaces. It costs \$24.95 on a 32K cassette, \$29.95 on 32K disk.

LEE'S GUIDE TO PUBLISHED COMPUTER PROGRAMS

by Dr. Henry Lee
Pasadena Technology Press
1444 Santa Anita Avenue
Box 3836
South El Monte, CA 91733
(800)423-4173

This guide tells you where to find free programs (machine categories other than the TRS-80 family include Apple and IBM). Volumes I and II cost \$14.95 each, and the company says there are more Color Com-

puter programs listed in Volume II. Together the volumes cost \$27. The guide also tells you how to get no- or low-cost government programs.

EDITTRON

Vidtron
4418 East Chapman Avenue
Suite 284
Orange, CA 92669
(714)639-4070

Vidtron bills Edittron as the first full screen Basic program editor for the Color Computer. The assembly language program uses 3K of RAM, offers 10 cursor control functions and 10 editing functions, including a built-in auto line-numbering utility. Edittron requires 16K of RAM and comes on disk for \$40, on cassette for \$35.

HARD DISK SYSTEMS

Micro R.G.S., Inc.
30 Canusa Street
Beebe Plaine, VT 05823
(800)361-4970

Micro R.G.S. now has hard disk systems available for the Color Computer. They are complete, software integrated units that plug right in. The five-meg model costs \$1295, the 10-meg costs \$1595. An interface card and H-DOS operating system is available separately for \$425. Also available is an H-DOS utility pack to boot-strap OS/9, Flex, and MDIR (master directory), for \$129.

SPEED READING

B&B Software
Box 210
Jenkintown, PA 19046

Speed Reading lets you select speeds at which material to be read appears on the screen, speeds that are variable even while you're reading. A drill to improve visual span and perception is also included. The cassette costs \$17.95 and requires 16K. Three pages of documentation are available for the cost of a self-addressed, stamped envelope.

PERSONAL FINANCE II

Radio Shack
One Tandy Center
Fort Worth, TX 76102
(817)390-3300

Personal Finance II can manipulate nine bank accounts, 25 budget categories, and 1818 checks. It lets you balance checking accounts, combine expense data and organize it into monthly and yearly reports, and print reports from the screen. You'll need 16K and a serial printer to use this \$34.95 tape.

ELECTRONIC TYPING TEACHER

Coco Warehouse
500 North Dobson
Westland, MI 48185
(313)722-7957

The Electronic Typing Teacher's video keyboard lets you practice typing with all keys labeled, all keys blank, or just the "home row" labeled. Visual cues guide you while the program keeps "score" and times you. You get a fresh set of sentences that include every letter of the alphabet each time you run the program. The tape costs \$21.95 and requires 16K.

THE ANIMATOR

Triad Pictures Corporation
Box 1299
Sequim, WA 98382
(206)683-6459

Triad says the Animator can turn your computer into a Hollywood cartoon studio. It cycles and recycles 32 character positions to create the illusion of motion at a "frame rate roughly equal to a Bugs Bunny cartoon." With supplied backgrounds, simple animation sequences can be produced in minutes. With more time, users can learn to draw their own cells and backgrounds. A sound effects library is built in. The three-cassette package requires 32K and Extended Basic. It costs \$35.



The Handicapper

Now available for all Color Computers, MC-10's and Model 100's! Use the power of your computer to improve your performance at the track! The Handicapper is two separate programs for thoroughbred and harness horses that apply sound handicapping techniques to rank the horses in each race. Factors include speed, distance, class, track condition, post position, past performance, jockey or driver ability and other attributes. Handicap a race in just a few minutes or a whole card in less than an hour! Easy enough for the beginner, sophisticated enough for the veteran horseplayer. Complete instructions and betting guide. State computer type, Basic version and memory size. Thoroughbred or Harness Handicapper, \$24.95 each on tape, \$27.95 on CoCo disk. Both programs only \$39.95 tape or disk.

NEW GREYHOUND HANDICAPPER! Written by a former greyhound trainer, this program puts the most sophisticated techniques at your disposal. Quickly and easily rates the dogs using speed, class, favorite box, kennel performance, breaking ability and other factors. Also shows recommended quinella, exacta and trifecta plays. List rankings to screen or printer. For CoCo only, 16K Ext. Bas. \$24.95 on tape, \$27.95 on disk.

Pigskin Predictions!

Pigskin Predictions, the best-selling NFL Handicapper from Rainbow Connection Software, is now part of our library. And we're absolutely delighted! Why wrestle with those Sunday point spreads? Let your Color Computer do the work for you! And what a job it does:

- Menu-driven selection of schedules, ratings, division races, predictions or results by team or week. Seven different reports to screen or printer!
- Easy once-a-week entry of scores—no complex, meaningless stats!
- Predicts scores of all games for remainder of season each week!
- Calculates projected won-lost records for all weeks.
- Maintains home field advantage and power ratings for all teams!
- 1984 schedule data file included free. Or enter the schedule yourself.
- 32K enhanced version features dazzling Rainbow Writer screen display! Seeing is believing. 16K abridged version included too.

If you're a football fan, you'll be absolutely amazed at the power of this program. 16/32K Extended Basic required. Only \$35.95 on tape or disk. 1984 data tape or disk for previous owners only \$13.95. Saves hours of typing.

Federal Hill Software
825 William St.
Baltimore, MD 21230



301-685-6254

TRS - 80 COMPUTER DISCOUNTS



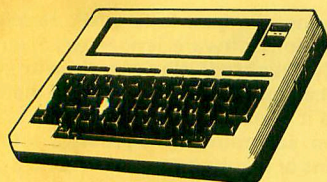
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NEW:PRODUCTS

WORD PROCESSOR

Bob Vercler
Rural Route #2
Chenoa, IL 61726
(815)945-7594

Vercler's Word Processor concentrates on the specialized processing of data. Partial printing controls make it a database manager too, with complete controls over printing every character in every line. Using graphic alphabets lets you generate special typefaces, including large multi-line letters and non-standard symbols. It will also create templates for mailing lists. It's not only user-modifiable, it comes with special entry points controlled by software for easy customization. It's available on tape only for \$35.

TRS-80 MODELS I, III, & COLOR COMPUTER INTERFACING PROJECTS

Howard W. Sams & Co., Inc.
4300 West 62nd Street
Indianapolis, IN 46268
(317)298-5400

This book has sections on analog to digital conversion, using the RS-232C port, using the cassette output port, connecting the system bus, and switches and transducers. Author William Barden, Jr. writes about interfacing projects as varied as voice and music synthesis, pressure reading, clocks, data communications, and joysticks. Some projects require special-purpose hardware, others don't. Detailed construction information is supplied with each design. The 264-page paperback costs \$14.95.

HF ANTENNA DESIGN

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

HF Antenna Design, for amateur radio enthusiasts, calculates specifications for dipole,

Yagi, and quad antennae. Dimensions for Yagi and quad antennae are optimized for maximum gain. You'll need 16K of RAM and Extended Color Basic, or an MC-10 with 4K of RAM. The program costs \$10.

GETTING ON-LINE

Prentice-Hall, Inc.
200 Old Tappan Road
Englewood Cliffs, NJ 07675
(201)592-2000

Getting On-Line is a 10-chapter book; the first six tell you how to get there, the rest are a catalog of information sources and an index to that catalog. Author M. David Stone likes to think of himself as a translator, translating scientific material into English. The 300-page paperback costs \$14.95.

128K MEMORY EXPANDERS

Dynamic Electronics
Box 896
Hartselle, AL 35640
(205)773-2758

Three memory upgrades are available for Color Computers; the ME-128D for D and E boards costs \$269, the ME-128F for 285 boards costs \$259, and the ME-128-64, for all 64K machines, costs \$199. The upgrades mount inside the machine and consist of two 64K memory banks, selected either by switch or software. Programs can run in either bank. Unselected banks will stand by with all variables and vectors preserved. No trace cutting or wiring changes are needed. All models come with a one-year guarantee.

SUPERGUIDE

Robotic Microsystems
Box 30807
Seattle, WA 98103
(206)782-6809

The Superguide fits in your cartridge slot to align and support circuit cards plugged to the ROM connector. It also holds the door open as it protects the machine's interior from foreign objects. It costs \$3.95.



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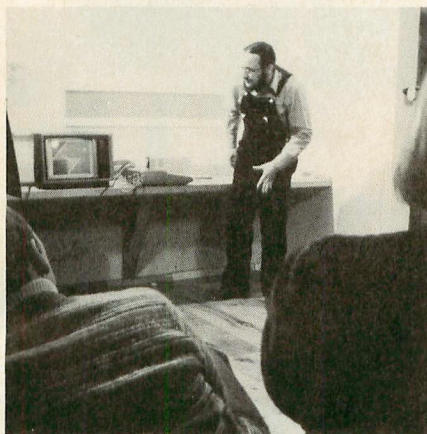
The Color Computer Magazine Goes To School

I once argued that users needn't know more about how a computer works or how to program any more than a TV user needs to understand the workings of TV circuitry or video broadcast transmission techniques. Computer education, I stated ("End of File," September, 1983), should be no more extensive than a lesson in loading programs and getting over the fear that pressing the wrong button would blow up the machine.

Dennis Kitz strongly disagreed. He stressed ("End of File," November, 1983) the importance of understanding how computers do what they do, and how that knowledge is the root to using the computer as a tool to unleash the imagination and, more importantly, as a tool to ensure that power, in the form of computer knowledge, would not become a privilege owned and controlled by a very few.

On reflection, we were both right. I was too simplistic in my approach ("Don't worry, just use the things") and Dennis too ardent ("Understand them or lose your freedom"). But both our approaches are borne from the fear that people will not use computers because they *seem* too difficult.

Driving a car is difficult, yet most of us do it. Why? Because the advantages of knowing how to drive are obvious: that knowledge will get you to the beach on a hot day; to your friend's house for a good time; to work to earn your salary; or to the airport to get away from the crowds at the beach, your friends, and your job. Few of us are afraid to



drive, yet unlike using a computer, making a mistake in a car could cost your life.

We had an opportunity to experience some first-rate computer education during a recent visit to our offices by Dennis Kitz. Not all our staff are ardent computerists; some are enthusiastic beginners, others are very experienced users. We are a diverse lot. I asked Dennis to give a talk (to all) that would introduce newcomers to the excitement of computer use while re-exciting the oldsters.

It's always fun to watch a master of anything practice his skill. Dennis's fingers are like natural extensions of his keyboard. Everyone was caught up in his obvious mastery over the computer. Most of his audience know the reverse is true for themselves — the computer is more the master. Because Dennis is so good at what he does, and because

his presentation was interesting and spoke to the mentality and level of interest of his audience, he instilled most with the desire to be in command at the keyboard as well.

Many people think education only means classrooms, teachers, chalk dust, and recess. That is a narrow point of view. Education means learning. You learn whenever you think. The quality of that learning depends on how interested you are in what you are thinking about.

Computer education should come in whatever form speaks to your interests. If you are an artist, or enjoy doodling, then your computer education should begin with computer graphics. It should impress you with the computer's ability to produce graphic designs, and it should impress you with how simple the techniques for producing such graphics are. If your interest is in number crunching, you should be shown how number crunching is at the heart of all computer functions — even word processing.

I was right when I advocated getting the basics down quick and begin using computers. Dennis was right when he said don't stop there, explore the "how it works" aspects of use.

In the classroom, if the teacher hasn't peaked your interest before delivering the data, he's lost you. A teacher who teaches without showing why the knowledge is useful and important is not doing a good job. Dennis got his message across: the brain of the computer is not the CPU, it is the user.

— K.L., Editor-in-Chief

FOR NEXT (10,84)

In the October issue you have lots to look forward to. Dennis Kitz will begin a project that will give your computer a real-time clock with voice synthesis; Bill Barden will start a series on RS-232 — what it is, how it works, and what to do with it; Jean Plesser will introduce kids and newcomers to input/output procedures to cassette; and there will be some special treats as well as our regular columnists. Look forward to this one!

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ABC'S IN COLOR

In the ABC program, all 26 letters spring up in color to the familiar ABC tune. Then, colorful detailed pictures depicting each individual letter of the alphabet appear one by one. Your child's fascination will mount as he or she correctly presses the letter on the keyboard and is rewarded with a musical tune before the next detailed picture is drawn line by line onto the screen: AIRPLANE for A, BUS for B, CLOWN for C and so on to ZEBRA for Z. Truly a must program for the preschool to first grade age group!

CoCo 16K ECB Tape: \$19.95 Disk: \$25.95



TM

SPELL BOMBER

As captain of your ship, you must destroy the enemy bomber by spelling the mystery word. In this exciting and educational game the bomber gets closer with each inaccurate letter. You have only EIGHT tries to guess the mystery word or your ship will be bombed! If you guess the word correctly, GENERAL QUARTERS will sound and your ship will fire a missile to destroy the bomber, Three levels are available: EASY, MEDIUM, and HARD. Challenging for all ages!

Atari16K Tape: \$18.95
CoCo 16k ECB Tape: \$18.95 Disk: \$22.95
Vic 20 13k Tape: \$18.95

SPELLING BEE

The word is pronounced vocally and it is up to you to type in the correct spelling. If wrong, the computer will be your friend and flash the word on the screen for just an instant. OK! Try typing the word in again. STILL WRONG! The computer wants success and allows you to see the word again this time a little longer. If you just can't spell the word, the computer realizes you need to learn to spell the word and leaves the word on the screen for you to copy. Try your best and the computer has a surprise for your reward!

SPELLING BEE I . . . GRADE 1 & 2 SPELLING BEE III . . . GRADE 5 & 6
SPELLING BEE II . . . GRADE 3 & 4 SPELLING BEE IV . . . GRADE 7 & 8
CoCo 16k ECB TAPE: \$16.95 Each

CRISS—CROSS MATH

As the program begins, your child is presented with a nine square playing board. It is your choice as to which square you choose. After a choice is made, a MATH PROBLEM appears in the square. You score your first X by answering the problem correctly. If your answer is incorrect, the square clears and your opponent is allowed his choice of squares. The game is over when three squares vertically, horizontally, or diagonally are won by the same player. When playing against the computer, every answer you get wrong is won by the computer. Multi-level ADDITION AND SUBTRACTION program.

CoCo 16K Tape: \$12.95

FRACTIONS

SIDE ONE: Fraction Lessons, explains fractions with the aid of graphics. Child studies the different ways fractions can be represented. Lessons include:

- IMPROPER FRACTIONS
- MIXED FRACTIONS
- PROPER FRACTIONS

Many educators have praised the use of motion and color to display the fractional equivalents.

SIDE TWO: Fraction practice, offers a random computer generated quiz.

Atari16k Tape: \$19.95
CoCo 16k Tape: \$19.95

JOYSTICK DRAW

Joystick Draw is the simple way to explore your artistic talents! Program operation is easy enough for a child to use, but effective enough that TCE uses it to design many sophisticated high-resolution graphic screens. Joystick Draw's design allows you or your child to save those masterpieces for future revisions or for use in other programs (instructions included). Your child will spend many hours enjoying this program and at the same time improving his or her eye hand coordination! You will find Joystick Draw to be an easy way to design those more sophisticated graphics for your own programs!

CoCo16 ECB Tape: \$16.95

TC—INVENTORY

Many insurance companies offer a discount for policy holders which have complete inventories on file. TC — Inventory is designed to help you organize, maintain, and compile the personal belongings of your home. Program is user friendly and menu driven. TC — Inventory allows input for location of item, price of item, serial number of item, date of purchase, and a text written description of the item. Don't put off recording your personal belongings until its too late. Requires printer for hard copy.

CoCo 32k ECB Tape: \$16.95

TEACHING CLOCK



Torn between teaching time on a digital or a conventional (face and hands) clock? Well, this program combines the two using high resolution graphics and prompts! Your child will learn to tell time with the aid of a specially designed CLOCK! Child enters the time, if wrong, the center of the clock displays a graphic aid. If the child is correct a musical reward is heard. Program offers three levels: hours, quarter hours, and five minute intervals.
Apple 48k Disk: \$19.95
Atari 32k Tape: \$16.95
CoCo 16k ECB Disk: \$19.95 Tape: \$16.95



Additional Educational Software available
for Color Computer, TDP 100, Atari®,
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