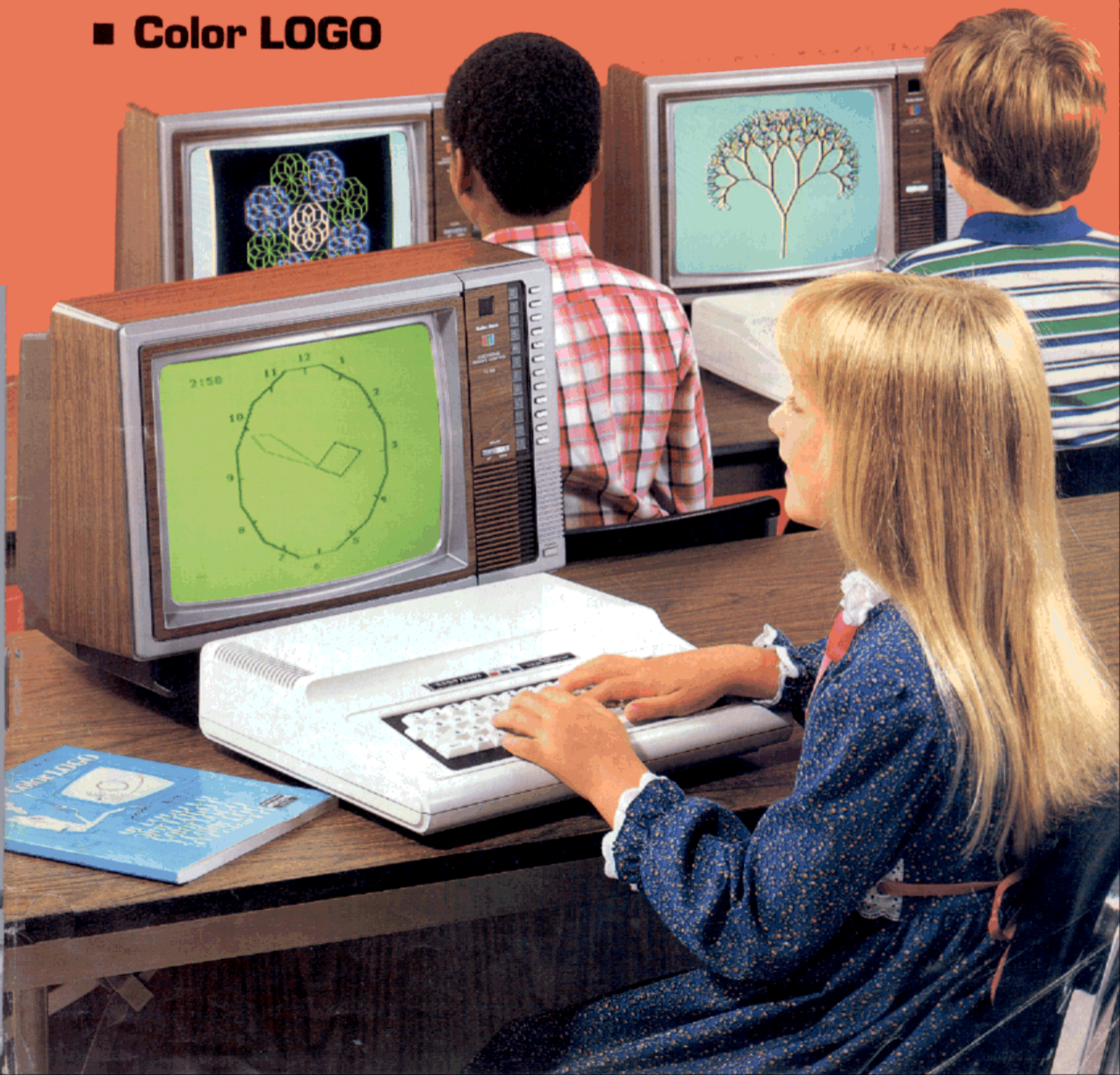
TRS-80® Microcomputer News

Volume 5, Issue 9 September 1983

$1.50

- PC-2 Assembly Language—Part 4
- Education Issue
- Color LOGO



Fort Worth Scene

It's September and time for the annual education issue. We truly believe that we have got something here for everyone. Color Computer, Models I/III/4, Model II/12/16, Model 100, and Pocket Computer educational programs, as well as descriptive materials, are offered for your perusal and enjoyment.

Our Education Department has provided us with an informative article on the state-of-the-art in classroom computing needs as they are defined and fulfilled here at Radio Shack. Be sure to read this excellent article.

There are the two educational programs written by Dr. Leo Finkelstein, Jr. for the Model 100. You will also notice that these two programs are included in a new Model 100 section, that we hope will become a regular feature of the *TRS-80 Microcomputer News*. So get busy all new Model 100 owners out there. Let's see those programs and innovative uses for that fantastic machine start rolling into the *Microcomputer News* offices for publication.

COLOR LOGO CONTINUES TO GROW

It seems that just a little less than a year ago, in our November 1982 issue to be exact, we were introducing Color LOGO to our readers. We were excited about it then, because of its potential in teaching children the fine art of computer programming and apparently the excitement was contagious and well-founded.

Dr. Paul Kimmelman, of the Norton City Schools in Ohio, offers our readers an insightful discussion on the role and impact of Color LOGO in the schools. If you are a teacher, parent, student, or someone concerned with the continued success of Color LOGO in the school environment, please read this fine article.

Data Conversions

Damarian Computer Service, Inc.
12 Tempo Road
New City, NY 10956

We have built a business around the conversion of files from and to IBM Magnetic Tape to and from diskettes. We can convert any files from and to a Model I, II, III, 4, 12, or 16. This capability allows a TRS-80 user to rent a mailing list on tape and to use it on the TRS-80. Also, the TRS-80 owner can rent out his list to others on Magnetic tape (1600 BPI). We also can make any file coming from tape look like your software products expect (Profile, Business Mailing List, etc.), or we can edit and sort lists and files.

Now, we are beginning to do CPM-TRSDOS-IBM-TAPE conversions. It should be noted that some of this work uses a Radio Shack Reformatter package in conjunction with our own software and hardware. The people at Microtech Exports Inc. are to be commended for their product and assistance to us. Their software is a real breakthrough in allowing the TRS-80 to use information previously unavailable.

We are currently experimenting with Color Computer Disk to and from Magnetic Tape conversion. In the meantime, interested readers may contact, Fay Greenbaum, President, for more information.

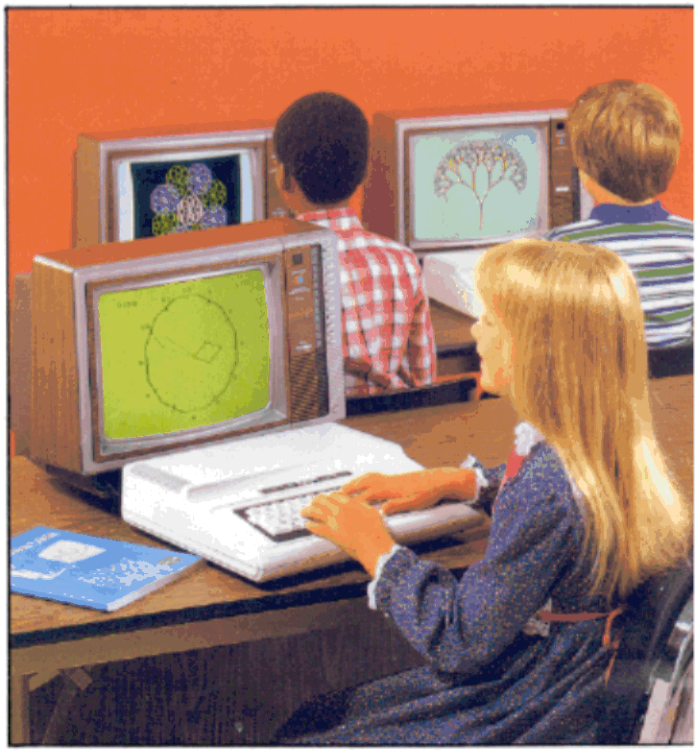
Warren Glimpse & Co.
105A Oronoco Street
Alexandria, VA 22314

We offer conversion services for all TRS-80 Computers:

Magnetic tape to/from diskette-hard disk.
Diskette to diskette.
File restructuring.
Software adaptation.

Now, that XENIX is being more widely used, we have again responded to users' needs by providing services to convert both data files and software for use with XENIX.

For further information, readers may contact Cathryn P. Gekas at the above address.



This month's cover features a Color LOGO lab.

TRS-80 Microcomputer News
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SEPTEMBER 1983

TRS-80 Microcomputer News is published monthly by Radio Shack, a division of Tandy Corporation. A single six month subscription is available free to purchasers of new full size TRS-80 Microcomputer systems with addresses in the United States, Puerto Rico, Canada and APO or FPO addresses. Certain smaller TRS-80 Microcomputers will not include this free subscription. Subscriptions to other addresses are not available.

The subscription rate for renewals and other interested persons with U.S., APO or FPO addresses is twelve dollars ($12.00) per year, check or money order. Single copies of the Microcomputer News may be purchased from Radio Shack Computer Centers or Computer Departments for $1.50 suggested retail each.

The subscription rate for renewals and other interested persons with Canadian addresses is Fifteen dollars ($15.00) per year, check or money order in U.S. funds. All correspondence related to subscriptions should be sent to: Microcomputer News, P.O. Box 2910, Fort Worth, Texas 76113-2910.

Retail Prices in this newsletter may vary at individual stores and dealers. The company cannot be liable for pictorial and typographical inaccuracies.

Back issues of Microcomputer News prior to January, 1981 are available through your local Radio Shack store as stock number 26-2115 (Suggested Retail Price $4.95 for the set). Back issues of 1981 copies are available as stock number 26-2240 (Suggested Retail Price $9.95 for the set).

The TRS-80 Newsletter welcomes the receipt of computer programs, or other material which you would like to make available to users of TRS-80 Microcomputer systems. In order for us to reprint your submission, you must specifically request that your material be considered for reprinting in the newsletter and provide no notice that you retain copyrights or other exclusive rights in the material. This assures that our readers may be permitted to recopy and use your material without creating any legal hassles.

Material for publication should be submitted on magnetic media (tape, disk, or CompuServe). If you submit material on tape or disk, and it is accepted for publication, we will send you two cassettes or diskettes for each one you sent us. Cassettes will come from our box of mixed blank cassettes. If you submit material on CompuServe, and we think we may use the material, we will extend your Microcomputer News subscription by six months for each article accepted. If you are submitting material over CompuServe, please include your name and address or your subscription number so we can find you. If the material is very short, send it to us in E-Mail. If you have more than a few lines, you need to place the material in the ACCESS area of CompuServe and then let us know it is there by leaving a message on E-Mail.

Material may be submitted by mail to P.O. Box 2910, Fort Worth, Texas 76113-2910, or through CompuServe. The Microcomputer News' CompuServe user ID number is 70007,535.

Programs published in the Microcomputer News are provided as is, for your information. While we make reasonable efforts to ensure that the programs we publish here work as specified, Radio Shack can not assume any liability for the accuracy either of the programs themselves or of the results provided by the programs.

Further, while Microcomputer News is a product of Radio Shack, the programs and much of the information published here are not Radio Shack products, and as such can not be supported by our Computer Customer Service group. If you have questions about a program in the Microcomputer News, your first option is to write directly to the author of the program. When possible, we are now including author's addresses to facilitate communications. If the address is not published, or if you are not happy with the response you get, please write us here at Microcomputer News. We will try (given the limited size of our staff) to find an answer to your question and, in many cases, will publish the answer in an up-coming issue of Microcomputer News.

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TRS-80® Microcomputer News

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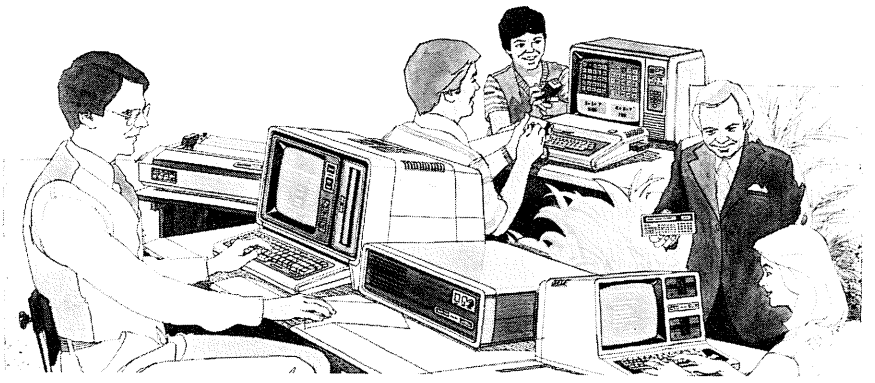

Computer Clubs

AGGIE COLOR COMPUTER USERS' GROUP
c/o Louise Darcey
1301 Francis
College Station, TX 77840
1-409-696-1656

ALASKA COLOR COMPUTER USERS' GROUP
c/o Rick McDannel
816 N. Pine #2
Anchorage, AK 99504
1-907-274-5778

BILLINGS COLOR COMPUTER CLUB
c/o Jayne Kenyon
4306 Phillip
Billings, MT 59101

BUG-80 USERS' GROUP
P.O. Box 62
Glen Gardens, NJ 08826

CENTRAL ILLINOIS TRS-80 COMPUTER CLUB
c/o Paul Fargusson
1418 So. Douglas Ave.
Springfield, IL 62704

COCO-MUG
c/o Tom Fandre
2420 Misty Lane
Waukesha, WI 53186
1-414-542-0600

COCONUTS & FRIENDS
2039 Main Street
Fortuna, CA 95540

DALTRUG
c/o D. D. Freeman
334 Fieldside Dr.
Garland, TX 75043
1-214-270-0625
1-214-637-4510

DEBUG/DUST BYTER'S USERS' GROUP
c/o Burt Haberman
6557-A East Calle La Paz
Tucson, AZ 85715
1-602-298-7888
1-602-297-2179

EAST BAY COLOR COMPUTER CLUB
c/o Joe Hayden
31166 Oakhill Way
Hayward, CA 94544
1-415-487-3537

MCTRUG
c/o D. D. Freeman
334 Fieldside Dr.
Garland, TX 75043
1-214-270-0625
1-214-637-4510

MEMPHIS COLOR COMPUTER USERS' GROUP
c/o Arnie Graber
3422 Plaza Ave.
Memphis, TN 38111
1-901-323-1183

MGCCC/METROPOLITAN GREENVILLE (SC) COLOR COMPUTER CLUB
c/o Ed Lowe
P.O. Box 6
Gray Court, SC 29645
1-803-876-3928
1-803-876-3812

MIDLANDS 80 COMPUTER CLUB
P.O. Box 7594
Columbia, SC 29202

MORGANTOWN-FAIRMONT WEST VIRGINIA AREA COLOR COMPUTER USERS' GROUP
c/o Donald Barber
P.O. Box 295
Granville WV 26534
1-304-599-4493

NATIONAL MODEL II USERS' GROUP
c/o Bob Stewart
P.O. Box 234
Ada, MI 49301

RICHMOND (VIRGINIA) COLOR COMPUTER USERS' GROUP
c/o Randolph W. Graham
2115 Buford Road
Richmond, VA 23235
1-804-320-0019

SALEM COMPUTER CLUB
c/o Clinton E. Trammel
P.O. Box 573
Salem, MO 65560

WESTSHORE TRS-80 COMPUTER CLUB
c/o Chris Lambros
3540 Archwood Drive
Rocky River, OH 44116
1-216-333-8969

WIZARDS COMPUTER CLUB
c/o Michael Foster
120 Centre
Hereford, TX 79045
1-806-364-2767

Radio Shack–The Company That Can Meet Your Classroom Computing Needs

In its fourth year of existence, the Radio Shack Education Division is as committed as ever to meeting the computing needs of the education community. We've built up the momentum to achieve significant goals and to set exciting new goals. In this brief overview of our activities, our latest products, and our standing in the education marketplace, we hope we'll show you why we think Radio Shack is the microcomputer manufacturer best equipped to meet your educational computing needs.

HELPING EDUCATORS MEET THE CHALLENGES OF THE COMPUTER AGE

No matter how much a school may spend on computers, someone in that school has to know how to use the equipment before effective computer-based instruction can take place. Radio Shack has long believed in providing teachers with the training and support that they need. This belief has been put into action in several ways.

First, user's manuals for our educational courseware provide clear, concise instructions—in most cases, these manuals are designed to be used by teachers who have never worked with a computer. Computer programs, too, are thoroughly edited for clarity. The user is never left wondering what the computer expects next.

Second, Radio Shack Computer Centers offer BASIC programming training and an "Educators' Workshop" on educational computer use, FREE to educators. In March, 1983, it was determined that more than 125,000 teachers had taken these classes in the preceding 12 months.

Third, the Radio Shack Education Division has a team of 24 Regional Educational Coordinators located across the country, to help local schools and districts determine how they can best implement a program of computer-based instruction.

Fourth, Radio Shack's Computer Customer Service department in Fort Worth has an education specialist ready to answer questions by telephone (817-390-3302).

Fifth, Radio Shack has recently initiated a nationwide effort to provide free computer literacy training to all educators. We call this project America's Educational Challenge.

AMERICA'S EDUCATIONAL CHALLENGE™

America's Educational Challenge gives all teachers in elementary and secondary schools the opportunity to achieve a basic understanding of computers and their applications in education, at no cost to themselves, their schools, or taxpayers.

Through this project, Radio Shack has distributed computer training materials directly to schools in two ways. In March, 1983, principals and headmasters of 103,445 schools in the United States were sent an initial packet. This packet contained an educator's handbook on microcomputer use in schools, a Basic Computer Literacy package designed to teach elementary computer concepts, a secondary-level textbook designed to illustrate programming concepts, examples of what several school districts are using with computers, and a certificate for free classes on BASIC programming and educational computer use. More recently, follow-up letters were sent to 16,000 school superintendents.

Also in the initial packet was an order form for a free staff-development package. This second package includes, among other items, two narrated filmstrips designed to introduce teachers to microcomputers and their use in education, and more certificates for free programming classes at Radio Shack Computer Centers.

If, for some reason, your school missed out on this second, free staff-development package, contact your principal or superintendent for more information about America's Educational Challenge.

NEW PRODUCTS, NEW RESOURCES

This has been a big year for Radio Shack courseware releases. Since last September, the Radio Shack Education Division has greatly increased its selection of quality courseware for elementary, secondary, and even college-level education. We've released new products for all of our hardware models used in education, with a special emphasis on the Color Computer.

SECONDARY MATH

In secondary mathematics, we released a **Number Theory** program (Cat. No. 26-2613) for TRS-80 Models I, III, and 4 that gives definitions, examples, and exercises on number theory concepts. Also for Models I/III/4, the **Matrices, Determinants, and Simultaneous Equations** program (Cat. No. 26-2620) generates practice exercises related to simple matrix algebra, while the **Quadratic Equations** program (Cat. No. 26-2623) generates problems in equation recognition, coefficient recognition, discriminant evaluation and type of roots.

Secondary mathematics programs for the Color Computer are now available from Radio Shack. **Investigations in Integral Calculus for the TRS-80 Color Computer** (Cat.

No. 26-2641) now lets you use a 16K cassette-based system with Extended Color BASIC or a 32K disk system with Disk Extended Color BASIC to graph and compute the areas of functions. The **Vector Addition Program for the TRS-80 Color Computer** (Cat. No. 26-2638) lets you use a 32K tape or disk machine to plot the components and sums of vectors.

LANGUAGE ARTS

In language arts, **C.A.R.D. II: Paragraphs** (Cat. No. 26-2604) is now available for use with Model III or 4. This package, based on the Philadelphia City Schools Computer Assisted Reading Development program, is the second in a four-part series that began with **C.A.R.D. I: Sentences** (Cat. No. 26-2603). Both packages are a comprehensive, cumulative series of numerous tutorial reading development lessons in the title topic (sentences or paragraphs), complete with pretests/posttests, and many practice exercises. **TRS-80 AUTHOR I** (Cat. No. 26-1727) **or the TRS-80 AUTHOR I Lesson Presentation Package** (Cat. No. 26-2707) is required to run C.A.R.D. lessons on a stand-alone Model III or 4. The **Network 3 TRS-80 AUTHOR I Lesson Presentation Package,** to be released this fall, will make it possible to run C.A.R.D. lessons on a Network 3 system.

HISTORY

In history, the **Basic Illustrated History of America** Learning Unit (Cat. No. 26-2645) is a major addition to our Model III/4 courseware line. Computer, audio, and print-media materials in the package provide an exciting, motivational survey of American history from the discovery of the "New World" to the present. Twelve different illustrated-format paperback history readers, written at reading levels 4-6, are included in the package. For each book, a read-along audio tape helps present the story, and a computer activities diskette presents exercises that test, and help reinforce, understanding. The illustrated format of the reading books is designed to involve students in the exciting story of America, making it easy for students of varied reading levels to understand the connections among historical events, and to remember these events. This is one history course that is anything but dry! (This history package requires one of the AUTHOR I packages mentioned above.)

COMPUTER EDUCATION

Several new computer/vocational education packages were released this year. Two of these are comprehensive multi-media instructional kits that do not require the use of computer hardware. The first, **Careers in Computing** (Cat. No. 26-2758) uses a narrated filmstrip, spirit masters, teacher's guide, and student guides, to give students the information they need to begin considering a computer career. The second, **The Computer Connection,** (Cat. No. 26-2663) has spirit masters, wall charts, a narrated filmstrip, and a teacher's guide, to introduce students to microcomputers and programming.

Part Four: TRSDOS (Cat. No. 26-2156), the latest volume of the Radio Shack Computer Education Series, is now available. Part Four: TRSDOS uses overhead transparencies, a teacher's manual with instructions and answers, and student workbooks to cover features of the TRS-80 Model III disk operating system. COBOL programming can now be taught using one of Radio Shack's latest courseware packages. **COBOL for the TRS-80 Models II, 12, and 16: Volume One** (Cat. No. 26-2706) was written by Robert T. Grauer, Ph.D. The package contains a 180-page COBOL textbook (with explanations, example programs, and exercises), and a COBOL Instructional Diskette for hands-on practice. It is ideal for classroom use or for self-study. The **Radio Shack COBOL Development System** (Cat. No. 26-4703) is also required, to run the hands-on exercises. **Class Notes** (Cat. No. 26-2723), also written by Dr. Grauer, are available separately as an aid to instructors who wish to teach this course in the classroom.

SCIENCE

TRS-80 Chemistry Lab, Volume One, is an important new science package. Versions for Models I/III/4 (Cat. No. 26-2609) and for the Color Computer (Cat. No. 26-2626) are available separately. This package contains six laboratory experiment simulations in these topics: Kinetic theory, Boyle's law, Charles' law, Titration, Conductivity, and Solubility. Students control variables in experiments in order to see the changing results. Student experiment books provided with the program contain instructions for using the programs, plus worksheets for use in summarizing experiment results.

The Solar System: Featuring the Discovery of the Planet Pluto (Cat. No. 26-2647) is a new audio/visual tutorial for the 16K Color Computer tape system. Among the features of this program is a segment narrated by Professor Clyde W. Tombaugh, the astronomer who discovered Pluto in 1930. A wall chart, hardback book by Dr. Tombaugh on the discovery of Pluto, and a list of suggested activities in the teacher's manual, provide enrichment for the computer program.

COLOR LOGO

TRS-80 Color LOGO was one of the most significant educational products released this past year. Available for the Color Computer in a 32K disk version (Cat. No. 26-2721) and a 16K Program Pak™ version (Cat. No. 26-2722), this TRS-80 version of the popular educational computer language LOGO has received several excellent reviews from educational journals. Color LOGO was taught in Radio Shack Computer Camps this summer. Supplementary Color LOGO materials, including a teacher's guide with suggested activities, will be released later in 1983. Student Stations using Color LOGO Program Paks may be connected via a Network 2 Controller to a teacher's Host Color Computer using the disk version of LOGO.

AND FUTURE PROJECTS?

Among the exciting new courseware products now in development at the Radio Shack Education Division are: a student records attendance, grades, and scheduling system for Models II, 12, and 16; an impressive business simulation package for secondary and college level; a Color Computer software package that teaches assembly language concepts through simulation; and a classroom package to teach BASIC programming on the new MC-10 microcomputer.

COURSEWARE AVAILABLE FROM OTHER SOURCES

Hundreds of third-party courseware publishers list their educational products in Radio Shack's *Educational Software Sourcebook.* These publishers include classroom teachers who develop their own programs and later market

them, professional computer programmers, and major educational publishing houses which are also involved in computer software production.

A new Second Edition to this useful sourcebook is due to be released any minute, if it isn't already available! This new, expanded edition will contain many new listings for all the TRS-80 machines used in education, as well as numerous "publisher profiles" submitted by the software developers themselves. While inclusion in the sourcebook does not imply endorsement by Radio Shack, the book serves as a valuable resource for educators looking for a wide range of TRS-80 courseware.

RADIO SHACK IN THE EDUCATION MARKET

Schools and school districts that choose Radio Shack TRS-80 computers are in good company. The individual state department of education surveys (that we've been able to collect so far) show that in almost every case, Radio Shack has more microcomputers in the schools than any other manufacturer. If you are using TRS-80 microcomputers, or are considering their use, this is good news for you. With so many TRS-80s being used in the classroom, the quantity and variety of high-quality, classroom-tested courseware packages available to you are sure to continue to increase geometrically!

Louisiana—1983 survey shows that 780 of 1,373 computers counted in the Louisiana schools are TRS-80 microcomputers — that's 52%. The second-place brand had only 22% representation.

Florida—the latest survey (1982) shows that Radio Shack has the best representation in Florida schools; more than 45% of their microcomputers are TRS-80s, versus only 24% for the second-place brand.

Kentucky—the 1982-83 state survey reveals TRS-80 microcomputers account for 52% of computers in the Kentucky schools, versus 22% for the second-place brand.

Indiana—Radio Shack is number one by the latest (1982) survey, with 37.5% of the classroom microcomputers. The second-place brand has 32.4%.

North Carolina—Radio Shack leads statewide. Also, Region 5 reported in March, 1982, that 71.4% of their districts used TRS-80s. 64.2% of the microcomputers used were TRS-80s, versus 35.8% for the second-place brand.

Oklahoma—a 1982 University of Oklahoma survey yielded the following statistics on the percentage of Oklahoma school computers that are TRS-80s: 59.5% in the Elementary schools (versus 24.8% for the second-place brand), 68% for middle schools (versus the second-place brand's 26.5%), and 72.6% for high schools (versus the second-place brand's 13.6%).

Pennsylvania—figures prepared in late 1981 for the Pennsylvania Department of Education by the state's contracting unit for microcomputers showed that purchases of Radio Shack TRS-80 computers by the state's schools were almost twice the volume of all other manufacturers combined.

Texas—a late 1981 survey reported statewide usage of TRS-80s at 58%, versus 40% usage of the second-place brand. A 1983 survey showed that in Region 5, TRS-80s accounted for 59% of all microcomputers, versus 36.4% for the second-place brand.

Washington State—again, Radio Shack is in the lead with 35.5% of all school computers, versus 33.7% for the second-place brand.

West Virginia—by number of locations, Radio Shack has a strong lead — the 1982 state survey shows TRS-80 microcomputers used in more schools than all major competitors combined (number of computers used was not reported).

Montana—1982 survey found 220 TRS-80 microcomputers in 89 schools, versus only 160 machines for the second-place company.

Idaho—December 1981 survey found that 59.38% of the state's school microcomputers were TRS-80s, versus 20.2% for the second-place brand.

Connecticut—1983 survey showed Radio Shack in the lead with 34% representation among computers, terminals, and microcomputers. (The second-place company had 32.9% representation.)

Catholic Schools—an article in the September, 1982 issue of *Today's Catholic Teacher* stated that Radio Shack had "conquered the lion's share (52.8 percent) of the Catholic school market" [pp. 62-64].

New England—the November/December 1981 issue of *Classroom Computer News* reported TRS-80 microcomputers the most widely used in the New England area schools.

SUMMARY

The Radio Shack Education Division is committed to making the microcomputer and its potential available to the education community. To meet this obligation, we continue to support an extensive development effort to produce quality microcomputer-based educational materials which are instructionally sound, effective, properly validated, and designed for use in the classroom.

We also maintain a network of locally-based Regional Educational Sales Coordinators who are available to provide guidance and information to schools and districts that are seeking to implement microcomputer-based programs.

A list of these Coordinators, including one you can contact, is at the end of this article.

Radio Shack is "The Name in Classroom Computing"™ because Radio Shack is committed to education.

Radio Shack Regional Educational Coordinators

Albany Region:
Don Francolino
Radio Shack
39 S. Main Street
W. Hartford, CT 06107
203/232-4529

Atlanta Region:
Art Williams
Radio Shack
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Atlanta, GA 30342
404/255-9438

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617/848-0780

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Southfield, MI 48076
313/552-9290

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813/886-2974

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Western Educational Marketing Manager:

Scott Bowers
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Fort Worth, TX 76102
817/390-3910

Model 12 Function Keys

Robert Carroll
111 Folly Road
Charleston SC 29407
CIS. NO. 70505,754

The TRS-80 Model 12 has eight function keys—F1 thru F8. Below is a sample program showing how they can be used in a menu program to branch to eight sub-programs. Try it, you may like it.

```
1Ø REM -MENU/PG- TO UTILIZE FUNCTION KEYS.
2Ø CLS
     : DEFSTR S
     : SB=CHR$(25)
     : SW=CHR$(26)
3Ø PRINT TAB(32)SW"     MENU/PG     "
     : PRINT
     : PRINT
     : PRINT SB
4Ø PRINT TAB(15)SW" <F 1> FOR OPTION 1 ";
     : PRINT SB;
5Ø PRINT TAB(45)SW" <F 5> FOR OPTION 5 "
     : PRINT
     : PRINT SB
6Ø PRINT TAB(15)SW" <F 2> FOR OPTION 2 ";
     : PRINT SB;
7Ø PRINT TAB(45)SW" <F 6> FOR OPTION 6 "
     : PRINT
     : PRINT SB
8Ø PRINT TAB(15)SW" <F 3> FOR OPTION 3";
     : PRINT SB;
9Ø PRINT TAB(45)SW" <F 7> FOR OPTION 7 "
     : PRINT
     : PRINT SB
1ØØ PRINT TAB(15)SW" <F 4> FOR OPTION 4";
     : PRINT SB;
     : PRINT TAB(45)SW" <F 8> FOR OPTION 8 "
11Ø PRINT SB
12Ø A$=INPUT $(1)
13Ø B1$=CHR$(Ø1)
     : B2$=CHR$(Ø2)
     : B3$=CHR$(Ø4)
     : B4$=CHR$(12)
14Ø B5$=CHR$(21)
     : B6$=CHR$(16)
     : B7$=CHR$(14)
     : B8$=CHR$(19)
15Ø X$=B1$+B2$+B3$+B4$+B5$+B6$+B7$+B8$
16Ø Y=INSTR(X$, A$)
17Ø ON Y GOTO 19Ø, 2ØØ, 21Ø, 22Ø, 23Ø, 24Ø, 25Ø, 26Ø
18Ø PRINT "TRY AGAIN YOU GOOFED"
     : GOTO 12Ø
19Ø PRINT " < F1 >  IT WORKS. "
     : GOTO 27Ø
2ØØ PRINT " < F2 >  IT WORKS. "
     : GOTO 27Ø
21Ø PRINT " < F3 >  IT WORKS. "
     : GOTO 27Ø
22Ø PRINT " < F4 >  IT WORKS. "
     : GOTO 27Ø
23Ø PRINT " < F5 >  IT WORKS. "
     : GOTO 27Ø
24Ø PRINT " < F6 >  IT WORKS. "
     : GOTO 27Ø
25Ø PRINT " < F7 >  IT WORKS. "
     : GOTO 27Ø
26Ø PRINT " < F8 >  IT WORKS. "
     : GOTO 27Ø
27Ø GOTO 12Ø
```

Creating a Network 2 Color SCRIPSIT Lab

With Color Scripsit for the TRS-80 Color Computer and a Network 2 Controller, you can set up a Network 2 Color Scripsit lab in your classroom.

Color SCRIPSIT word processing puts an end to erasing, strikeovers, and messy correcting fluids. Students can type-in and edit their themes and reports right on the screen. They can easily insert, delete, move and duplicate words, sentences, even whole paragraphs. Their text can then be printed out or saved to disk and evaluated by the teacher at a later time.

THE SETUP

The teacher's Host computer is a 32K Color Computer (Cat. no. 26-3003) with a single disk drive (Cat. no. 26-3022). Disk Scripsit (Cat. no. 26-3255) is running in the Host.

A Network 2 controller (Cat. no. 26-1211) connects the Host computer with each of the Student Stations. The "Baud Rate" switch is set at 1500, and the "Mode" switch is set at MPLX. Up to 16 Student Stations can be connected to the Host via the Network 2. Each Student Station is a 16K Color Computer (Cat. no. 26-3004) with standard Color BASIC. Each Student Station contains a Scripsit Program Pak (Cat. no. 26-3105).

SENDING DOCUMENTS TO THE STUDENT STATIONS

The teacher may have written a document and saved it as "PRACTICE" on a diskette to show the students.

At the Host computer, the teacher chooses option #3 (SAVE TEXT) from the Main Menu and then option #2 (TO TAPE) from the save sub-menu. Enter the file name, in this case "PRACTICE", and press ENTER. Press ENTER at the next prompt. When the teacher is prepared to send information, students should set up their stations.

To prepare to receive the information from the teacher, the students should do the following: Choose option #4 (LOAD FROM TAPE) from the Main Menu. Enter the file name, "PRACTICE" and press ENTER. Press ENTER at the next line. Press ENTER a third time and the word "SCANNING" will appear on the Student screen. When all students are "SCANNING", the teacher will press ENTER at the Host for the third time. The word "RECORDING" will appear at the Host station. When the Student Station has found the file, the word "LOADING" will appear and the file name will be in the lower left-hand corner.

The Host will return to the Main Menu when it has finished sending. The Student Stations will also return to the Main Menu.

RECEIVING DOCUMENTS FROM THE STUDENT STATIONS

Set the Input Select knob on the Network 2 Controller to the appropriate student station number.

The student is now ready to send a prepared document to the Host to be saved on the Host disk or to be printed out.

The Host computer chooses option #4 (LOAD TEXT) at the Main Menu and then option #2 (FROM TAPE) from the sub-menu. The teacher types in the file name at the Host and presses ENTER. Press ENTER again. Press ENTER a third time and the word "SCANNING" will appear on the Host screen. At the student station, choose option #3 (SAVE ON TAPE) from the Main Menu. The student then types in the file name and presses ENTER. Press ENTER again. Press ENTER a third time and "RECORDING" will appear at the student station. When the Host has found the file, the word "LOADING" will appear and the file name will be in the lower left-hand corner.

The Student Station will return to the Main Menu when it has finished sending. The Host will also return to the Main Menu after the document has been loaded.

PRINTING DOCUMENTS

Printing can be done directly from the Student Station by connecting a printer to the Student Station. Printing can also be done through the Host.

To print directly from the Student Station, connect one end of the printer cable to the Color Computer in the socket marked "SERIAL", and the other end to the printer. The Student then selects option #5 (PRINT) from the Main Menu and then option #1 (PRINTER) from the sub-menu. If all connections have been made properly the document will then be printed on the printer. NOTE: If you attempt to print and the printer is not ready, the message "PRINTER NOT READY" will appear on the bottom line of the screen. There is no way to return to the Main Menu or exit this mode except through printing the document or by pressing the reset button. Pressing reset will erase the document.

To print the document from the Host computer, the Student Station sends the document to the Host. The Host then saves the document (if desired) by selecting option #3 (SAVE TEXT) from the Main Menu and then option #1 (TO DISK) from the sub-menu. Type the filename and press ENTER. Press ENTER again. Press ENTER a third time and the document will be saved on the Host diskette under the specified filename. To print the document, the Host selects Main Menu option #5 (PRINT), then option #1 (TO PRINTER) to print to the printer. As long as all connections have been made correctly, the document will be printed to the printer. On the Host, if the printer is not ready, the teacher can return to

the Main Menu by pressing (BREAK), and will not lose the document.

IMPORTANT NOTE:

Before documents are sent to the Host or the Student Stations, the person on the receiving end (the person who is about to get the document) should select Main Menu option #1 (CLEAR MEMORY) then press (ENTER), this will clear the memory. If memory is not cleared before receiving a document, the document that is being received will append itself to anything already in memory.

Computer Customer Service Address and Phone Numbers

8AM to 5PM Central Time
Computer Customer Services
400 Atrium, One Tandy Center
Fort Worth, Texas 76102

Model I/III/4 Business Group ..... (817) 390-3939
Model II/12/16 Business Group ..... (817) 390-3935
Languages and Compilers ..... (817) 390-3946
Color/Model 100/Pocket Computer Group (817) 390-3944
Hardware and Communications Group ... (817) 390-2140
Educational Software ..... (817) 390-3302
Games, Books, and New Products ..... (817) 390-2133
Newsletter Subscription Problems ..... (817) 870-0407

VisiCalc Commas

A. J. Bassett
G. Richards
Shell Offshore Inc.
P.O. Box 61933
New Orleans, LA 70161

VisiCalc is deserving of its reputation as a first-class program with many applications. It certainly has fit in well with the routine here in our office and we depend on it for keeping track of many of the details in our business.

However, the printed reports that we generate on VisiCalc and pass on to other departments frequently cause the same question to be asked; "Why don't you have commas in the large numbers to make them more readable." The question threatened to become a complaint, so we wrote a short program to insert commas. After using it a few times, we agree that the readability of our reports is greatly enhanced. We are using a Model II with a Daisy-Wheel II, but the program should work with Model I/III and just about any printer.

The following steps should be taken to utilize COMMAS/BAS:

1. Key in and save program COMMAS/BAS
2. Create your VISICALC screen in normal manner up to the point where you are ready to print.
3. Create a print file in ASCII format. VISICALC automatically adds the "/PRF" to your file name.
4. Go to TRSDOS with /SE and enter BASIC COMMAS/BAS -F:1
5. Enter the name of your ASCII print file when requested and watch COMMAS/BAS do its stuff.

PROGRAM #1

```
1Ø PROGRAM TO INSERT COMMAS IN LARGE NUMBERS ON
     VISICALC OUTPUT: CREATED 1Ø/82 A. J. BASSETT,
     W5UU, AND G. RICHARDS, BOX 61933, NEW ORLEANS,
     LA. 7Ø161
2Ø DEFINT A-Z
     : DIM C(25)
     : M=Ø
3Ø CLS
     : PRINT "BE SURE THAT ASCII FILE IS CREATED IN
     VISICALC TO USE FOR INPUT TO THIS PROGRAM. BE
     SURE TO RESERVE AT LEAST ONE FILE WHEN YOU ENTER
     BASIC. I.E. ENTER BASIC -F:1. PROGRAM WILL
     RETURN TO TRSDOS IF NO MORE PRINTS ARE
     REQUESTED."
4Ø PRINT""
     : PRINT""
     : INPUT"ENTER THE NAME OF THE VISICALC FILE";I$
5Ø OPEN "I", 1, I$
     : LPRINT CHR$(13);
6Ø A$=INPUT$(1,1)
     : IF EOF (1) THEN 9Ø
7Ø A=ASC(A$)
     : PRINT CHR$(A);
8Ø IF A=45 THEN A=32
     : A$=CHR$(A)
9Ø IF A>47 AND A<58 THEN M=M + 1
     : C(M)=A
     : GOTO 6Ø
1ØØ IF M=Ø THEN LPRINT A$;
11Ø IF M=O THEN 6Ø
12Ø IF M=Ø THEN CLOSE
     : GOTO 15Ø
13Ø C(M+1)=A
14Ø I=(M-1)/3
     : IF I=Ø THEN 11Ø
15Ø FOR N=1 TO I
     : LPRINT CHR$(8);
     : NEXT
16Ø FOR I=1 TO M+1
     : L=(M-I+2)
     : N=L/3
     : II=L-N*3
     : LPRINT CHR$(C(I));
17Ø IF I=>M THEN GOTO 13Ø
18Ø IF II=2 THEN LPRINT CHR$(44);
19Ø NEXT
     : IF EOF(1) THEN CLOSE GOTO 15Ø
2ØØ M=O
     : GOTO 6Ø
21Ø PRINT"DO YOU WISH TO RUN PROGRAM AGAIN (Y/N)"
22Ø A$=INKEY$
     : IF A$="" THEN 16Ø
23Ø IF A$="Y" THEN 2Ø
24Ø SYSTEM
```

Our COMMAS/BAS program has been very useful for reports with large numbers. Wouldn't you know that other people started using it on reports with negative numbers and long decimal numbers. Naturally things were not so hot.

We are also including a revised program that handles just about anything we have encountered so far. It correctly places commas in large numbers in reports containing a

(Continued on page 12)

CompuServe: Not Just Fun and Games

Editor's Note: The CompuServe Information Service is one of the largest information and entertainment services available to owners of personal computers and computer terminals. With each issue of TRS-80 Microcomputer News, various features of CompuServe will be discussed. The CompuServe Information Service is sold at Radio Shack stores nationwide and in Canada.

COMPUSERVE: NOT JUST FUN AND GAMES

The CompuServe Information Service is a games center. CompuServe is also a shopping and banking service. And now, CompuServe is moving into the limelight as an educator. CompuServe offers valuable educational features to its subscribers through a variety of services. One of the most prominent is the Electronic Edition of Grolier's *Academic American Encyclopedia*. The *Academic American* will provide owners of personal computers with a searchable nine-million word database of over 29,000 subject entries, accessible through a telephone connection to CompuServe. Articles in the *Academic American* are specifically suited for videotex use, formatted for video screens and written to be concise yet thorough. The on-line *Academic American* allows the user to type in all or part of a search word. The computer will search through subject headings and create a menu of all articles beginning with the specified term. The user can then choose the specific section he or she wants to read. Recognized as the premier videotex encyclopedia, the *Academic American* has been praised by reviewers as the most consistently up-to-date encyclopedia available. It answers the general informational needs of users ranging from school children to adults.

Grolier Incorporated is the world's largest publisher of quality encyclopedias and reference sets. Among its leading products are the *Encyclopedia Americana*, the nation's oldest encyclopedia, and the *New Book of Knowledge*. The company is also a leading publisher of children's books and educational materials.

THE COLLEGE BOARD: A TOOL FOR THE COLLEGE BOUND

In addition to the Grolier's *Academic American*, CompuServe offers the College Board. The College Board is not reference material but a guide for planning your college experience. The College Board services include College Planning. College Planning helps the college bound student choose a college. This section discusses some of the myths surrounding college selection and admission and some hints on how not to choose a college. Preparing for the SAT discusses whether or not studying and coaching help raise a student's score. This section also considers such points as the SAT—not a test of inborn and unchanging capacity; improvement of scores with the accumulation of educational experience; time and effort spent in development and preparation of abilities; familiarization with question types; the decision to take extra preparation steps and the studying of a wide variety of topics in relation to scores. In the "Getting a Head Start" section, the idea of the Advanced Placement program for students in high school is discussed.

A checklist of dates for high school juniors and seniors is detailed under "Countdown To College", and a checklist for those attending college immediately out of high school is included in "Are You Ready For College?" "Adult Education" discusses the prospect of going back to school, learning opportunities for adults and the fact that you're never too old to learn.

The "Financial Aid" section discusses how to go about getting financial aid, the language used in that process, and, also includes a program on how to meet the costs of college. A list of publications for college planning, financial aid, and other college-related topics is given in the "Read On—Selected Publication" section. Also provided, is a special Feedback section connecting subscribers who would like to leave questions and comments to the College Board staff.

THE MULTIPLE CHOICE: A, B, C, OR NONE OF THE ABOVE

Under The Multiple Choice area, subscribers will find numerous tests for educational purposes or just plain enjoyment. "TMC Analogies" provides you with a sample entrance exam for graduate school. Will you be accepted? Our aptitude test may give you an idea of what to expect. "Trivia Unlimited" will let you test compete with yourself or others around the country in categories of TV, movies, history, science, and others. Find out how you see yourself and how well you take care of yourself. "The Personality Profile" will help you determine this by asking questions about your psychological, physical and spiritual self, as well as other enlightening questions.

The Multiple Choice for Kids offers games, puzzles, and trivia designed for the younger set. The TMC Intelligence Test is similar to an IQ test, and will give you a fair estimate of how smart you are. The faster you complete the 30 questions the more your score will improve.

"Categorically Trivial" questions you until you miss three consecutive picks. To improve your score, just play again.

In "Author! Author!" The computer lets you choose the story you'd like to compose: The Woman of My Dreams, Those Were the Good Old Days, My True Self, Dear John and the Perfect Male. Just fill in the missing words. You can't miss achieving an award winning paragraph.

Separate yourself as a genius or just a bright person with the Super Brain Challenge. Super Brain includes high IQ questions, brain teasers and obscure facts.

As with the College Board, The Multiple Choice also offers a subscriber Feedback to converse with the Multiple Choice staff.

CLARKE SCHOOL FOR THE DEAF FEATURES THE MAINSTREAM NEWS

One of CompuServe's newer services is the Clarke School for the Deaf. This service features the *Mainstream News*, a monthly newsletter about mainstreaming hearing, impaired students into regular schools. It contains articles for teachers, tutors, guidance counselors, speech therapists, parents, and students.

Authors of the *Mainstream News* have been involved in the education of hearing impaired students through teaching different levels of school, directing hearing impaired programs and coordinating efforts of mainstreaming programs.

Clarke uses a support team of audiologists, teachers, tutors and others to achieve mainstreaming. This aspect is discussed and is accompanied with definitions of key words and phrases used in the mainstreaming process.

The Clarke School is a boarding and day school for deaf children, and is located in Northampton, Mass. Clarke's 30-acre campus is adjacent to Smith College campus and houses 22 departments including research, physical, and dormitory facilities.

Clarke's educational program helps students develop the speech, lipreading, and language skills they need to continue their education in schools for hearing impaired children. These and many other aspects are detailed in the *Mainstream News* and Announcements section of the Clarke School for the Deaf.

Questions and comments about the CompuServe Information Service can be sent to Richard A. Baker, editorial director, or Jacqueline A. Farthing, assistant editorial director, CompuServe Information Service, 5000 Arlington Centre Boulevard, P. O. Box 20212, Columbus, Ohio 43220 or through Feedback, main menu item 5, CompuServe User Information.

VisiCalc Commas

(From page 10)

mixture of positive, negative, decimals and large integers. So until someone thinks of some new application that we have not seen, we are all fixed up.

REVISION OF PROGRAM #1

```
1Ø '"COMMAS/BAS", A PROGRAM TO INSERT COMMAS IN LARGE
     NUMBERS ON VISICALC OUTPUT
2Ø 'BY A. J. BASSETT, G. RICHARDS, OCTOBER 1982
3Ø 'MODIFIED 2/83 TO ACCOMODATE MINUS SIGNS AND
     DECIMALS
4Ø DEFINT A-Z
5Ø DIM C(15Ø)
6Ø CLS
7Ø CLS
     : PRINT "BE SURE THAT ASCII FILE IS CREATED IN
     VISICALC TO USE FOR INPUT TO THIS PROGRAM."
8Ø PRINT "BE SURE TO RESERVE AT LEAST ONE FILE IN
     BASIC. I.E. ENTER BASIC -F:1"
9Ø PRINT "PROGRAM RETURNS TO TRSDOS IF NO MORE
     PRINTING IS REQUESTED"
1ØØ PRINT""
11Ø PRINT""
12Ø INPUT"ENTER THE NAME OF THE VISICALC FILE";I$
13Ø OPEN "I", 1, I$
14Ø LPRINT CHR$(13);
15Ø '
16Ø M=Ø
17Ø A$=INPUT$(1,1)  'READ A CHARACTER FROM VISICALC
     FILE
18Ø IF EOF(1) AND M=Ø THEN 59Ø ELSE IF EOF(1) THEN
     29Ø
19Ø A=ASC(A$)
2ØØ PRINT CHR$(A);      'PRINT CHARACTERS ON SCREEN AS
     THEY ARE READ IN
21Ø IF A<45 OR A>58 GOTO 25Ø   'CHECK FOR NUMBER
     CHARACTERS
22Ø M=M+1       'COUNT THE NUMBER OF CHARACTERS
23Ø C(M)=A
24Ø GOTO 17Ø'GO BACK AND READ IN ANOTHER CHARACTER
25Ø IF M>Ø GOTO 29Ø
26Ø LPRINT A$;
27Ø GOTO 17Ø
28Ø '
29Ø MF=Ø
3ØØ FOR K=1 TO M    'CHECK FOR ".", "/", OR ":" AND
     BYPASS COMMA COUNT
31Ø IF C(K)=46 OR C(K)=47 OR C(K)=58 GOTO 34Ø
32Ø NEXT K
33Ø '
34Ø IF C(1)=45 THEN MF=1   'CHECK IF NEGATIVE
35Ø FOR F=2 TO K      'CHECK FOR NEEDED COMMAS
36Ø IF F=2 AND MF=1 GOTO 42Ø
37Ø FOR J=1 TO 5
38Ø FF=F+J*3
39Ø IF FF>K GOTO 42Ø
4ØØ IF FF=K THEN LPRINT CHR$(8);      'BACKSPACE TO
     MAKE ROOM FOR COMMAS
41Ø NEXT J
42Ø NEXT F
43Ø '
44Ø FOR F=1 TO M       'PUT IN COMMAS IF NEEDED
45Ø IF F=1 OR F>K GOTO 52Ø
46Ø IF F=2 AND MF=1 GOTO 52Ø
47Ø FOR J=1 TO 5
48Ø FF=F+J*3
49Ø IF FF=K THEN LPRINT CHR$(44);      'INSERT A COMMA
5ØØ IF FF=>K GOTO 52Ø
51Ø NEXT J
52Ø LPRINT CHR$(C(F));      'PRINT THE REST OF NUMBERS
     EXCEPT LAST
53Ø NEXT F
54Ø '
55Ø IF EOF(1) GOTO 59Ø
56Ø LPRINT A$;      'PRINT FINAL CHARACTER IN BUFFER
57Ø GOTO 16Ø  'GO BACK AND START READING
58Ø '
59Ø CLOSE
     : PRINT"DO YOU WISH TO RUN PROGRAM AGAIN?
     (Y/N)";
6ØØ A$=INKEY
61Ø IF A$="" THEN 6ØØ
62Ø IF A$="Y" THEN 8Ø
63Ø SYSTEM
```

Sangarnet™ Bulletin Board

The Sangarnet Bulletin Board is now on-line 24 hours a day, 7 days a week. Sangarnet is a free bulletin board which features uploading, downloading, electronic mail, bulletins, and much more. This 300 baud Bulletin Board also features System Chess, a new concept in electronic computer bulletin boards. Sangarnet can be accessed at 1-919-758-5261.

Color LOGO And Education

Dr. Paul Kimmelman
Norton City Schools
4128 Cleveland-Massillon Road
Norton, OH 44203
also
Education Editor
Color Computer Magazine

With the phenomenal growth of microcomputer use in education, the need to consider the appropriate educational use for computers has become a high priority for educators. Questions such as where do we begin, how do we use computers for instruction, how many do we need, where should we put them, what grade levels should have computer instruction, and what brand to purchase are all examples of problems that perplex educational decision-makers. Unquestionably, answers will emerge as this new technological phenomenon for schools becomes a more significant component of the daily curriculum; however, for the time being, parents, teachers, and administrators are all being besieged with "expert" answers.

In addition to the previously noted problems, the decision of what software to use for instruction creates another dilemma for many educators. I find that many people tend to want a surplus of software instead of a few programs that meet each user's basic needs. Consider the fact that computer uses for instruction are primarily for such activities as skill-building, tutorial, inquiry, simulation, problem-solving, and instructional games. When a particular program is found to meet these needs, why not use it and begin a search for other programs that meet other needs. For example, if one math program is sufficient for supplementing the curriculum, you will more than likely, not need another similar math program. In this instance, why not look for programs to supplement other subjects in your curriculum such as science, language arts, etc.?

It seems to me there is too much confusion concerning educational software. In order to get started, why not begin with Color LOGO, in my opinion the best curricular program for introducing computer literacy. From Doodle Mode to the more complex procedures that can be written in Edit Mode can be found a fundamental computer programming experience. Further, these programming opportunities can begin with kindergartners and continue through high school if desired.

The history of LOGO merits a brief explanation. In the late 1960's a researcher named Seymour Papert conducted a research program at the Artificial Intelligence Laboratory of the Massachusetts Institute of Technology. His goal was to develop a means for children to be able to easily communicate and interact with the computer. Papert, a former student of Swiss psychologist, Jean Piaget, wanted the computer to be an object for young children to think with. In his book, *Mindstorms, Children, Computers and Powerful Ideas,* Papert noted two fundamental ideas. The ideas were:

1. "It is possible to design computers so that learning to communicate with them can be a natural process, more like learning French by living in France than trying to learn through the unnatural process of American foreign language instruction in the classrooms."

2. "Learning to communicate with a computer may change the way other learning takes place."

There are many versions of LOGO. Many of the computer manufacturers have made a version of LOGO available to their users. This has created some controversy among LOGO users over which version is "best" or "truly LOGO." While experiences with this controversy have lead me to believe that many educators sometimes cannot see the forest for the trees, I have found that Color LOGO meets what I consider to be the most important introductory basic requirements for LOGO instruction. Perhaps in the future it will be necessary for us to recommend to Radio Shack that an enhanced version of Color LOGO will be necessary to help advance those who have become proficient using the Color LOGO version currently available. For now, however, let's quit worrying about who has the best LOGO and just start teaching it.

Color LOGO has some unique qualities that separate it from some of the other versions of LOGO. First, the Doodle Mode, where you simply place the overlay that is supplied with the LOGO package on the keyboard and begin moving the turtle around the screen. This is an important feature because it enables young children to work with their programs and satisfy their curiosity about how to move the turtle and create shapes.

Another feature of Color LOGO that creates student excitement is the opportunity to hatch multiple turtles. This enables the user to create some interesting programs especially with the feature that allows messages to be sent between turtles.

Finally, there is a shape command for those who prefer a differently shaped "turtle".

Why Color LOGO for schools? If economy is an important concern, then Radio Shack has helped you meet this objective. Not only is the Color Computer one of the finest, most economical computers available, but the ROM pack version of LOGO is the most economical LOGO available. A review of other hardware and software manufactured by other companies that is more expensive can easily lead one to conclude that instead of buying one expensive computer, it is more practical to purchase several Color Computers and ROM packs thus, creating more student stations. This should

not be perceived as a criticism of other equipment, only that one can obtain more hardware and software on a fixed budget utilizing the Radio Shack equipment. Further, another outstanding feature of the LOGO environment is that it can be networked with up to sixteen student stations.

Before I discuss school curriculum and LOGO, I want to mention the use of LOGO in the home. The use of computers for educational purposes has rapidly expanded to the home. LOGO is an excellent program to stimulate creative thinking and introduce computer programming. The Radio Shack *Parent's Guide to LOGO* will be very helpful to parents who want to establish an educational LOGO environment using their home computer.

When using LOGO in the schools, consider allowing two students per computer. While one student per computer may be most desirable, there is some debate among educators whether this is the best user environment. There is an important need for children to be able to interact with each other and share their ideas. However, when combining more than two students, some caution should be used. Learning Style theory emphasizes that unless students prefer small group instruction, the student will not respond favorably to this learning environment. In addition, three or more students working at one computer is too cumbersome and crowded.

Simply stated, there is really no "best" configuration for LOGO instruction. I suggest that you develop your program around your needs and the available equipment and software. I personally like the concept of "COLOR COMPUTER MINI-LOGO LEARNING LABS" for schools that have four to five computers per building. This configuration includes five computers on mobile carts. Using this type of set-up, the computers can be moved to a classroom and up to ten students can be scheduled at one time. A convenient time to schedule the lab work for LOGO can be during reading class when the class is normally divided into three or four smaller ability groups. With the assistance of an aide or parent volunteer, the teacher can work on reading instruction with one of the groups while one group is completing seatwork, and the last group working with LOGO.

I would also suggest that whole class instruction on LOGO be provided before sending the students to the computers. Two new guides from Radio Shack, *Color LOGO FOR TEACHERS*, Parts 1 and 2, provide comprehensive instructional materials for the LOGO classes. In addition to the background material, activity sheets which can be duplicated are included. One note of caution. One of the most important uses of LOGO is for creative thinking. Educators must be resistant to the temptation to over-structure the LOGO curriculum with objectives and assignments. Teach commands but let students explore the use of the commands and create their own designs and programs.

Finally, do not be misled by thinking LOGO is only for young children. George Gerhold, co-author of Color LOGO has used Color LOGO in his college classes with interesting results. His students have taken the time to develop some unique programs. Even if LOGO was intended for a young audience, its rapid growth in popularity has excited many adults as well.

If you need a final goal for your school, strive to establish a LOGO network with a host unit and disk. The Network 2 system will handle up to sixteen stations. For more information on the network configuration, see the article by Dennis Tanner in the May issue of *Microcomputer News*.

In conclusion, the following procedures were made available to me by Dennis Tanner for your use with LOGO so turn your computer on and enjoy the fascinating things that can happen with this "children's computer language".

Color LOGO
for the
TRS-80 Color Computer
Sample Procedures

```
BOX 1 . . . RUN MODE
    FD 50
    RT 90
    FD 50
    RT 90
    FD 50
    RT 90
    FD 50
    RT 90
```

```
BOX 2

TO BOX
    FD 50
    RT 90
    FD 50
    RT 90
    FD 50
    RT 90
    FD 50
    RT 90
END
```

```
BOX 3

TO LINE
    FD 10
END
```

```
BOX 4

TO CIRCLE
    REPEAT 10 (LINE RT 36)
END
```

```
BOX 5

TO PATTERN
    REPEAT 10 (CIRCLE RT 36)
END
```

```
BOX 6
TO THREE
     SETX 40 HATCH 1 PATTERN
     SETX 110 HATCH 2 PATTERN
     SETX 180 HATCH 3 PATTERN
VANISH
END
```

```
BOX 7
TO LINE
     MAKE :COLOR:COLOR + 1
     PC:COLOR
     FD 10
END
```

```
BOX 8
TO THREE
     COLORSET 1
     BG 2
     SETX 40 HATCH 1 PATTERN
     SETX 110 HATCH 2 PATTERN
     SETX 180 HATCH 3 PATTERN
     VANISH
END
```

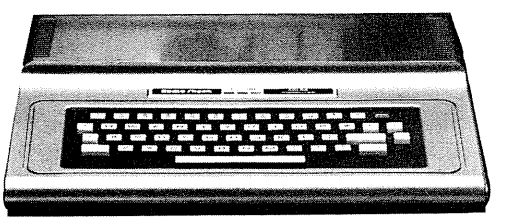
Plotter for Algebra Teachers

Ross H. Penix
Bob Jones Academy
Greenville, SC 29614

This Extended BASIC Color Computer program will be of interest to Algebra I and II teachers. The program named Plotter is used to plot equations in the form y = f(x) on an x-y coordinate plane with units along the x and y axes. The program first displays a menu from which the user chooses one of fourteen equations. By entering a number from one to fourteen, the user sends the computer into a high-resolution graphic mode. After the equation line is plotted, the menu can be returned by pressing any key. The points that are outside the boundary of the screen are plotted along the boundary.

Of course, the equations can be changed to allow students to check their homework!

```
1 '      *** PLOTTER ***
2 '
3 '       ROSS H. PENIX
4 '       BOB JONES ACADEMY
5 '       GREENVILLE, SC 29614
6 '
7 CLS
8 GOTO 200
10 Y = 10
     : RETURN
20 Y = X
     : RETURN
30 Y = X+4
     : RETURN
40 Y = X-2
     : RETURN
50 Y = X*X
     : RETURN
60 Y = (X*X)-4
     : RETURN
70 Y = (X+2)*(X-2)
     : RETURN
80 Y = -X*X
     : RETURN
90 Y = -(X+3)
     : RETURN
100 Y = X*X*X
     : RETURN
110 Y = -X*X*X
     : RETURN
120 Y = X*((X*X)-9)
     : RETURN
130 Y = X*X*X-3*X*X+X
     : RETURN
140 Y = 4/X
     : RETURN
200 PRINT@32,"ENTER THE NUMBER OF THE GRAPH"
205 PRINT@64,"YOU WISH TO SEE PLOTTED."
210 PRINT@128,"1 Y = 10            8 Y = -X*X"
215 PRINT@160,"2 Y = X             9 Y = -(X+3)"
220 PRINT@192,"3 Y = X+4          10 Y = X*X*X"
225 PRINT@224,"4 Y = X-2          11 Y = -X*X*X"
230 PRINT@256,"5 Y = X*X          12 Y = X((X*X)-9)"
235 PRINT@288,"6 Y = (X*X)-4      13 Y = X(X*X-3X-1)"
240 PRINT@320,"7 Y = (X+2)(X-2)   14 Y = 4/X"
245 INPUT G
250 PMODE 4,1
255 PCLS
260 SCREEN 1,0
265 LINE (127,5)-(127,185),PSET
270 LINE (7,95)-(247,95),PSET
275 FOR XAXIS = 7 TO 247 STEP 10
280 PRESET (XAXIS,95)
285 NEXT XAXIS
290 FOR YAXIS = 7 TO 182 STEP 8
295 PRESET (127,YAXIS)
300 NEXT YAXIS
305 FOR X = -12 TO 12 STEP .05
308 ON G GOSUB 10,20,30,40,50,60,70,80,90,100,110,
    120,130,140
310 XP = 10*X+127
315 YP = 95-8*Y
320 IF XP < 0 THEN XP = 0
325 IF YP < 0 THEN YP = 0
330 IF XP > 255 THEN XP = 255
335 IF YP > 191 THEN YP = 191
340 PSET(XP,YP,1)
345 NEXT X
350 B$ = INKEY$
360 IF B$ = ""THEN 350
370 IF B$<>" "THEN 200
```



Communications Corner

Al and Dru Simon

Hello, and welcome back to Communications Corner. Since this month's issue is about education, we thought we would take a paragraph or two to talk about the value of communications in the realm of education. Computers are becoming more and more important in all of our lives, not only as a pastime, but more and more as a device for learning, creating and, of course, communication.

Long ago the telephone was a rare but widely spreading phenomenon, and today the computer is in that same position. So many computer users know about communications via these wonderful devices, and make full use of the public access systems all around the country such as CompuServe, The Source and all the Bulletin Boards we speak so much about. Is it unreasonable to believe that sooner or later the computer will replace the telephone? Probably not, especially since Bell seems to be moving in a direction to accommodate data quality communications lines. It is an exciting and promising era we are living in, watching a metamorphosis in communications taking place right before our eyes!

Education also is moving to take advantage of the great "computer revolution" as more and more schools offer courses in computer languages, programming and operation. Many areas are beginning to use computers in their teaching curricula, making use of the devices to help each student progress at his or her own individual pace. Students seem to learn easily from computers, very possibly because operating them is so easy and so much fun. Indeed, not only are computers used to teach subjects, but some school systems have begun to seriously consider "computer fluency" as one of their requirements for graduation from high school!

More and more schools are inviting companies like Tandy to make presentations about computers before assembled groups of students. In fact, this past year we made a presentation that included students down to the Kindergarten level! Our daughter (now 6) learned the alphabet before she was 20 MONTHS old, using a home-written program which flashed the letters on the monitor, while a synchronized tape pronounced each letter for her, and encouraged her to imitate the sound.

The possibilities and potentials for education through computers are truly limited only by the imagination of those making use of these wondrous machines! We are proud and excited to be a part of this new age in education and communication!

Communications is a rather broad word though, and takes many forms. Everything from writing a letter on your word processor to making a videotape to present to your friends or special interest group can be called communications.

Just for fun, this month we are going to move out of the realm of strict computer communications and discuss the possibilities that are open to you when you consider Communications between your computer and your videotape recorder.

We will discuss the use of your computer in creative video, plus the strict use of a VCR (Video Cassette Recorder) as a mass storage device. You might ask how your computer can help you in making interesting videotapes and the answer is simple. Creating titles, cartoons, and captions to add to your original filming efforts can be very rewarding and add a touch of professionalism and flair to your home videotape efforts.

We will speak about three aspects of combining videotaping with computers. These are HARDWARE, SOFTWARE, and WETWARE. (Wetware, for those of you who have not heard the term before simply refers to the human brain as a creative device.)

HARDWARE

Let's start off with Hardware. Any type of VCR will do, as long as it has auxiliary inputs, which most do. What do we mean by auxiliary? Well most VCRS will accept something called a COMPOSITE INPUT that you plug an RG59 cable into. That is usually the white or black cable you find rated at 75 ohms that you plug into the back of your television set or screw in, depending on the type of connector that you have. (It is not 300 ohm twin lead, but a cable.) You will also need a 15-1261 video selector switch, and for the computer, we have personally found the most success with the Color Computer.

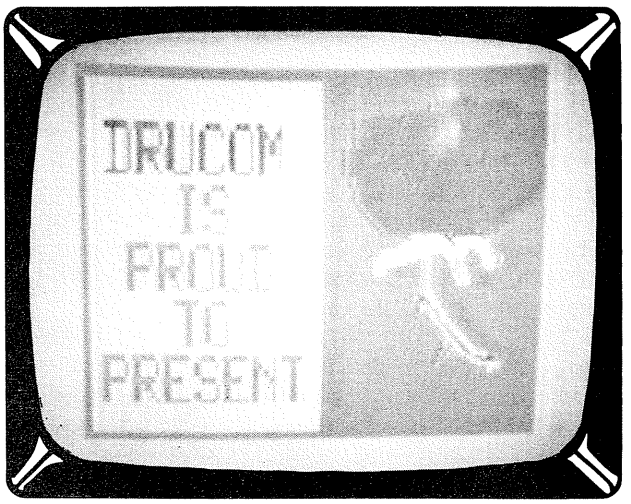
That does not mean that you cannot use any other type of computer. However, it does mean that if you choose another type, you'll have to address the problem of adapting an RF modulator to your computer. An RF modulator is a device which will take your composite output from your computer and modulate it on channel 3 or 4 (usually) so that you can input it directly into a television as opposed to a monitor. We will not detail how to do that in this article.

With the Color Computer all you do is run the computer output cable into one of the auxiliary inputs in the video switch. You can then simply toggle back and forth between your titles or recorded media and your camera.

SOFTWARE

That link being established, let's talk about Software. We recommend that you go out and buy Radio Shack's Art Gallery Program (Cat. No. 26-3061). This is an exciting program that allows you to draw color pictures on the screen and save them to tape. You can also create texts that can either be inserted over existing pictures or (if you have 16K) can scroll horizontally or vertically across your screen. The program is supplied with several sample art screens in a demonstration of the possible creations that you can make. You can superimpose text upon the screens provided or over those you

have created yourself. The program also includes a template which fits nicely over the color computer keyboard, outlining which of your keys are used for which commands and colors when using Art Gallery. We have created several screens with Art Gallery which we use to introduce our own videotape efforts, a sample of which you will find below. In this manner you can add titles, credits, and insert commentary to your personal video efforts.



Another piece of hardware-with-a-program which we have found interesting and useful is the X-PAD for the Color Computer (Cat. No. 26-1196) which allows you to take a sensing pen and work from a drawing board. The results which you see on the board will be reflected on the screen of the Color Computer (very nice for ISOs etc).

Something else you might try with the Color Computer is called Micro Painter (Cat. No. 26-3077), in which you load a picture into the computer and "paint" it with three different palettes of four colors each. Saving the results on tape affords you the opportunity to use these screens in your videotape work.

WETWARE

Imagination is the most important part of any endeavor. Your objective in creating these screens is to try and present as much variety in your tapes as possible. This insertion of screens, titles, commentary and color will help make your films more interesting and help to take your efforts somewhat out of the "home movie" class and move it a little closer to the "professionally prepared" class.

Just as variety of angles and lighting are important when you're using the camera, remember that variety is just as important when using your computer. While you cannot have variety of angle or closely controlled lighting in your computer, you can control background color. Psychologists proved long ago that colors influence mood. We suggest you study up on and use this technique in your films. Remember in your filming that greens are soothing and reds are exciting. Create a mood with colors on an originally drawn screen to be inserted in your videotape. With this technique you can turn a simple family gathering into an exciting and rewarding film that will be fun both to create and to watch!

Aha! Let's recall that with videotape machines you not only have the picture to worry about, but the option of including sound as well! What to do about audio? When you want to tape the family picnic in the park what do you do about mobile audio, so that your efforts sound as good as they look?

For outdoor use, we use the Cardioid Dynamic Microphone (Cat. No. 33-1071), because it is protected against wind noise and the like. We have solved the hardware problem of mobile audio mixing by combining a Four Channel Microphone Mixer (Cat. No. 32-1105) with an Electronic Reverb Unit (Cat. No. 32-1110). Since portability is of primary importance when working outdoors we mounted them on the back of our camera bag using Velcro. Since these are both battery operated items we can take them anywhere we go. We can mix up to eight inputs with the microphone mixer going into the reverb unit and mix yet another microphone with level control going into a reverb unit with a line going in as well. This works very well for us and provides us surprising versatility.

For sound effects, you might want to invest in records (you can buy an entire sound effects library in most record stores), and for outdoor filming you might want to transfer some of the sounds to tape loops. We also carry among our portable equipment a small AM/FM radio-type device with which we can insert background music.

All right, now that we're all set up to make exciting videotapes, let's talk about the VCR as a mass storage device which can be used in place of a disk.

Sometimes we have a need to store great quantities of data, and it becomes truly inconvenient for us to take thirty different ten minute cassettes to dump onto a hard or floppy disk. It would become convenient to dump this quantity of data out to the VCR. There are several ways to do this.

The first and most obvious is to simply connect the audio input of the VCR to the audio output of the tape recorder cable and then simply do a CSAVE.

You can use a more sophisticated technique, if you can create a machine language program whereby you redirect input from the disk to the cassette port directly rather than have it go into memory and then out again. All you do is look at one input. (Please refer to our previous article where we discussed looking at ports and writing to ports. You'd be doing the same thing, but the cassette port is 255 in most cases.) The location of the info coming from your disk is dependent on your machine. So you'll have to refer to your technical manual to find out where to look for the info, but once you've found it you simply move it out to the cassette port, thereby storing massive quantities of data at fairly high baud rates. Thus you have found yet another way to interface between your computer and your videotape equipment.

THE NEWS FROM PLUMB

We hope you recall that last month we introduced *PLUMB*, a brand new newsletter published for Bulletin Board aficionados. *PLUMB* can be obtained by writing to Riverside Data Inc at P.O. Box 300, Harrods Creek, KY 40027 or inquiries can be made through CompuServe account 72715,210 or The Source account #STQ007. Here's some more news for you about Bulletin boards from our friends at *PLUMB*.

New Jersey board callers don't despair! Aphrodite East in Northern New Jersey, which had shut down for revamping, has gone back online. You may establish a new account number with the Sysops and join in on their varied discussion

groups or special interest club. Contact their small corner of Olympus at 201-790-5910.

Here's an easy way to keep up with the latest news in arcade video games. Coin Games Net, 213-336-5535, is owned and operated by Amusement World arcades in Los Angeles. The board lists what's out and what's coming in the race to gobble your quarters. The board also contains a list of computer stores and products, a download section for computers, movie reviews, and message exchange board.

Joke Byte in Atlantic City is stuffed with ethnic, sexist and generally pretty awful humor. Sysop Rob, a TV producer, said he started a humor board because, "With all this number crunching going on, I thought some humor would be a nice change." Joke Byte's number is 609-927-5922.

Once again our thanks go to Ric Manning for his permission to use these excerpts from *PLUMB* magazine. If you know of any interesting bulletin boards that you feel should be highlighted in *PLUMB*, please write to us here at Communications Corner, and we'll forward the information on to Ric.

THE CORNER MAILBOX

. . . I have a Model III and a Model II. I wonder if it is possible to move a BASIC program written for the Model III over to the Model II, and if so, how this may be accomplished.

John Clark
Montgomeryville, Pa

Dear John,

There are two ways to accomplish this. The easiest is of course to get yourself a Communications Package (Cat. No. 26-1146) for your Model III and send your ASCII (it MUST be in ASCII) program to the Model II. There is also another program called Assembly Language Development System (26-4712) for the Model II which includes Model I and III diskettes. This package contains software for file transfers of non-ASCII material between Model II and Models I/III.

Should you desire not to purchase any software, please refer to your Model III manual regarding device re-routing which we mentioned in a previous article. Please note that this must be done by POKEing source and destination locations into the proper RAM vectors on the Model III. A Null modem must be used between the two machines. This may be either purchased from Radio Shack (Cat. No. 26-1496), or you may construct a cable as outlined in our June article. The only thing left to do is to activate the terminal program in your Model II as described in the manual.

We are using a Model 16 . . . to send news releases and feature stories to several newspapers . . . The [ENTER] on the Model 16 does not register as such in the receiving computers . . . Do you know of any commands or methods of making the Model 16 communicate a carriage return in ASCII? I understand most of the computers we will be servicing in the newspapers are based on the old TTS six-level paper-punch tape languages.

Dan M. Crummett
Stillwater, OK

Dear Dan,

The Model 16 is quite capable of sending an [ENTER] or carriage return which is translated as an 0DHex. In the TRS-80 series of computers an 0A or line feed is also sent. Perhaps the receiving computer needs only one, not two. In the sample text you sent me, I see a line-wrap character which would indicate to me that in fact the receiving computer might be looking for some other character. In addition to this, it would be far better for you to pre-format your text with a word processor such as Scripsit, but you must enter a carriage return from your keyboard at the physical end of each line. This will ensure that your text is formatted in whatever way you prefer. Be sure that you are not using Scripsit's compressed form rather than it's ASCII form. We have made the mistake of doing that while sending this column to Microcomputer News and found that we had a problem similar to yours. The way we solved the problem was by hard-coding the carriage return as described above and then using the Convert Utility in Scripsit to turn the article into ASCII. Upon completion of that task, if you instruct your Model 16 to "LIST Filename, A(SCII) you should see the text in the form you want it in. Should you still have problems, please send us a sample (in single sided Model II format, please) of the data in the form in which you transmit.

That will do it for this month. Please feel free to write to us with any questions you may have. Happy Communicating!

MAGAZINES

Below are five magazines of speical interest to TRS-80 owners that we believe have editorial content of high quality and will be of use to our customers.

Basic Computing—The TRS-80
User Journal (Name change for
80-US Journal—covers all TRS-80's)
3838 South Warner Street
Tacoma, WA 98409
(206)475-2219

Color Computer Magazine
Highland Hill
Camden, ME 04843
(207)236-9621

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

Rainbow (Covers the TRS-80 Color Computer)
5803 Timber Ridge Dr.
Prospect KY 40059
(502)228-4492

two/sixteen magazine
P.O. Box 1216
Lancaster, PA 17603
(717)397-3364

PROSORT: A New Profile Enhancement

The small Computer Company
P.O. Box 2910
Fort Worth, TX 76113-2910
By Ivan Sygoda, Director, Pentacle

The word "enhancement" hardly describes the sophisticated, new sort utilities now available for the Model II/12 and the Model III Profile systems. Model II/12 users can purchase the Prosort enhancement through Radio Shack. Model III users get it free with Profile LDOS, where it isn't called Prosort or any other fancy name. It's just there. (Model III floppy users will have to write Santa for a hard disk.)

SORT OF WONDERFUL

Whatever it's called, it's amazing. The sales people at your local Radio Shack will tell you that it offers greater flexibility and convenience in manipulating your new or existing data bases. (Yes, all your Profile formats and data segments are compatible with Prosort.) But most important, it profoundly changes the way you conceive of and organize your file.

Briefly, Prosort lets you set up and store up to five print indexes, called USERFILE/IY1 to 5. These new indexes are parallel to the inquiry index (USERFILE/IX1), with which you're already familiar. The sort and select procedures used in setting up each index are a "super-version" of Profile's extended selection. You can sort by up to five fields, with any or all of the last four in descending order. What's more, the sort can be performed on the fields in any one data segment in your file, not just on the key segment. Finally—and this is the key to Prosort's infinite flexibility—you can make an index from an index. This means that you can bridge data segments to pick records and put them in order.

FREE AT LAST

Model II users will especially appreciate being freed from the tyranny of their 85-character key segment. (Model III Profile allows a full 255 bytes in segment 1.)

For example, you can sort a file by state, and within each state you can have the people who ordered your widgets ranked in descending order, based on number of widgets they bought. In case of ties, the records can be sorted alphabetically.

You can also sort a file by telephone area code, which you might have stored in segment two, assigning the extension /IY1 to this index. Then, using it as input, you can create index two, sorting this time by name, a segment one field. This gives you a listing organized alphabetically within each area code. You might then create a third index, using index two as the input and selecting only those records that match a certain criterion from segment four—all customers who purchased more than $400 worth of widgets, for instance. You then print a report directly from index three. This report would show major widget purchasers, listed alphabetically within area code; it may save your telephone salespeople a lot of time and effort.

You can also search through and sort larger files than before because Prosort uses all available disk space. Plus, you can do mass operations off an index. This means, for instance, that you can recalculate math formulas for an indexed selection of records.

HOW DOES IT WORK?

The chart illustrates the various pathways a Profile user can take through Prosort. You begin by indicating which of your data segments you want to use. Then, you specify whether you are creating an inquiry index (always USERFILE/IX1) or one of the five new print indexes. In either case, any existing inquiry or print index can be the foundation for the new index. Or else, by pressing [ENTER] the whole file is used as is, in record number order, as the starting point.

The screen then shows you the fields from the segment you picked, and allows you to sort by up to five of them. For each field, you specify the sort field length and, except for the main sort field when building USERFILE/IX1, whether the sort should be in descending order. Alternately, pressing [ESC] (Model II/12) or [CLEAR] (Model III) at the beginning of the sort process skips this function entirely; records will be in record number order or in the order of the input index.

Select allows you to name up to 16 fields. The program then lists the selected fields on the screen. As shown in the chart, you then fill in the Boolean logic involved for each selection (equal to, greater than, etc.) and the match string—the value (name, phone number, etc.) you want the computer to find. Indicate "and/or" pairings in the leftmost column. The selection process can be bypassed altogether by pressing [ESC] or [CLEAR] to select all sorted records.

DO IT AGAIN

You are then returned to the menu, either the Profile menu or your user menu. This is one way Prosort gives you such flexibility. You can go back into Prosort to make indexes from your index. You can make an inquiry index from any one of your print indexes and go into Inquire, Update, Add,

perhaps to perform a mass operation. Plus, you can print reports, labels, special forms, even Scripsit selections directly from a print index!

The more records you have in your file, the more you'll come to depend on Prosort's capabilities because of the time and effort it saves. Sorting takes time, even at machine language speed. With Prosort, an array of complicated and lengthy sort indexes are always at your fingertips, ready to scan or print at the touch of a few keys.

WHAT'S ON THE MENU?

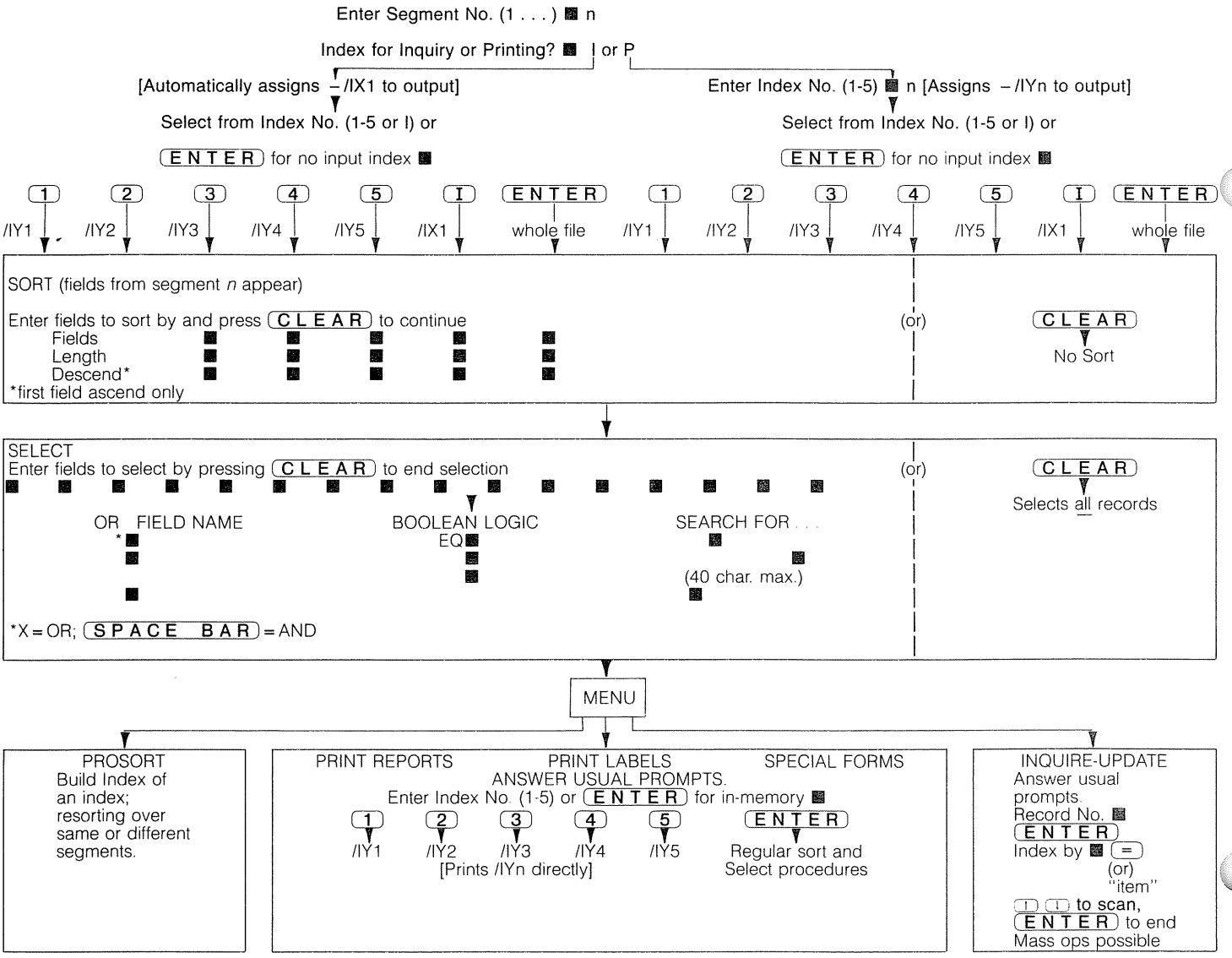
I said above, that Prosort represents a sort (ahem!) of revolution in Profile file management. You'll see this if you have user menus, and then acquire Prosort (or Profile LDOS). You used your user menus to automate the sort and selection processes needed to run off your various reports and labels. Now, after Prosort, you'll find that you can store the results of these sorts and selections in indexes. And so your user menus will call indexes instead. Your work will go much faster.

Of course, your indexes will have to be updated whenever you add, delete, or update records. But this process can be automated just the way you may have already automated the rebuilding of your inquiry index (formerly "user index"). This is what I've done with my SPONSTAT dance presenter data base. By creating a DO file, I can automatically update my three main print indexes (zip, contact name, institution), one right after the other, with one keystroke from my user menu. Then I have a cup of coffee while Profile does all the work.

PROFILE Editor's Note: This is Mr. Sygoda's tenth article in a series of 'how-to' Profile articles. Other articles in the series will be published over the next few issues in this column. We hope that you enjoy this feature, and we look forward to your comments and questions on Profile.

Pentacle is a New York City-based non-profit service organization specializing in administrative services for performing art groups.

PROFILE FLOWCHART



PC-2 Assembly Language–Part 4

By Bruce Elliott

This is the fourth in a series of articles which describe the MPU (microprocessor unit) used in the Radio Shack PC-2 pocket computer. It is our intention to include specific information about the 8-bit CMOS microprocessor, the machine code used by the microprocessor, as well as information about the PC-2 memory map, and certain ROM calls which are available. Please realize that much of what we are talking about refers to the overall capabilities of the MPU, and does not imply that all of these things can be done with a PC-2.

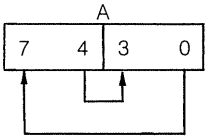
The information provided in these articles is the only information which is available. We will try to clarify any ambiguities which occur in the articles, but can not reply to questions outside the scope of these articles. Further, published copies of *TRS-80 Microcomputer News* are the only source of this information, and we will not be maintaining back issues. Parts One, Two and Three of this series were published in the March, April, and May 1983 issues, respectively.

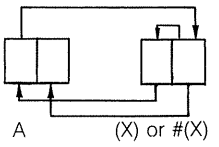
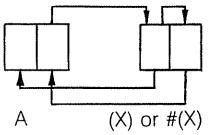
The first three articles described the MPU used in the PC-2, including information on the MPU's structure and its machine language. We also gave you details on the PC-2 memory map and the locations of ROM routines which are available. In this article we will present two lists which we hope will make finding a particular machine language instruction easier. We will also provide some information on how you might begin to use the information we have published.

ALPHABETIC OP-CODE LIST

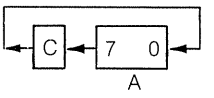
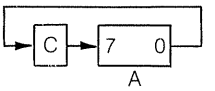
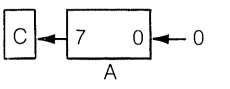
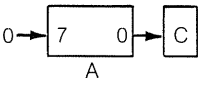
The following list presents the PC-2 machine language instructions alphabetically along with each code's symbolic operation and its hex op-code, and byte count.

Parts two and three of this series presented the same information arranged according to function and provided details on how the instructions work.

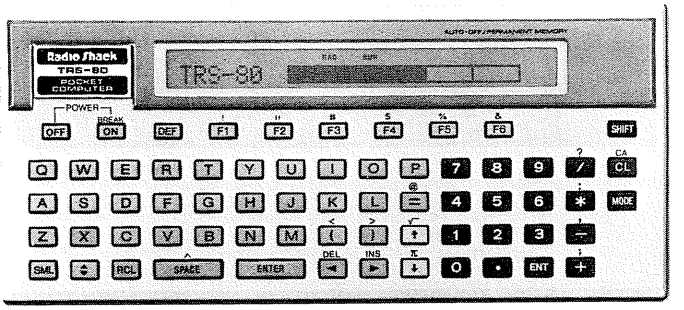
Mnemonic	Symbolic Operation	Hex Op-Code	Byte
ADC #(ab)	A + #(ab) + C → A	FD A3 a b	4
ADC #(U)	A+ #(U) + C → A	FD 23	2
ADC #(X)	A+ #(X) + C → A	FD 03	2
ADC #(Y)	A+ #(Y) + C → A	FD 13	2
ADC (ab)	A + (ab) + C → A	A3 a b	3
ADC (U)	A + (U) + C → A	23	1
ADC (X)	A + (X) + C → A	03	1
ADC (Y)	A + (Y) + C → A	13	1
ADC UH	A + UH + C → A	A2	1
ADC UL	A + UL + C → A	22	1
ADC XH	A + XH + C → A	82	1
ADC XL	A + XL + C → A	02	1
ADC YH	A + YH + C → A	92	1
ADC YL	A + YL + C → A	12	1
ADI #(ab),i	#(ab) + i → #(ab)	FD EF a b i	5
ADI #(U),i	#(U) + i → #(U)	FD 6F i	3
ADI #(X),i	#(X) + i → #(X)	FD 4F i	3
ADI #(Y),i	#(Y) + i → #(Y)	FD 5F i	3
ADI (ab),i	(ab) + i → (ab)	EF a b i	4
ADI (U),i	(U) + i → (U)	6F i	2
ADI (X),i	(X) + i → (X)	4F i	2
ADI (Y),i	(Y) + i → (Y)	5F i	2
ADI A,i	A + i + C → A	B3 i	2
ADR U	UL + A → UL	FD EA	2
ADR X	XL + A → XL	FD CA	2
ADR Y	YL + A → YL	FD DA	2
AEX		F1	1
AM0	A → Timer (0-7) 0 → Timer (8)	FD CE	2
AM1	A → Timer (0-7) 1 → Timer (8)	FD DE	2
AND #(ab)	A ∧ #(ab) → A	FD A9 a b	4
AND #(U)	A ∧ #(U) → A	FD 29	2
AND #(X)	A ∧ #(X) → A	FD 09	2
AND #(Y)	A ∧ #(Y) → A	FD 19	2
AND (ab)	A ∧ (ab) → A	A9 a b	3
AND (U)	A ∧ (U) → A	29	1
AND (X)	A ∧ (X) → A	09	1
AND (Y)	A ∧ (Y) → A	19	1
ANI #(ab),i	#(ab) ∧ i → #(ab)	FD E9 a b i	5
ANI #(U),i	#(U) ∧ i → #(U)	FD 69 i	3
ANI #(X),i	#(X) ∧ i → #(X)	FD 49 i	3
ANI #(Y),i	#(Y) ∧ i → #(Y)	FD 59 i	3
ANI (ab),i	(ab) ∧ i → (ab)	E9 a b i	4
ANI (U),i	(U) ∧ i → (U)	69 i	2
ANI (X),i	(X) ∧ i → (X)	49 i	2
ANI (Y),i	(Y) ∧ i → (Y)	59 i	2
ANI A,i	A ∧ i → A	B9 i	2
ATP	A → Data Bus	FD CC	2
ATT	A → T	FD EC	2
BCH+i	P + i → P	8E i	2
BCH –i	P – i → P	9E i	2
BCR+ i	if C=0, P + i → P	81 i	2
BCR– i	if C=0, P – i → P	91 i	2
BCS+ i	if C=1, P + i → P	83 i	2
BCS– i	if C=1, P – i → P	93 i	2

Mnemonic	Symbolic Operation	Hex Op-Code	Byte
BHR+ i	if H=0, P + i → P	85 i	2
BHR– i	if H=0, P – i → P	95 i	2
BHS+ i	if H=1, P + i → P	87 i	2
BHS– i	if H=1, P – i → P	97 i	2
BII #(ab),i	#(ab) ∧ i → Z	FD ED a b i	5
BII #(U),i	#(U) ∧ i → Z	FD 6D i	3
BII #(X),i	#(X) ∧ i → Z	FD 4D i	3
BII #(Y),i	#(Y) ∧ i → Z	FD 5D i	3
BII (ab),i	(ab) ∧ i → Z	ED a b i	4
BII (U),i	(U) ∧ i → Z	6D i	2
BII (X),i	(X) ∧ i → Z	4D i	2
BII (Y),i	(Y) ∧ i → Z	5D i	2
BII A,i	A ∧ i → Z	BF i	2
BIT #(ab)	A ∧ #(ab) → Z	FD AF a b	4
BIT #(U)	A ∧ #(U) → Z	FD 2F	2
BIT #(X)	A ∧ #(X) → Z	FD 0F	2
BIT #(Y)	A ∧ #(Y) → Z	FD 1F	2
BIT (ab)	A ∧ (ab) → Z	AF a b	3
BIT (U)	A ∧ (U) → Z	2F	1
BIT (X)	A ∧ (X) → Z	0F	1
BIT (Y)	A ∧ (Y) → Z	1F	1
BVR+ i	if V=0, P + i → P	8D i	2
BVR– i	if V=0, P – i → P	9D i	2
BVS+ i	if V=1, P + i → P	8F i	2
BVS– i	if V=1, P – i → P	9F i	2
BZR+ i	if Z=0, P + i → P	89 i	2
BZR– i	if Z=0, P – i → P	99 i	2
BZS+ i	if Z=1, P + i → P	8B i	2
BZS– i	if Z=1, P – i → P	9B i	2
CDV	0 → Divider	FD 8E	2
CIN	A – (X), X+1 → X	F7	1
CPA #(ab)	A – #(ab)	FD A7 a b	4
CPA #(U)	A – #(U)	FD 27	2
CPA #(X)	A – #(X)	FD 07	2
CPA #(Y)	A – #(Y)	FD 17	2
CPA (ab)	A – (ab)	A7 a b	3
CPA (U)	A – (U)	27	1
CPA (X)	A – (X)	07	1
CPA (Y)	A – (Y)	17	1
CPA UH	A – UH	A6	1
CPA UL	A – UL	26	1
CPA XH	A – XH	86	1
CPA XL	A – XL	06	1
CPA YH	A – YH	96	1
CPA YL	A – YL	16	1
CPI A,i	A – i	B7 i	2
CPI UH,i	UH – i	6C i	2
CPI UL,i	UL – i	6E i	2
CPI XH,i	XH – i	4C i	2
CPI XL,i	XL – i	4E i	2
CPI YH,i	YH – i	5C i	2
CPI YL,i	YL – i	5E i	2
DCA #(U)	A + #(U) + C → A	FD AC	2
DCA #(X)	A + #(X) + C → A	FD 8C	2
DCA #(Y)	A + #(Y) + C → A	FD 9C	2
DCA (U)	A + (U) + C → A	AC	1
DCA (X)	A + (X) + C → A	8C	1
DCA (Y)	A + (Y) + C → A	9C	1
DCS #(U)	A – #(U) – $\overline{C}$ → A	FD 2C	2
DCS #(X)	A – #(X) – $\overline{C}$ → A	FD 0C	2
DCS #(Y)	A – #(Y) – $\overline{C}$ → A	FD 1C	2
DCS (U)	A – (U) – $\overline{C}$ → A	2C	1
DCS (X)	A – (X) – $\overline{C}$ → A	0C	1
DCS (Y)	A – (Y) – $\overline{C}$ → A	1C	1
DEC A	A – 1 → A	DF	1
DEC U	U – 1 → U	66	1
DEC UH	UH – 1 → UH	FD 62	2
DEC UL	UL – 1 → UL	62	1
DEC X	X – 1 → X	46	1
DEC XH	XH – 1 → XH	FD 42	2
DEC XL	XL – 1 → XL	42	1
DEC Y	Y – 1 → Y	56	1
DEC YH	YH – 1 → YH	FD 52	2
DEC YL	YL – 1 → YL	52	1
DRL #(X)		FD D7	2
DRL (X)		D7	1
DRR #(X)		FD D3	2
DRR (X)		D3	1
EAI i	A ⊕ i → A	BD i	2
EOR #(ab)	A ⊕ #(ab) → A	FD AD a b	4
EOR #(U)	A ⊕ #(U) → A	FD 2D	2
EOR #(X)	A ⊕ #(X) → A	FD 0D	2
EOR #(Y)	A ⊕ #(Y) → A	FD 1D	2
EOR (ab)	A ⊕ (ab) → A	AD a b	3
EOR (U)	A ⊕ (U) → A	2D	1
EOR (X)	A ⊕ (X) → A	0D	1
EOR (Y)	A ⊕ (Y) → A	1D	1
HLT		FD B1	2
INC A	A + 1 → A	DD	1
INC U	U + 1 → U	64	1
INC UH	UH + 1 → UH	FD 60	2
INC UL	UL + 1 → UL	60	1
INC X	X + 1 → X	44	1
INC XH	XH + 1 → XH	FD 40	2
INC XL	XL + 1 → XL	40	1
INC Y	Y + 1 → Y	54	1
INC YH	YH + 1 → YH	FD 50	2
INC YL	YL + 1 → YL	50	1
ITA	IN → A	FD BA	2
JMP i,j	i → PH, j → PL	BA i j	3
LDA #(ab)	#(ab) → A	FD A5 a b	4
LDA #(U)	#(U) → A	FD 25	2
LDA #(X)	#(X) → A	FD 05	2
LDA #(Y)	#(Y) → A	FD 15	2

Mnemonic	Symbolic Operation	Hex Op-Code	Byte
LDA (ab)	(ab) → A	A5 a b	3
LDA (U)	(U) → A	25	1
LDA (X)	(X) → A	05	1
LDA (Y)	(Y) → A	15	1
LDA UH	UH → A	A4	1
LDA UL	UL → A	24	1
LDA XH	XH → A	84	1
LDA XL	XL → A	04	1
LDA YH	YH → A	94	1
LDA YL	YL → A	14	1
LDE U	(U) → A, U − 1 → U	67	1
LDE X	(X) → A, X − 1 → X	47	1
LDE Y	(Y) → A, Y − 1 → Y	57	1
LDI A,i	i → A	B5 i	2
LDI S,i,j	i → SH, j → SL	AA i j	3
LDI UH,i	i → UH	68 i	2
LDI UL,i	i → UL	6A i	2
LDI XH,i	i → XH	48 i	2
LDI XL,i	i → XL	4A i	2
LDI YH,i	i → YH	58 i	2
LDI YL,i	i → YL	5A i	2
LDX P	P → X	FD 58	2
LDX S	S → X	FD 48	2
LDX U	U → X	FD 28	2
LDX X	X → X	FD 08	2
LDX Y	Y → X	FD 18	2
LIN U	(U) → A, U + 1 → U	65	1
LIN X	(X) → A, X + 1 → X	45	1
LIN Y	(Y) → A, Y + 1 → Y	55	1
LOP UL,i	UL − 1 → UL If borrow = 0, P − i → P	88 i	2
NOP		38	1
OFF	0 → BF	FD 4C	2
ORA #(ab)	A v #(ab) → A	FD AB a b	4
ORA #(U)	A v #(U) → A	FD 2B	2
ORA #(X)	A v #(X) → A	FD 0B	2
ORA #(Y)	A v #(Y) → A	FD 1B	2
ORA (ab)	A v (ab) → A	AB a b	3
ORA (U)	A v (U) → A	2B	1
ORA (X)	A v (X) → A	0B	1
ORA (Y)	A v (Y) → A	1B	1
ORI #(ab),i	#(ab) v i → #(ab)	FD EB a b i	5
ORI #(U),i	#(U) v i → #(U)	FD 6B i	3
ORI #(X),i	#(X) v i → #(X)	FD 4B i	3
ORI #(Y),i	#(Y) v i → #(Y)	FD 5B i	3
ORI (ab),i	(ab) v i → (ab)	EB a b i	4
ORI (U),i	(U) v i → (U)	6B i	2
ORI (X),i	(X) v i → (X)	4B i	2
ORI (Y),i	(Y) v i → (Y)	5B i	2
ORI A,i	A v i → A	BB i	2
POP A	(S + 1) → A, S + 1 → S	FD 8A	2
POP U	(S + 1) → UH, (S + 2) → UL,S + 2 → S	FD 2A	2
POP X	(S + 1) → XH, (S + 2) → XL,S + 2 → S	FD 0A	2
POP Y	(S + 1) → YH, (S + 2) → YL,S + 2 → S	FD 1A	2

Mnemonic	Symbolic Operation	Hex Op-Code	Byte
PSH A	A → (S), S − 1 → S	FD C8	2
PSH U	UL → (S), UH → (S − 1), S − 2 → S	FD A8	2
PSH X	XL → (S), XH → (S − 1), S − 2 → S	FD 88	2
PSH Y	YL → (S), YH → (S − 1), S − 2 → S	FD 98	2
RDP	0 → Display	FD C0	2
REC	0 → C	F9	1
RIE	0 → IE	FD BE	2
ROL		DB	1
ROR		D1	1
RPU	0 → PU	E3	1
RPV	0 → PV	B8	1
RTI	(S + 1) → PH, (S + 2) → PL, (S + 3) → T, S + 3 → S	8A	1
RTN	(S + 1) → PH, (S + 2) → PL, S + 2 → S	9A	1
SBC #(ab)	A − #(ab) − $\overline{C}$ → A	FD A1 a b	4
SBC #(U)	A − #(U) − $\overline{C}$ → A	FD 21	2
SBC #(X)	A − #(X) − $\overline{C}$ → A	FD 01	2
SBC #(Y)	A − #(Y) − $\overline{C}$ → A	FD 11	2
SBC (ab)	A − (ab) − $\overline{C}$ → A	A1 a b	3
SBC (U)	A − (U) − $\overline{C}$ → A	21	1
SBC (X)	A − (X) − $\overline{C}$ → A	01	1
SBC (Y)	A − (Y) − $\overline{C}$ → A	11	1
SBC UH	A − UH − $\overline{C}$ → A	A0	1
SBC UL	A − UL − $\overline{C}$ → A	20	1
SBC XH	A − XH − $\overline{C}$ → A	80	1
SBC XL	A − XL − $\overline{C}$ → A	00	1
SBC YH	A − YH − $\overline{C}$ → A	90	1
SBC YL	A − YL − $\overline{C}$ → A	10	1
SBI A, i	A − i − $\overline{C}$ → A	B1 i	2
SDE U	A → (U), U − 1 → U	63	1
SDE X	A → (X), X − 1 → X	43	1
SDE Y	A → (Y), Y − 1 → Y	53	1
SDP	1 → Display	FD C1	2
SEC	1 → C	FB	1
SHL		D9	1
SHR		D5	1

Mnemonic	Symbolic Operation	Hex Op-Code	Byte
SIE	1 → IE	FD 81	2
SIN U	A → (U), U+1 → U	61	1
SIN X	A → (X), X+1 → X	41	1
SIN Y	A → (Y), Y+1 → Y	51	1
SJP	PL → (S), PH → (S−1), S − 2 → S, i → PH, j → PL	BE i j	3
SPU	1 → PU	E1	1
SPV	1 → PV	A8	1
STA #(ab)	A → #(ab)	FD AE a b	4
STA #(U)	A → #(U)	FD 2E	2
STA #(X)	A → #(X)	FD 0E	2
STA #(Y)	A → #(Y)	FD 1E	2
STA (ab)	A → (ab)	AE a b	3
STA (U)	A → (U)	2E	1
STA (X)	A → (X)	0E	1
STA (Y)	A → (Y)	1E	1
STA UH	A → UH	28	1
STA UL	A → UL	2A	1
STA XH	A → XH	08	1
STA XL	A → XL	0A	1
STA YH	A → YH	18	1
STA YL	A → YL	1A	1
STX P	X → P	FD 5E	2
STX S	X → S	FD 4E	2
STX U	X → U	FD 6A	2
STX X	X → X	FD 4A	2
STX Y	X → Y	FD 5A	2
TIN	(X) → (Y), X+1 → X, Y+1 → Y	F5	1
TTA	T → A	FD AA	2
VCR i	if C=0, PH → (S−1), PL → (S) (FFab) → PH (FFab+1) → PL S − 2 →S	C1 i	2
VCS i	if C=1, PH → (S−1), PL → (S) (FFab) → PH (FFab+1) → PL S − 2 → S	C3 i	2
VEJ (C0)	PL → (S), S−1 → S	C0	1
VEJ (C2)	PH → (S), S−1 → S	C2	1
VEJ (C4)	(FFab) → PH	C4	1
VEJ (C6)	(FFab+1) → PL	C6	1
VEJ (C8)		C8	1
VEJ (CA)		CA	1
VEJ (CC)		CC	1
VEJ (CE)		CE	1
VEJ (D0)		D0	1
VEJ (D2)		D2	1
VEJ (D4)		D4	1
VEJ (D6)		D6	1
VEJ (D8)		D8	1
VEJ (DA)		DA	1
VEJ (DC)		DC	1
VEJ (DE)		DE	1
VEJ (E0)		E0	1
VEJ (E2)		E2	1
VEJ (E4)		E4	1
VEJ (E6)		E6	1
VEJ (E8)		E8	1
VEJ (EA)		EA	1
VEJ (EC)		EC	1
VEJ (EE)		EE	1
VEJ (F0)		F0	1
VEJ (F2)		F2	1
VEJ (F4)		F4	1
VEJ (F6)		F6	1
VHR i	if H=0, PH → (S−1), PL → (S) (FFab) → PH (FFab+1) → PL S − 2 → S	C5 i	2
VHS i	if H=1, PH→ (S−1), PL → (S) (FFab) → PH (FFab+1) → PL S − 2 → S	C7 i	2
VMJ i	PL → (S), S−1 → S PH → (S), S−1 → S (FFab) → PH (FFab+1) → PL	CD i	2
VVS i	if V=1, PH → (S−1), PL → (S) (FFab) → PH (FFab+1) → PL S − 2 → S	CF i	2
VZR i	if Z=0, PH → (S−1), PL→(S) (FFab) →PH (FFab+1) →PL S − 2 →S	C9 i	2
VZS i	if Z=1, PH → (S−1), PL→(S) (FFab) →PH (FFab+1) →PL S − 2 →S	CB i	2



NUMERIC OP-CODE LIST

The following list presents the PC-2 machine language instructions numerically and includes the hex and decimal values for the op-codes. Numeric values which are missing from the list have no valid op-code that we are aware of.

Hex Value	Decimal Value	Opcode
00	00	SBC XL
01	01	SBC (X)
02	02	ADC XL
03	03	ADC (X)
04	04	LDA XL
05	05	LDA (X)
06	06	CPA XL
07	07	CPA (X)
08	08	STA XH
09	09	AND (X)
0A	10	STA XL
0B	11	ORA (X)
0C	12	DCS (X)
0D	13	EOR (X)
0E	14	STA (X)
0F	15	BIT (X)
10	16	SBC YL
11	17	SBC (Y)
12	18	ADC YL
13	19	ADC (Y)
14	20	LDA YL
15	21	LDA (Y)
16	22	CPA YL
17	23	CPA (Y)
18	24	STA YH
19	25	AND (Y)
1A	26	STA YL
1B	27	ORA (Y)
1C	28	DCS (Y)
1D	29	EOR (Y)
1E	30	STA (Y)
1F	31	BIT (Y)
20	32	SBC UL
21	33	SBC (U)
22	34	ADC UL
23	35	ADC (U)
24	36	LDA UL
25	37	LDA (U)
26	38	CPA UL
27	39	CPA (U)
28	40	STA UH
29	41	AND (U)
2A	42	STA UL
2B	43	ORA (U)
2C	44	DCS (U)
2D	45	EOR (U)
2E	46	STA (U)
2F	47	BIT (U)
38	56	NOP
40	64	INC XL
41	65	SIN X
42	66	DEC XL
43	67	SDE X
44	68	INC X
45	69	LIN X
46	70	DEC X
47	71	LDE X
48 i	72 i	LDI XH,i
49 i	73 i	ANI (X),i
4A i	74 i	LDI XL,i
4B i	75 i	ORI (X),i
4C i	76 i	CPI XH,i
4D i	77 i	BII (X),i
4E i	78 i	CPI XL,i
4F i	79 i	ADI (X),i
50	80	INC YL
51	81	SIN Y
52	82	DEC YL
53	83	SDE Y
54	84	INC Y
55	85	LIN Y
56	86	DEC Y
57	87	LDE Y
58 i	88 i	LDI YH,i
59 i	89 i	ANI (Y),i
5A i	90 i	LDI YL,i
5B i	91 i	ORI (Y),i
5C i	92 i	CPI YH,i
5D i	93 i	BII (Y),i
5E i	94 i	CPI YL,i
5F i	95 i	ADI (Y),i
60	96	INC UL
61	97	SIN U
62	98	DEC UL
63	99	SDE U
64	100	INC U
65	101	LIN U
66	102	DEC U
67	103	LDE U
68 i	104 i	LDI UH,i
69 i	105 i	ANI (U),i
6A i	106 i	LDI UL,i
6B i	107 i	ORI (U),i
6C i	108 i	CPI UH,i
6D i	109 i	BII (U),i
6E i	110 i	CPI UL,i
6F i	111 i	ADI (U),i
80	128	SBC XH
81 i	129 i	BCR + i
82	130	ADC XH
83 i	131 i	BCS + i
84	132	LDA XH
85 i	133 i	BHR + i
86	134	CPA XH
87 i	135 i	BHS + i
88 i	136 i	LOP UL,i
89 i	137 i	BZR + i
8A	138	RTI
8B i	139 i	BZS + i
8C	140	DCA (X)
8D i	141 i	BVR + i
8E i	142 i	BCH + i
8F i	143 i	BVS + i
90	144	SBC YH
91 i	145 i	BCR – i
92	146	ADC YH
93 i	147 i	BCS – i
94	148	LDA YH
95 i	149 i	BHR – i
96	150	CPA YH
97 i	151 i	BHS – i
99 i	153 i	BZR – i
9A	154	RTN
9B i	155 i	BZS – i
9C	156	DCA (Y)
9D i	157 i	BVR – i
9E i	158 i	BCH – i
9F i	159 i	BVS – i
A0	160	SBC UH
A1 a b	161 a b	SBC (ab)
A2	162	ADC UH
A3 a b	163 a b	ADC (ab)
A4	164	LDA UH
A5 a b	165 a b	LDA (ab)
A6	166	CPA UH
A7 a b	167 a b	CPA (ab)
A8	168	SPV
A9 a b	169 a b	AND (ab)
AA i j	170 i j	LDI S,i,j
AB a b	171 a b	ORA (ab)
AC	172	DCA (U)
AD a b	173 a b	EOR (ab)
AE a b	174 a b	STA (ab)
AF a b	175 a b	BIT (ab)
B1 i	177 i	SBI i
B3 i	179 i	ADI A,i
B5 i	181 i	LDI A,i
B7 i	183 i	CPI A,i
B8	184	RPV
B9 i	185 i	ANI A,i
BA i j	186 i j	JMP i,j
BB i	187 i	ORI A,i
BD i	189 i	EAI i
BE i j	190 i j	SJP
BF i	191 i	BII A,i
C0	192	VEJ (C0)
C1 i	193 i	VCR i
C2	194	VEJ (C2)
C3 i	195 i	VCS i
C4	196	VEJ (C4)
C5 i	197 i	VHR i
C6	198	VEJ (C6)
C7 i	199 i	VHS i
C8	200	VEJ (C8)
C9 i	201 i	VZR i
CA	202	VEJ (CA)
CB i	203 i	VZS i
CC	204	VEJ (CC)
CD i	205 i	VMJ i
CE	206	VEJ (CE)
CF i	207 i	VVS i
D0	208	VEJ (D0)
D1	209	ROR
D2	210	VEJ (D2)
D3	211	DRR (X)
D4	212	VEJ (D4)
D5	213	SHR
D6	214	VEJ (D6)
D7	215	DRL (X)
D8	216	VEJ (D8)
D9	217	SHL
DA	218	VEJ (DA)
DB	219	ROL
DC	220	VEJ (DC)
DD	221	INC A
DE	222	VEJ (DE)
DF	223	DEC A
E0	224	VEJ (E0)
E1	225	SPU
E2	226	VEJ (E2)
E3	227	RPU
E4	228	VEJ (E4)
E6	230	VEJ (E6)
E8	232	VEJ (E8)
E9 a b i	233 a b i	ANI (ab),i
EA	234	VEJ (EA)
EB a b i	235 a b i	ORI (ab),i
EC	236	VEJ (EC)
ED a b i	237 a b i	BII (ab),i
EE	238	VEJ (EE)
EF a b i	239 a b i	ADI (ab),i
F0	240	VEJ (F0)
F1	241	AEX
F2	242	VEJ (F2)
F4	244	VEJ (F4)
F5	245	TIN
F6	246	VEJ (F6)
F7	247	CIN
F9	249	REC
FB	251	SEC
FD 01	253 01	SBC #(X)
FD 03	253 03	ADC #(X)
FD 05	253 05	LDA #(X)
FD 07	253 07	CPA #(X)
FD 08	253 08	LDX X
FD 09	253 09	AND #(X)
FD 0A	253 10	POP X
FD 0B	253 11	ORA #(X)
FD 0C	253 12	DCS #(X)
FD 0D	253 13	EOR #(X)
FD 0E	253 14	STA #(X)
FD 0F	253 15	BIT #(X)
FD 11	253 17	SBC #(Y)
FD 13	253 19	ADC #(Y)
FD 15	253 21	LDA #(Y)
FD 17	253 23	CPA #(Y)
FD 18	253 24	LDX Y
FD 19	253 25	AND #(Y)
FD 1A	253 26	POP Y
FD 1B	253 27	ORA #(Y)
FD 1C	253 28	DCS #(Y)
FD 1D	253 29	EOR #(Y)

Hex Value	Decimal Value	Opcode
FD 1E	253 30	STA #(Y)
FD 1F	253 31	BIT #(Y)
FD 21	253 33	SBC #(U)
FD 23	253 35	ADC #(U)
FD 25	253 37	LDA #(U)
FD 27	253 39	CPA #(U)
FD 28	253 40	LDX U
FD 29	253 41	AND #(U)
FD 2A	253 42	POP U
FD 2B	253 43	ORA #(U)
FD 2C	253 44	DCS #(U)
FD 2D	253 45	EOR #(U)
FD 2E	253 46	STA #(U)
FD 2F	253 47	BIT #(U)
FD 40	253 64	INC XH
FD 42	253 66	DEC XH
FD 48	253 72	LDX S
FD 49 i	253 73 i	ANI #(X),i
FD 4A	253 74	STX X
FD 4B i	253 75 i	ORI #(X),i
FD 4C	253 76	OFF
FD 4D i	253 77 i	BII #(X),i
FD 4E	253 78	STX S
FD 4F i	253 79 i	ADI #(X),i
FD 50	253 80	INC YH
FD 52	253 82	DEC YH
FD 58	253 88	LDX P

Hex Value	Decimal Value	Opcode
FD 59 i	253 89 i	ANI #(Y),i
FD 5A	253 90	STX Y
FD 5B i	253 91 i	ORI #(Y),i
FD 5D i	253 93 i	BII #(Y),i
FD 5E	253 94	STX P
FD 5F i	253 95 i	ADI #(Y),i
FD 60	253 96	INC UH
FD 62	253 98	DEC UH
FD 69 i	253 105 i	ANI #(U),i
FD 6A	253 106	STX U
FD 6B i	253 107 i	ORI #(U),i
FD 6D i	253 109 i	BII #(U),i
FD 6F i	253 111 i	ADI #(U),i
FD 81	253 129	SIE
FD 88	253 136	PSH X
FD 8A	253 138	POP A
FD 8C	253 140	DCA #(X)
FD 8E	253 142	CDV
FD 98	253 152	PSH Y
FD 9C	253 156	DCA #(Y)
FD A1 a b	253 161 a b	SBC #(ab)
FD A3 a b	253 163 a b	ADC #(ab)
FD A5 a b	253 165 a b	LDA #(ab)
FD A7 a b	253 167 a b	CPA #(ab)
FD A8	253 168	PSH U

Hex Value	Decimal Value	Opcode
FD A9 a b	253 169 a b	AND #(ab)
FD AA	253 170	TTA
FD AB a b	253 171 a b	ORA #(ab)
FD AC	253 172	DCA #(U)
FD AD a b	253 173 a b	EOR #(ab)
FD AE a b	253 174 a b	STA #(ab)
FD AF a b	253 175 a b	BIT #(ab)
FD B1	253 177	HLT
FD BA	253 186	ITA
FD BE	253 190	RIE
FD C0	253 192	RDP
FD C1	253 193	SDP
FD C8	253 200	PSH A
FD CA	253 202	ADR X
FD CC	253 204	ATP
FD CE	253 206	AM0
FD D3	253 211	DRR #(X)
FD D7	253 215	DRL #(X)
FD DA	253 218	ADR Y
FD DE	253 222	AM1
FD E9 a b i	253 233 a b i	ANI #(ab),i
FD EA	253 234	ADR U
FD EB a b i	253 235 a b i	ORI #(ab),i
FD EC	253 236	ATT
FD ED a b i	253 237 a b i	BII #(ab),i
FD EF a b i	253 239 a b i	ADI #(ab),i

HOW DO I USE ALL THIS?

The primary advantage of machine language over BASIC is speed. Your PC-2 has a very complete BASIC so there really isn't a lot of reason to program in machine language unless you are looking for a speed advantage. Let's look at a couple of programs which will demonstrate how fast machine language is compared to BASIC.

What we will do is write a BASIC program which will reverse each graphic point on the PC-2's LCD display. Any point which is black (on) will be turned white (off) and any point which is off will be turned on. We will then show you a similar program in machine language. This should let you compare the speeds of the two languages.

First the BASIC program:

```
200 WAIT 0
210 CLS
220 GCURSOR 3
     : REM SHIFT PRINTING RIGHT SLIGHTLY
230 PRINT "Microcomputer News"
240 FOR I=0 TO 155
     : REM GRAPHIC COLUMNS
250 GCURSOR I
     : REM SET GRAPHIC CURSOR
260 A=POINT I
     : REM STORE COLUMN VALUE
270 B=0
     : REM NEW COLUMN - ALL POINTS OFF
280 FOR J=6 TO 0 STEP -1
     : REM EXAMINE DOTS
290 C=INT(A/2^J)
     : POINT ON OR OFF (1 OR 0)
300 IF C=0 LET B=B+2^J
     : REM TURN ON IF OFF
310 A=A-C*2^J
     : REM GET READY FOR NEXT POINT
320 NEXT J
     : REM DO NEXT DOT
330 GPRINT B;
     : REM PRINT REVERSED COLUMN
340 NEXT I
     : REM DO NEXT COLUMN
350 GOTO 350
```

To use the program, enter it into your PC-2. Change line 230 to print what ever you wish on the LCD. When you run the program, the LCD will be reversed one column at a time from left to right.

Lets look at a machine language program to do the same thing:

```
10 WAIT 0
20 CLS
30 GCURSOR 3
40 PRINT "TRS-80 PC-2"
50 POKE 18409, 72, 118, 74, 0, 5, 189, 255, 65, 78,
     78, 153, 8
60 POKE 18421, 76, 119, 139, 6, 72, 119, 74, 0, 158,
     18, 154
80 CALL 18409
90 NEXT I
```

Looks kind of like a BASIC program doesn't it?

With the PC-2, you will normally use BASIC as a "vehicle" for getting the machine language routine into the computer and then executing it.

Lines 10-40 of this second program look a lot like the first four lines of our first program, and they do the same things—housekeeping and getting something on the LCD so the program can reverse it.

Lines 50 and 60 contain the actual machine code for our program. POKE is a PC-2 command which tells the computer to "poke" values into memory. The first value following POKE (18409 and 18421) tells the computer where in memory to start poking and the remaining values are the values to be POKEd into successive memory locations.

The CALL statement in line 80 tells the PC-2 to "jump" to the memory location specified (18409) and begin executing the program it finds there. If you have the computer jump to a

memory location and the location does not begin a valid program, your PC-2 may freeze or perform in an unpredictable manner.

The GOTO 100 statement in line 100 "freezes" the LCD and lets you see the result of the reversal.

If you have entered and RUN the second program, you should have noticed that your message was printed on the display and then, almost instantly, the LCD was reversed. Quite a bit faster than BASIC's many seconds to reverse the screen.

This second program was copied from pages 62 and 63 of your PC-2 Owner's Manual. Add lines 70 and 90 from those pages to see multiple reversals. I numbered the first program in so that both programs can be in memory at the same time for comparisons of their speed.

DISASSEMBLY

You may be curious about how the machine code in lines 50 and 60 are able to reverse the display. To find out, we need to "disassemble" the machine code. The term "disassemble" means to take the hexadecimal (hex) or decimal values which represent a machine code program and to translate those values into more recognizable assembly language operation codes (op-codes.) Once you have the op-codes you will be better able to understand the logic that makes the program work.

Here is how I went about disassembling the machine code from lines 50 and 60:

1. Find the first value which represents an instruction to the computer. This is the value 72 in line 50. We know that this is a decimal value because a hex value (on the PC-2) is preceded by an '&'.

2. Locate the value 72 in the numeric op-code list. Remember that the decimal values are in the second column. The listing looks like this:

Hex Value	Decimal Value	Op-Code
48 i	72 i	LDI XH,i

The Op-code is LDI XH, i.

3. The 'i' in the op-code tells us that this instruction requires another value to be complete.

4. A quick check in the alphabetic listing gives this listing for LDI XH,i:

Mnemonic	Symbolic Operation	Hex Op-Code	Byte
LDI XH,i	i → XH	48 i	2

Mnemonic is just another word for op-code. The symbolic operation tells us that the value 'i' is stored into 'XH' (the high 8-bits of the 16-bit X register). We already knew the Hex Op-Code. The 'Byte' information tells us that this instruction requires two bytes (two values.)
Since this command requires a second value, we go back to line 50 in the BASIC program and get the next value (118).

5. I now have two values (72 118) which represent an instruction to the computer. The instruction translates as: Load the high portion of the X register with the decimal value 118.

6. I would now go back to line 50, get the next available value (74) and continue with steps 2-5 until I had used all of the available values in lines 50 and 60.

The result of the disassembly is:

Decimal Values	Hex Codes	Op-Code Translation
72 118	48 76	LDI XH, 76H
74 0	4A 00	LDI XL, 00H
5	05	LDA (X)
189 255	BD FF	EAI FFH
65	41	SIN X
78 78	4E 4E	CPI XL, 4EH
153 8	99 08	BZR – 08H
76 119	4C 77	CPI XH, 77H
139 6	8B 06	BZS + 06H
72 119	48 77	LDI XH, 77H
74 0	4A 00	LDI XL, 00H
158 18	9E 12	BCH – 12H
154	9A	RTN

You should have noticed that I included the hex equivalents of the decimal values as I went along, and noticed that I used the hex values in my disassembled list (with an 'H' after those values for clarity.) The reason for doing this is that it will make comparisons with the PC-2 memory map a little easier. Also, most assembly language listings you read will use hex, so now is the time to start getting used to hex codes (if you aren't already.)

The simplest way of getting the hex codes is to get them from the numerical listing of op-codes that was presented earlier in this article.

Great, you say, but what do I do with all of this stuff? We will look at each line of the listing and see if we can make sense of it. To help the process, I am going to give each line a number (starting with 100 and incrementing by 10) to make referring to the lines a little easier.

Line	Decimal	Hex	Op-Code
100	72 118	48 76	LDI XH, 76H
110	74 0	4A 00	LDI XL, 00H
120	5	05	LDA (X)
130	189 255	BD FF	EAI FFH
140	65	41	SIN X
150	78 78	4E 4E	CPI XL, 4EH
160	153 8	99 08	BZR – 08H
170	76 119	4C 77	CPI XH, 77H
180	139 6	8B 06	BZS + 06H
190	72 119	48 77	LDI XH, 77H
200	74 0	4A 00	LDI XL, 00H
210	158 18	9E 12	BCH – 12H
220	154	9A	RTN

Lines 100 and 110 load the X register with the hex value 7600.

Line 120 then tells the computer to load the A register with the value stored in the memory location that the X register is pointing to (7600). A quick glance at the PC-2 memory map (March MCN, pg. 26) shows us that the memory locations beginning at 7600H and continuing to 764DH are part of the PC-2's LCD display. What the computer has done is to look at the first byte of LCD memory (which corresponds to the first column of dots in the main LCD display area) and then place a copy of the value in that location into the MPU's A register.

Line 130 tells the computer to take the value in the A register and exclusive OR (XOR) it with the immediate value FFH. The bit pattern for FFH is: 1111 1111.

The exclusive OR operation compares each bit of the display value (stored in A) with a one bit from the FFH (a solid black, all on, column). If both bits are ones the computer stores a zero (0). If one bit is a one and the other is a zero, the computer stores a one. The net result is that after the EAI (XOR) operation, the A register contains a reversed copy of the original display byte.

Line 140 contains the one byte instruction SIN X. This single instruction tells the computer to take the value which is currently in the A register (our reversed column image) and store that value in the memory location pointed to by the X register.

If you remember (the computer does), this is currently the first byte of LCD RAM. Once the value from A has been stored, the computer will add one to the value currently in the X register.

Let's pause a moment and see what has happened. With only eight bytes of memory we have told the computer where the first column of LCD memory is (7600H), we have made a copy of that column, reversed the copy, stored the result back into the first column of LCD memory (7600H) and we have incremented our counter (the X register) so that it now points to the second column of the LCD. No wonder machine language is so fast!

Line 150 tells the computer to compare the lower 8-bits of the X register with the value 4EH. The computer will set its 'flags' based on whether the value in XL is 4EH or not.

Recall that the X register is pointing to LCD memory. A glance back to the PC-2 memory map shows us that if X contains 764EH, it is pointing just past the end (764DH) of LCD display sections 1 and 3.

Line 160 instructs the computer to examine the flags which were set by the CPI instruction in line 150. If the Z flag is zero (Z = 0), meaning that XL did NOT contain the value 4EH, then the computer is instructed to count backwards eight bytes and continue executing the program from that point. If Z = 1 the computer will continue to the instruction in line 170.

To count back eight bytes the way the computer will do it, we have to understand that the program counter (which is what will be reduced by eight) is already pointing to the first byte of the instruction in line 170. Count back eight from that point. You should have stopped on the 05H in line 120. The computer would continue executing instructions beginning with line 120.

What the programmer did was to create a loop. The purpose of the loop is to have the computer move one byte at a time through the memory of LCD chips 1 and 3 (7600H - 764DH) reversing each byte in memory as the computer comes to them.

Line 170 tells the computer that if the value in XL was 4EH (from the test and compare in lines 150 and 160), then test the value in XH (the upper 8-bits of X) to see if a 77H is present. The first time the computer executes line 170 the value in XH will be a 76H (put there in line 100.)

Line 180 tells the computer to move its program counter forward six bytes if the value in XH WAS a 77H. Remembering that the program counter is currently pointing to the first byte in line 190, adding six would move the pointer forward to the single byte in line 220.

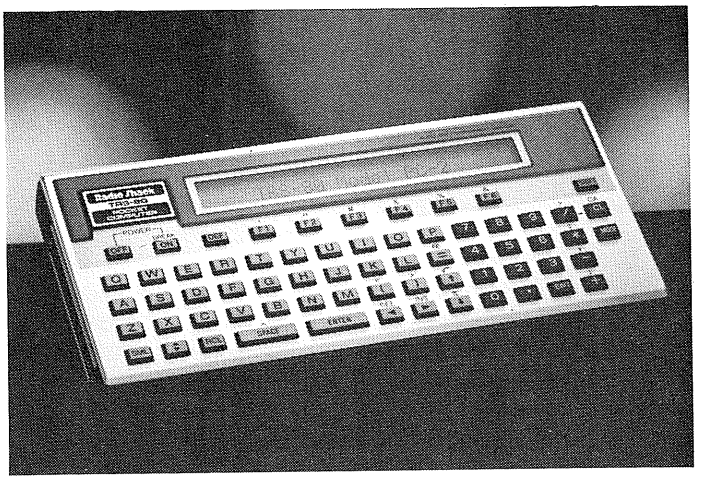
Line 190 is executed only if the value XH was not a 77H.

Line 200 will put a 00H into XL. A quick glance at the memory map shows us that 7700H if the first byte of LCD display memory for chips 2 and 4.

Line 210 tells the computer to subtract 12H (18 decimal) from its current program counter value. Since the program counter would be pointing at the 9AH in line 220, moving back 18 decimal would make the program counter point to line 120 again.

We already know that this will cause the computer to move through this new section of LCD memory (starting at 7700H this time) until the value in XL reaches 4EH. When XL reaches 4EH (this would be the second time), the computer would find 77H in XH (line 170) and the program counter would be moved forward to point at line 220 (line 180).

Line 220 is very important in any program which began by BASIC executing a CALL command. If you will look back to the BASIC program which loaded the machine code into memory, you will find the CALL command in line 80. The purpose of the RTN instruction in line 220 of our machine language program is to return control of the computer to BASIC and the program which contained the CALL command. If you forget to do this, you may have to push the ALL RESET button on the back of the PC-2 to regain control of the computer.



Ferro-Cardano Equations for the Pocket Computer

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Having purchased a TRS-80 Pocket Computer and gone through the usual experiments and games, I decided to test its power by programming something "hard and useful". After thinking about it a while I settled on the Ferro-Cardano-Ferrari equations for the solutions of cubic and quartic equations. For good measure I threw in quadratic equations. (First degree equations are trivial, while fifth degree and beyond require different methods.)

The equations I implemented come straight out of the *CRC Handbook of Tables for Mathematics*, revised fourth edition of 1975, CRC Press, pages 129-132. Because of the need to provide for input and output routines, it took some time and juggling to get everything to fit into the pocket TRS-80; but I finally managed to do this, as shown by Listing 1. In the form shown by Listing 1 the program has 23 locations free. A little bit of combining statements, using smaller statement numbers, etc., would probably reduce the program length by another 50-100 locations; but I got tired of playing with it, since it worked well enough for my purposes.

A subroutine tree (hierarchy) diagram is shown in Figure 1. The basic structure of the program is that of: (1) a main or driving program, which accepts input and drives the subroutines; (2) three subroutines to perform the quadratic, cubic and quartic computations; (3) two output routines, one for real roots, one for complex; and (4) a very short (three line) driver for the cubic case. One logical inconsistency is that the routine performing the quartic calculations also outputs the results, whereas the other two computational routines do not have output statements (indeed this is the purpose of the three line cubic driver). The numbers above the boxes in Figure 1 are the starting line numbers (left hand side), the number of statement lines in the routine (right hand side), and the number of these statements which are REM statements (right hand side in parenthesis).

As a check case for the program I provide the equation:

$$X^4 - 3X^3 + 2X^2 + 2X - 4 = 0$$

which has solutions

$$2,\ -1,\ 1 \pm i$$

Listing 2 shows the actual printer output when the above equation is entered into the program. Note that the solutions come out exact, except that the real part of the complex solutions is off by one part in 10^6 Perhaps it should also be mentioned that the computer's display output is more annotated than the printer output because of the use of PAUSE statements.

A check case for cubics is provided in the reference. I provide here another one:

$$X^3 - 2X^2 - X + 2 = 0$$

which has solutions

$$-1,\ 1,\ 2$$

Readers who are used to essentially instantaneous responses from a computer will be somewhat surprised how long it takes the pocket TRS-80; about twelve seconds for the quartic of equation (1).

After having programmed up and verified your version of this program, here is a fun problem for you: What fraction of quartic equations having coefficients ± 1 (or 0, ± 1) have at least one real root?

HISTORICAL EPILOGUE OF FERRO-CARDANO-FERRARI EQUATIONS

Although at the present time the Ferro-Cardano-Ferrari Equations have a greater historical than practical significance, the discovery by Scipio Ferro of the equations for the solution of the cubic equation (ca. 1505) marks one of the important milestones in the renaissance of western mathematics. The equations for the fourth-degree equation were obtained by Ferrari at a somewhat later date. Both solutions were published by Cardano, under controversial circumstances, 1545.

The discovery of more general, and under some circumstances superior, algorithms has reduced the practical importance of this set of equations. However, these more general algorithms are of an iterative nature and are probably unsuitable for pocket computers employing interpretive higher-order language (because of the high overhead involved).

```
1Ø REM 2-3-4-DEGREE EQNS
2Ø INPUT "DEGREE EQN?",N
3Ø IF N<2 THEN 2Ø
4Ø IF N>4 THEN 2Ø
6Ø INPUT "COEFFS (HIGH 1ST):",E
7Ø FOR I=N TO 1 STEP -1
8Ø INPUT "NEXT:",A(I)
85 A(I)=A(I)/E
     : NEXT I
95 IF N=3 THEN 2ØØ
97 IF N=4 THEN 5ØØ
1Ø2 GOSUB 12Ø
     : GOSUB 17Ø
1Ø6 IF J=Ø GOSUB 18Ø
1Ø8 GOTO 2Ø
12Ø E=B*B-4*A
     : G=SQR(ABS (E))
13Ø F=.5
     : J=2
135 IF E<Ø THEN 155
14Ø X=(-B+G)*F
     : Y=X-G
147 Z=X
     : RETURN
155 X=-B*F
     : Y=ABS(G*F)
16Ø J=Ø
     : RETURN
17Ø IF J=Ø RETURN
171 BEEP 1
     : IF J=4 THEN 176
172 PRINT "1ST REAL RT.",Z
173 IF J=1 RETURN
174 PRINT "2ND REAL RT.",Y
175 IF J=2 RETURN
176 PRINT "3RD REAL RT.",X
177 IF J=3 RETURN
178 PRINT "4TH REAL RT.",Y
179 RETURN
18Ø BEEP 2
182 PAUSE "2 COMPLEX ROOTS"
185 PRINT "REAL PART",X
19Ø PRINT "IMAG.=+/-",Y
195 RETURN
2ØØ GOSUB 3ØØ
     : GOSUB 17Ø
212 IF J=1 GOSUB 18Ø
```

```
23Ø GOTO 2Ø
3ØØ REM 3-DEGREE
3Ø5 E=(3*B-C*C)/3
31Ø F=(2*C*C*C-9*B*C+27*A)/27
315 G=F*F/4+E*E*E/27
32Ø IF G<Ø THEN 4ØØ
33Ø H=SQRG
    : P=H-F/2
335 Q=SGN (P)*(ABS (P))^(1/3)
34Ø P=-H-F/2
345 R=SGN (P)*(ABS (P))^(1/3)
35Ø Z=Q+R-C/3
355 X=-(R+Q)/2-C/3
36Ø Y=ABS ((R-Q)*SQR3/2)
37Ø J=1
    : RETURN
4ØØ H=(F*F/4+ABS(G))^(1/6)
41Ø DEGREE
    : T=9Ø
415 IF F<>Ø LET T=ATN (-2*SQR-G/F)
42Ø IF T<Ø LET T=18Ø+T
425 S=2*H*COS (T/3)
43Ø X=S-C/3
435 U=H*SIN (T/3)*SQR3
44Ø Y=-S/2+U-C/3
    : Z=Y-2*U
45Ø J=3
    : RETURN
5ØØ A(27)=A
    : A(28)=B
    : A(29)=C
515 E=D*B-4*A
517 F=4*A*C-A*D*D-B*B
518 A=F
    : B=E
    : C=-C
52Ø GOSUB 3ØØ
525 A=A(27)
    : B=A(28)
    : C=A(29)
535 P=D*D/4-C+Z
54Ø S=3*D*D/4-P-2*C
542 IF P=Ø THEN 7ØØ
545 R=D*C-2*B-D*D*D/4
55Ø U=SQR(ABS (P))
    : R=R/U
555 J=2
    : IF P<Ø THEN 6ØØ
56Ø T=S+R
    : E=SQR(ABS (T))/2
565 X=-D/4+U/2
    : Y=E
57Ø IF T<Ø GOSUB 18Ø
    : GOTO 58Ø
575 X=X+E
    : Y=X-2*E
    : Z=X
577 GOSUB 17Ø
58Ø IF J=4 THEN 2Ø
585 J=4
    : R=-R
    : U=-U
    : GOTO 56Ø
6ØØ REM CMP -SQR
6Ø5 M=SQR(S*S+R*R)
61Ø E=SQR((M+S)/2)
```

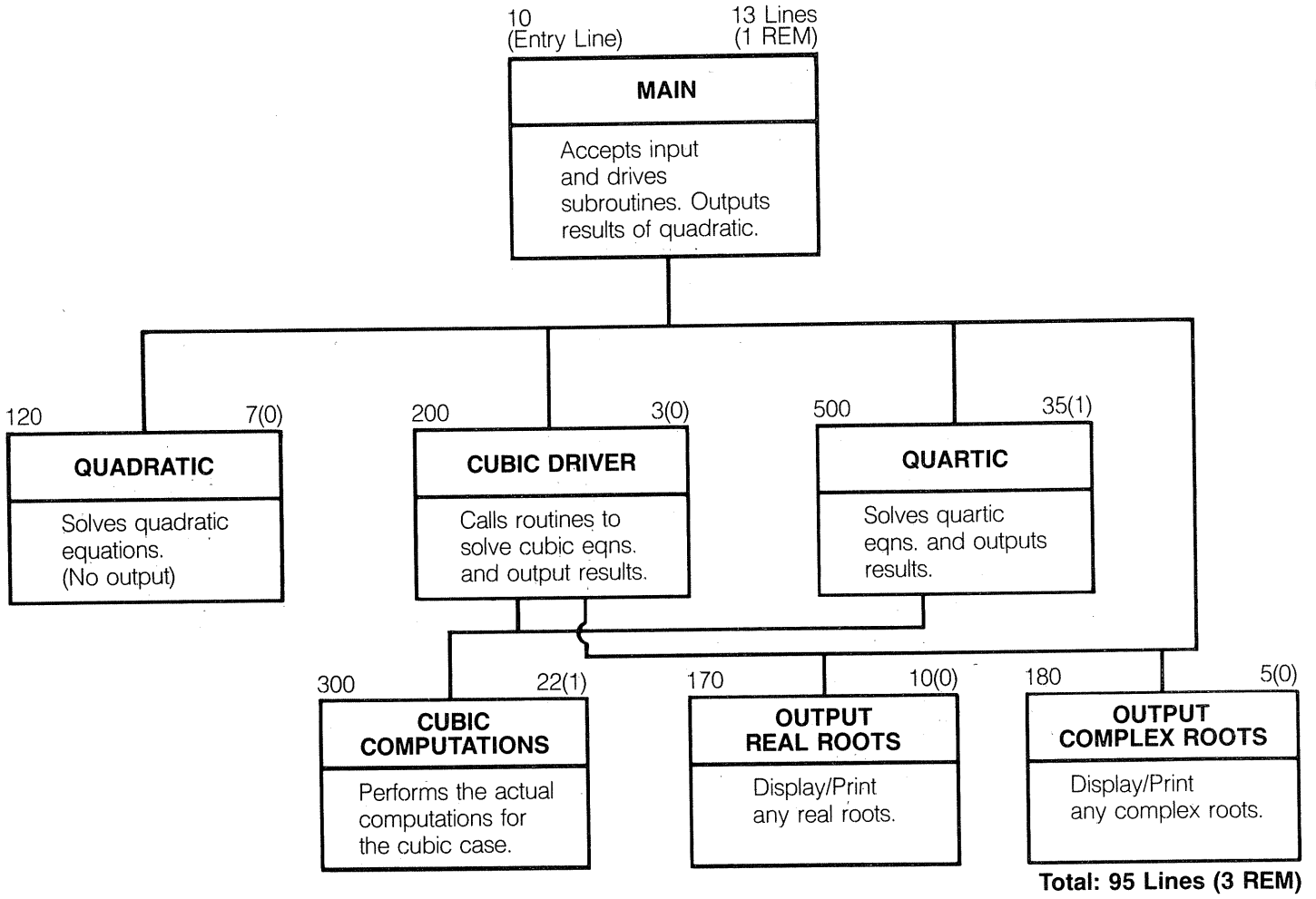

FIG. 1 — SUBROUTINE HIERARCHY (TREE) DIAGRAM

```
     : F=SQR((M-S)/2)
615 X=-D/4+E/2
     : Y=ABS (U+F)/2
62Ø IF Y>ABS (X)*E-4 THEN 63Ø
622 Y=X
     : Z=X
625 GOSUB 17Ø
     : GOTO 65Ø
63Ø GOSUB 18Ø
     :  J=Ø
65Ø X=X-E
     : Y=ABS (U-F)/2
655 IF Y>ABS (X)*E-4 THEN 67Ø
657 Y=X
     : Z=X
     : J=J+2
66Ø GOSUB 17Ø
     : GOTO 2Ø
67Ø GOSUB 18Ø
     : GOTO 2Ø
7ØØ P=Z*Z-4*A
7Ø5 R=2*SQR(ABS (P))
     : U=Ø
71Ø GOTO 555
```

NOTE: SQR = √

SAMPLE OUTPUT

```
REAL PART
     9.99999E-Ø1
IMAG.  =+/-
               1.
3RD REAL RT.
               2.
4TH REAL RT.
              -1.
```

Model 100 Educational Programs

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Enon, OH 45323

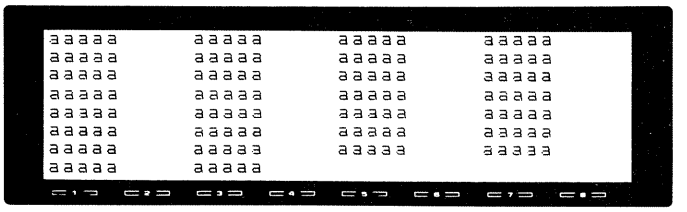
These are two programs for the Model 100—both educational games for preschool age youngsters. The first teaches the association of upper and lower case letters. The second provides elementary addition practice using numbers of "space men."

With the letters practice program, be sure to have the CAPS LOCK locked in the caps position. Then run the program. The child views a pattern of the first letter of the alphabet, then presses the corresponding capital letter on the keyboard. If he or she is correct, the machine plays a tune, then moves on the next letter in the alphabet. If incorrect, the machine goes through a short error routine, then returns to that letter.

The addition game provides two patterns of "space droids" which the child counts. The numbers reflecting the amount in each pattern are also included. The answer is keyed in, ENTER is pressed, and the machine responds. If correct, a tune plays; if incorrect, an error routine occurs, and that same number problem returns for another try.

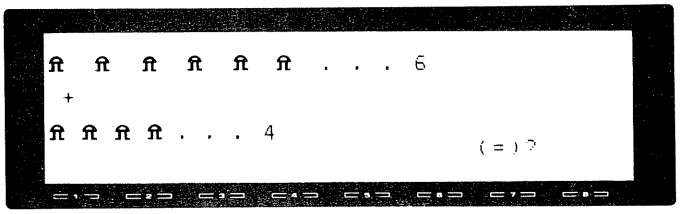
I hope some of your readers might find these short programs useful for the Model 100. My 5½ year old loves them.

```
5 REM UPPER/LOWER CASE LETTERS PRACTICE
6 REM PROGRAMMER LEO FINKELSTEIN, JR.
1Ø CLS
     : X=X+1
     : IF X>26 THEN X=1
2Ø U=X+64
     : L=X+96
3Ø FOR Z=1 TO 5Ø
4Ø PRINT STRING$(5,L);"     ";
5Ø NEXT Z
6Ø A$=INKEY$
     : IF A$="" THEN 6Ø
7Ø IF ASC(A$)=U THEN 1ØØ
8Ø CLS
     : FOR ZZ=1 TO 5Ø
82 BEEP
85 PRINT CHR$(U);CHR$(L);" ";
9Ø NEXT ZZ
93 FOR D=1 TO 5Ø
     : NEXT D
     : CLS
95 GOTO 3Ø
1ØØ CLS
11Ø FOR G1=1 TO 4Ø
115 SOUND (4ØØ*G1),5
12Ø FOR G2=128 TO 135
13Ø PRINT CHR$(G2);
14Ø NEXT G2
15Ø NEXT G1
16Ø GOTO 1Ø
```




```
2Ø REM ELEMENTARY ADDITION PRACTICE
3Ø REM PROGRAMMER LEO FINKELSTEIN, JR.
5Ø SEC=VAL(RIGHT$(TIME$,2))
6Ø FOR I=1 TO SEC
7Ø DUMMY=RND(1)
8Ø NEXT I
1ØØ CLS
     : A=Ø
     : B=Ø
     : C=Ø
11Ø X=INT(RND(1)*1Ø)
12Ø Y=INT(RND(1)*1Ø)
122 IF X=Ø OR Y=Ø THEN 11Ø
125 CLS
14Ø PRINT "     "
15Ø FOR A=1 TO X
     : PRINT CHR$(144);"  ";
     : NEXT A
     : PRINT ". . .";X
16Ø PRINT "          "
17Ø PRINT " + "
18Ø PRINT "   "
19Ø FOR B=1 TO Y
     : PRINT CHR$(144);" ";
     : NEXT B
     : PRINT ". . .";Y
2ØØ PRINT @27Ø,"(=)";
     : INPUT C
21Ø IF C=X+Y THEN 3ØØ
25Ø CLS
     : FOR R=1 TO 18
26Ø PRINT "INCORRECT   ";
27Ø BEEP
28Ø NEXT R
29Ø GOTO125
```

```
300 CLS
310 FOR X=1 TO 40
     : PRINT CHR$(127+X);
     : SOUND (400*X),5
     : NEXT X
315 FOR X=40 TO 1STEP-1
     : PRINT CHR$(127+X);
     : SOUND (400*X),5
     : NEXT X
320 GOTO100
```



Note: Simulated Model 100 screens.

Uploading .DO Files From Model 100 to Model 16 (Mod II Mode)

1. Have or create a text file in the Model 100 (this will have a **.DO** extension).

2. Connect the two computers with an **RS232** cable and a **null modem**. The RS232 cable should be attached to the **RS232** port of the Model 100, the null modem should be attached to the other end of the RS232 cable, and the null modem should be plugged into the top (or "A") serial channel of the Model 16.

3. Power up the Model 16 under TRSDOS. At TRSDOS READY, type in **SETCOM A=(2400,8,E,1)**, Hit ENTER.

4. At TRSDOS READY, type in **TERMINAL**.

5. At the TERMINAL menu, type in option **R** to be sure the RAM buffer is open. If it's open, answer N to the Reset question.

6. At the TERMINAL menu, choose option **T**. The message **Data Carrier LOST** will come up; this is OK.

7. On the Model 100, move the cursor over **TELCOM** and hit ENTER. Hit the F3 key (for stat). Type **68e1e** and hit ENTER. Hit the F4 key (for term). Now hit the F3 key (for Upload). Answer the prompt with the file name of the text file in the Model 100 that you want to transfer to the 16. Hit ENTER. Answer the "Width:" prompt with whatever you like (up to 132) and hit ENTER.

8. The message **Data Carrier RESTORED** appears, and you can watch the file appear on the screen of the Model 16.

9. When the transfer is complete, hit BREAK on the Model 16 to get back to the **TERMINAL** menu.

10. At the **TERMINAL** menu on the Model 16, choose option **C** to copy what's in the **RAM** buffer to disk.

11. On the Model 100, hit the F8 key for "Bye", then answer **y** ENTER to disconnect.

Now you have an ASCII file on the disk (check the DIR) and you can use **Convert** to get the file into **SCRIPSIT.**

Downloading ASCII Files From Model 16 to Model 100

1. Have an **ASCII** file on disk in the Model 16.

2. Follow the same procedure for connecting the two computers from the previous page.

3. Power up the Model 16 under TRSDOS. At **TRSDOS READY**, follow the same procedure for setting the **SETCOM**.

4. Same as previous #4.

5. Same as previous #5.

6. At the **TERMINAL** menu, type in **OPTION "G"** to get the file from the disk into the RAM buffer. Answer the filespec prompt with the name of the ASCII file in the Model 16.

7. On the Model 100, move the cursor over **TELCOM** and hit ENTER. Hit the F3 key (for stat). Type in 68e1e and hit ENTER. Hit the F4 key (for term). Now hit the F2 key (for Download). Answer the prompt with the name you wish the file to be stored under in the Model 100. Hit ENTER.

8. When the transfer is complete, hit BREAK on the Model 16 to return to the **TERMINAL** menu.

9. Hit the F8 key on the Model 100 for **"bye"** and answer **"Y"** ENTER to disconnect.

You now can hit the F8 on the Model 100 to return to the menu and you can see your text file is listed. Move the "shadow" cursor over the name and hit ENTER to view the file.

High Accuracy Trigonometry on the Model 100

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On page 127 of the *Model 100 Owner's Manual* the resulting value from the ATN function ranges from $-\pi/2$ to $+\pi$, not from $-\pi$ to π as indicated in the discussion.

Page 218 of the *Model 100 Owner's Manual* suggests the use of the formula 4*ATN(1) for calculating the value of pi. The value obtained in that manner is correct to ten significant figures. An alternate formula, 2*ATN(3D13), will return a value for pi which is correct to the full fourteen digit range of the Model 100. The use of any larger argument for the ATN function will yield the same value. The following table compares values for pi as obtained from various formulas on the Model 100.

Reference Value (from AMS-55):		3.1415 92653 58979 32384 . . .
Model 100	2*ATN(3D13):	3.1415 92653 5898
	2*ATN(2D13):	3.1415 92653 5896
	2*ATN(1D13):	3.1415 92653 5896
	2*ATN(1D12):	3.1415 92653 5878
	2*ATN(1D11):	3.1415 92653 5698
	4*ATN(1):	3.1415 92653 1932

Since the arguments for the trigonometric functions on the Model 100 are in radians, it is typically necessary to change from degrees to radians using the conversion factor pi/180. The example for the cosine function on page 132 of the *Owner's Manual* uses the conversion factor 0.01745329. With that conversion factor the Model 100 will return a value for the cosine of 60 degrees of 0.50000013094004, not the value of 0.50000013093981 as listed in the example. Of course, we all know that the correct value for the cosine of 60 degrees is exactly 0.5. The use of a more accurate conversion factor will yield more accurate results. Suppose we use the conversion factor derived from the equation 4*ATN(1)/180 performed on the Model 100, or a value of 0.01745329251774. Then the cosine of 60 degrees will be returned as 0.50000000011447. But if instead we use the conversion factor derived from the equation 2*ATN(3D13)/180 performed on the Model 100, which is a value of 0.017453292519943, then the cosine of 60 degrees will be returned as 0.49999999999998.

Similar improvements in accuracy of trigonometric results will be obtained for other arguments through the use of the more accurate conversion factor. For example, we all know that the sine of 45 degrees is exactly equal to the cosine of 45 degrees, and both are exactly equal to the square root of 2 divided by 2. Using the various conversion factors and again comparing to a reference value from AMS-55:

Reference Value from AMS-55		= 0.70710 67811 86548
Model 100:	sin(45*ATN(1)/45)	= 0.70710 67811 1643
	cos(45*ATN(1)/45)	= 0.70710 67812 5665
	sin(45*ATN(3D13)/90)	= 0.70710 67811 8659
	cos(45*ATN(3D13)/90)	= 0.70710 67811 8651

Limited testing indicates that, over the range from 0 to 90 degrees, slightly more accurate sine and cosine values will be obtained by calculating the conversion factor before multiplying by the input argument in degrees; e.g.,

sin(45*ATN(3D13/90))	= 0.70710 67811 8655
cos(45*ATN(3D13/90))	= 0.70710 67811 8655

In summary, it is a commonly used programming technique to obtain the value of pi from a computer by executing the formula 4*ATN(1), but users of the Model 100 will be better served with an alternate formula 2*ATN(3D13).

Note: References are made from pages 3 and 197 of the AMS-55, *Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables.*

Multiple Curve Graphs On TRS-80 Dot Matrix Printers

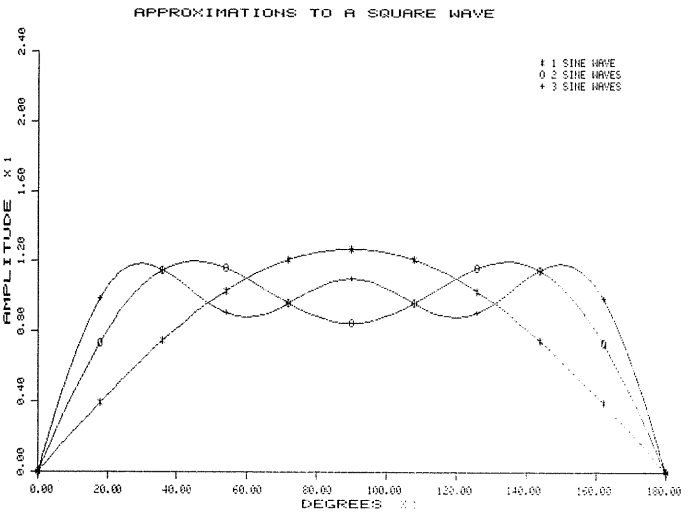
This article presents a subroutine (MULTI-GRAPH) to produce high resolution graphs on TRS-80 line printers using a Model I/III. You will need the following hardware and software:

Computer:
Model I/III, Level II BASIC, and 16K/32K/48K
Disk 32K/48K

Printer:
LP VII/LP VIII/DMP-100/DMP-200/DMP-400

Software:
DOTPLOT-80 Graphics Software Package (Cat.No. 26-2023)

With DOTPLOT-80, a new program from Radio Shack, the user can easily produce high resolution graphics on any of several different line printers. Included are various scaling routines for plotting, in either inches or the user's own coordinates. Titles may be drawn in any of four directions. Subroutines are provided to easily draw axes. A subroutine is provided in the DOTPLOT-80 manual to produce single curve graphs. Subroutine MULTI-GRAPH expands on this capability, and makes it simple to produce multiple curve graphs.



MULTI-GRAPH produces a complete multiple curve graph. The axes are automatically scaled for 'nice' tic mark values, symbols are drawn along each curve, a legend is produced to define the curve symbols, and a grid may optionally be included. Of course, the graph is titled and the axes are fully annotated.

The MULTI-GRAPH DRIVER program is used with subroutine MULTI-GRAPH to graph user data entered in data statements, or subroutine MULTI-GRAPH can be used to graph data generated within your own program. Examples for these two programs are provided.

Note: 16K users must omit the comments (anything that follows an apostrophe " ' ") to conserve memory.

Instructions for using the MULTI-GRAPH DRIVER program with input in data statements.

1. Delete lines 100-4390 from the "DOTPLOT-80 SAMPLE PROGRAM" supplied on cassette.
2. Type in the MULTI-GRAPH DRIVER program and subroutine MULTI-GRAPH.
3. Enter your data on DATA statements in the following sequence:

T$ = "Graph Title"
X$ = "X Axis Title"
Y$ = "Y Axis Title"

For each curve:
L$(J) = "Label for the J'th curve"

For each point on the J'th curve:
X(I,J) = X for the I'th point on the J'th curve
Y(I,J) = Y for the I'th point on the J'th curve next point.

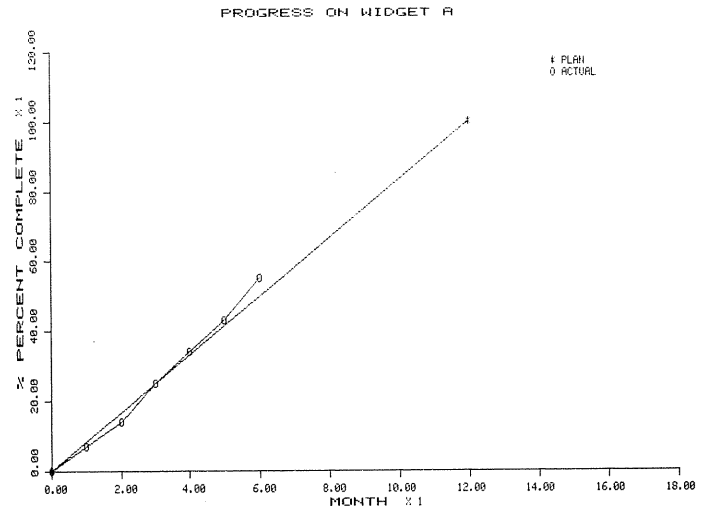
8888,8888 if there are more curves (goto L$(J))
or
9999,9999 if this is the last curve

4. Type: RUN

Notes:

A. The maximum number of curves (MC) is five, and the maximum number of points per curve (MP) is 25. These values may be changed in lines 58020 and 58030.

B. See additional notes following the instructions for subroutine MULTI-GRAPH.



Instructions for using the SAMPLE DATA FOR THE MULTI-GRAPH DRIVER PROGRAM:

1. Delete lines 100-4390 from the "DOTPLOT-80 SAMPLE PROGRAM" supplied on cassette with DOTPLOT-80.

2. Type in the SAMPLE DATA FOR THE MULTI-GRAPH DRIVER PROGRAM, the MULTI-GRAPH DRIVER program, and subroutine MULTI-GRAPH.

3. Type: RUN

Instructions for using subroutine MULTI-GRAPH within your own program:

1. Delete lines 100-4390 from the DOTPLOT-80 SAMPLE PROGRAM" provided on cassette with DOTPLOT-80.

2. Type in subroutine MULTI-GRAPH.

3. At the beginning of your program include:

```
CLEAR 400          ' Clear string space
MC = #             ' # = Maximum number of curves
MP = #             ' # = Maximum # of points / curve
GOSUB 59010        ' Set-up DOTPLOT-80 and MULTI-
                     GRAPH
```

4. In your program assign values to the following variables:

T$ = "Graph Title"
X$ = "X Axis Title"
Y$ = "Y Axis Title"
NC = # of curves

For each curve:
L$(J) = "Label for the J'th curve"
NP(J) = # of points on the J'th curve

For each point on the J'th curve:
X(I,J) = X for the I'th point on the J'th curve
Y(I,J) = Y for the I'th point on the J'th curve

5. Call subroutine MULTI-GRAPH:

GOSUB 59020

6. Repeat steps four and five for additional graphs.

Notes:

A. The variables used by DOTPLOT-80 are listed in the manual. Subroutine MULTI-GRAPH uses the following variables in addition to those used by DOTPLOT-80:

I, J, L$(J), S$(J), MC, MP, NC, NP(J), NS, S$(J), X(I,J), XA, Y(I,J), YA

B. To plot a reference grid, include the following lines:

```
59660 NX = XL+1      ' # VERTICAL GRID LINES
59670 NY = YL+1      ' # HORIZONTAL GRID LINES
59680 GOSUB 60150    ' DRAW THE GRID
```

C. To change the axis lengths, change XL and YL in line 59150.

Instructions for using the MULTI-GRAPH SAMPLE program.

1. Delete lines 100-4390 from the "DOTPLOT-80 SAMPLE PROGRAM" supplied on cassette with DOTPLOT-80.

2. Type in the MULTI-GRAPH SAMPLE program and subroutine MULTI-GRAPH.

3. Type: RUN

SUBROUTINE MULTI-GRAPH

```
59000 ' SUBROUTINE MULTI-GRAPH
59002 ' COPYRIGHT 1983 BY J. ANTHONY CERVANTES
      DAYTON, OHIO
59004 '
59010 GOTO 59100    ' SETUP DOTPLOT-80 & MULTI-GRAPH
59020 GOTO 59150    ' CALL MULTI-GRAPH
59100 ML%=MC*MP+50  ' MAXIMUM NUMBER OF LINES
59110 MS%=MC*12+25  ' MAXIMUM NUMBER OF STRINGS
59120 DIM L$(MC),NP(MC),X(MP,MC),Y(MP,MC)
59130 DIM M1%(4*ML%),M2%(2*MS%),Z$(MS%)
59140 RETURN
59150 XL=9
      : YL=6   ' X & Y AXIS LENGTHS
59160 ' CURVE SYMBOLS
59170 S$(1)="*"
      : S$(2)="O"
      : S$(3)="+"
      : S$(4)="#"
      : S$(5)="@"
```

```
59180 XA=XL-1.8
      : YA=YL-.2 ' START OF LEGEND
59190 XL=XL+2       ' TOTAL PLOT LENGTH IN INCHES
59200 GOSUB 60010   ' INIT. DOTPLOT-80
59210 XL=XL-2
59220 X=1
      : Y=1
      : GOSUB 60040 ' MOVE REF. POINT FOR AXES
59230 ' FIND X MINIMUM, X MAXIMUM, Y MINIMUM, Y
      MAXIMUM
59240 XN=X(1,1)
      : XX=XN
      : YN=Y(1,1)
      : YX=YN
59250 FOR J=1 TO NC
59260 FOR I=1 TO NP(J)
59270 IF X(I,J) <XN THEN XN=X(I,J)
59280 IF X(I,J) >XX THEN XX=X(I,J)
59290 IF Y(I,J) <YN THEN YN=Y(I,J)
59300 IF Y(I,J) >YX THEN YX=Y(I,J)
59310 NEXT I,J
59320 ' COMPUTE AND SET NICE SCALE FACTORS
59330 GOSUB 60110   ' COMPUTE NICE X0 AND DX
59340 GOSUB 60120   ' COMPUTE NICE Y0 AND DY
59350 GOSUB 60030   ' SET SCALE FACTORS
59360 GOSUB 60130   ' DRAW THE X AXIS
59370 GOSUB 60140   ' DRAW THE Y AXIS
59380 Z$=T$         ' THE TITLE
59390 SX=1          ' CHARACTER SIZE = 5 CPI
59400 X=XL/2-.1*LEN(Z$) ' CENTER THE TITLE
59410 Y=YL+.5       ' ABOVE THE GRAPH
59420 GOSUB 60070   ' DRAW THE TITLE
59430 SZ=0          ' CHARACTER SIZE = 10 CPI
59440 FOR J=1 TO NC ' DRAW THE CURVES
59450 Z$=S$(J)+" "+L$(J) ' SYMBOL AND LABEL FOR THE
      J'TH CURVE
59460 X=XA
      : Y=YA  ' POSITION OF THE CURVE LABEL
59470 GOSUB 60070   ' DRAW THE CURVE LABEL
59480 YA=YA-.17     ' SHIFT YA FOR THE NEXT CURVE
      LABEL
59490 NS=INT((NP(J)-1)/XL) ' EVERY NS'TH POINT WILL
      HAVE
59500 IF NS<1 THEN NX=1 ' A SYMBOL
59510 SC=1          ' USE THE SCALE FACTORS FOR X & Y
59520 X=X(1,J)
      : Y=Y(1,J) ' THE FIRST POINT
59530 GOSUB 60050   ' MOVE TO THE FIRST POINT
59540 Z$=S$(J)      ' SYMBOL FOR THE J'TH CURVE
59550 CT=1          ' CENTER THE SYMBOL AT X & Y
59560 GOSUB 60070   ' DRAW THE SYMBOL FOR THE FIRST
      POINT
59570 FOR I=2 TO NP(J)
59580 X=X(I,J)
      : Y=Y(I,J) ' THE I'TH POINT ON THE J'TH CURVE
59590 GOSUB 60060   ' DRAW A LINE TO THE I'TH POINT
59600 Z=(I-1)/NS    ' DRAW A SYMBOL AT EVERY NS'TH
      POINT
59610 IF Z=INT(Z) GOSUB 60070
59620 NEXT I        ' NEXT POINT
59630 SC=0          ' X & Y ARE IN INCHES AGAIN
59640 CT=0          ' DON'T CENTER SYMBOLS
59650 NEXT J        ' NEXT CURVE
59660 ' NX=XL+1     ' # VERTICAL GRID LINES
59670 ' NY=YL+1     ' # HORIZONTAL GRID LINES
59680 ' GOSUB 60150 ' DRAW THE GRID
59690 GOSUB 60100   ' MAKE A HARDCOPY
59700 CLS
      : INPUT"REPLOT THE SAME FIGURE? (Y/N) = ";Z$
59710 IF LEFT$(Z$,1)="Y" GOTO 59690
59720 RETURN
```

MULTI-GRAPH DRIVER PROGRAM

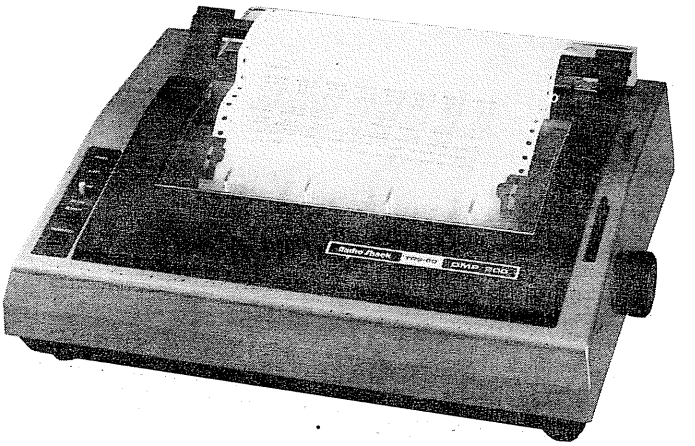
```
58000 ' MULTI-GRAPH DRIVER PROGRAM
58010 CLEAR 400     ' CLEAR STRING SPACE
58020 MC=5          ' MAXIMUM NUMBER OF CURVES
58030 MP=25         ' MAXIMUM NUMBER OF POINTS PER
      CURVE
58040 GOSUB 59010   ' SETUP MULTI-GRAPH AND DOTPLOT-80
58050 READ T$       ' READ THE GRAPH TITLE
58060 IF T$="STOP" STOP ' STOP IF LAST GRAPH
58070 READ X$,Y$    ' READ X AND Y AXIS TITLES
58080 J=0           ' INITIALIZE CURVE COUNTER
58090 J=J+1         ' INCREMENT CURVE COUNTER
58100 READ L$(J)    ' READ CURVE LABEL J
58110 I=0           ' INITIALIZE POINT COUNTER
58120 READ X,Y      ' READ THE I'TH POINT ON THE J'TH
      CURVE
58130 IF X=8888 AND Y=8888 GOTO 58090
58140 IF X=9999 AND Y=9999 GOTO 58180
58150 I=I+1
      : NP(J)=I ' INCREMENT # OF POINTS ON CURVE J
58160 X(I,J)=X
      : Y(I,J)=Y ' STORE X AND Y
58170 GOTO 58120    ' NEXT POINT
58180 NC=J          ' STORE # OF CURVES
58190 GOSUB 59020   ' CALL MULTI-GRAPH
58200 GOTO 58050    ' DRAW ANOTHER GRAPH
58210 END
```

SAMPLE DATA PROGRAM

```
2000 ' SAMPLE DATA FOR THE MULTI-GRAPH DRIVER PROGRAM
2010 DATA "PROGRESS ON WIDGET A"
2020 DATA "MONTH"
2030 DATA "% PERCENT COMPLETE"
2040 DATA "PLAN"
2050 DATA 0, 0
2060 DATA 12, 100
2070 DATA 8888, 8888
2080 DATA "ACTUAL"
2090 DATA 0, 0
2100 DATA 1, 7
2110 DATA 2, 14
2120 DATA 3, 25
2130 DATA 4, 34
2140 DATA 5, 43
2150 DATA 6, 55
2160 DATA 9999, 9999
2170 DATA "STOP"
```

SAMPLE PROGRAM

```
1000 ' MULTI-GRAPH SAMPLE PROGRAM
1010 CLEAR 400      ' SET ASIDE STRING SPACE
1020 MC=3           ' MAXIMUM NUMBER OF CURVES
1030 MP=61          ' MAXIMUM NUMBER OF POINTS PER
     CURVE
1040 GOSUB 59010    ' SET UP MULTI-GRAPH AND
     DOTPLOT-80
1050 T$="APPROXIMATIONS TO A SQUARE WAVE" ' TITLE
1060 X$="DEGREES"   ' X AXIS TITLE
1070 Y$="AMPLITUDE" ' Y AXIS TITLE
1080 NC=3           ' NUMBER OF CURVES
1090 L$(1)="1 SINE WAVE" ' SET THE CURVE LABELS
1100 L$(2)="2 SINE WAVES"
1110 L$(3)="3 SINE WAVES"
1120 PI=3.1415927
1130 DR=PI/180      ' DEGREES TO RADIANS FACTOR
1140 FOR J=1 TO NC ' LOOP FOR CURVES
1150 I=0            ' INITIALIZE COUNTER FOR POINTS
1160 FOR X=0 TO 180 STEP 3 ' LOOP FOR POINTS
1170 R=X*DR
1180 Y=0
1190 FOR N=1 TO 2*(J-1)+1 STEP 2 ' COMPUTE Y
1200 Y=Y+SIN(N*R)/N
1210 NEXT N
1220 Y=Y*4/PI
1230 I=I+1          ' INCREMENT POINT COUNTER
1240 X(I,J)=X
     : Y(I,J)=Y ' STORE X AND Y
1250 NEXT X
1260 NP(J)=I        ' SAVE NUMBER OF POINTS ON CURVE J
1270 NEXT J
1280 GOSUB 59020    ' CALL MULTI-GRAPH
1290 END
```



Hex Arithmetic Scratchpad

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CIS ID: 71625, 1210

This program is more than a hex/decimal interconversion program. It does hexadecimal arithmetic, will operate accurately even with very large hexadecimal numbers, and will not accept most forms of input errors.

I hope that someone may benefit from these programs! I own a Model I, Level II TRS-80 with Modem I, Line Printer VII, and RS232-C but, not disk capacity.

```
10 'THIS PROGRAM WRITTEN SEPTEMBER, 1981, BY JERRY
    DULIN
20 'AND RUNS IN 8K, FOR MODEL 1, LEVEL 2 TRS-80
30 'THIS PROGRAM WILL BOTH PERFORM HEXADECIMAL
    ARITHMETIC
40 'AND PERFORM HEX/DECIMAL INTERCONVERSIONS
50 'AND WILL NOT ACCEPT ERROR INPUT.
60 '
70 CLS
80 CLEAR 500 : 'LOTS OF STRING SPACE FOR HEX NUMBERS
90 LN$=STRING$(64, ".") : 'FOR GRAPHICS
100 DEFDBL H, L, M, T, U
110 PRINT @ 79, "THE HEX ARITHMETIC SCRATCHPAD"
120 PRINT
130 PRINT "THIS PROGRAM WILL LET YOU INPUT
    HEXADECIMAL NUMBERS"
140 PRINT "AND ARITHMETIC OPERATORS DIRECTLY, AND
    WILL OUTPUT"
150 PRINT "THE ANSWER IN HEX AND ADDITIONALLY DISPLAY
    THE ENTIRE"
160 PRINT "EQUATION CONVERTED TO DECIMAL FORMAT."
170 PRINT
180 PRINT "THE PROGRAM WILL NOT ACCEPT ANY INPUT
    INVOLVING A"
190 PRINT "DECIMAL POINT. INVALID OPERATORS OR HEX
    INPUTS WILL"
200 PRINT "SIMPLY RESULT IN THE SCREEN ERASING ITSELF
    AND ASKING"
210 PRINT "FOR A NEW INPUT."
    : PRINT
220 PRINT "THE PROGRAM WILL ALSO DO DIRECT HEX TO
    DECIMAL OR"
230 PRINT "DECIMAL TO HEX CONVERSIONS."
240 INPUT "     HIT ENTER TO BEGIN: "; E$
250 GOTO 2090
260 STOP
270 C=1 : 'START PEELING D$ FROM LEFTMOST CHARACTER
280 U=0 : 'U WILL BECOME THE DECIMAL BEING CONVERTED
290 K3=0
    : Y$=""
    : J$=""
    : B4=0 : 'INITIALIZE
300 X$="" : 'X$ WILL HOLD FINAL ANSWER
310 FOR K=1 TO LEN(D$)
320 B$=MID$(D$, C, 1)
330 IF B$="" THEN 2180 : 'NO CHARACTER, AN ERROR
340 IF ASC(B$)<=47 THEN 2180 : 'LESS THAN 0, AN ERROR
350 IF ASC(B$)>=58 THEN 2180 : 'GREATER THAN 9, AN
    ERROR
360 C=C+1 : 'PEEL NEXT CHARACTER OFF D$
370 NEXT K
380 U=VAL(D$) : 'OK TO USE D$ INPUT
390 IF U<=15 THEN 490 : 'WILL ONLY NEED ONE
    CHARACTER
400 K3=INT(U/16)
410 B4=U-(K3*16)
420 IF B4>=10 THEN 470
430 J$=CHR$(B4+48) : 'GET A DECIMAL CHARACTER FROM 0
    TO 9
440 Y$=Y$+J$ : 'BUILD A MIRROR REVERSE OF HEX ANSWER
450 U=K3 : 'DO NEXT CHUNK OF DECIMAL INPUT
460 GOTO 390
470 J$=CHR$(B4+55) : 'GET A HEX CHARACTER FROM A TO
    F
480 GOTO 440
490 IF U>=10 THEN 530
500 J$=CHR$(U+48) : 'GET A DECIMAL CHARACTER FROM 0
    TO 1
510 Y$=Y$+J$ : 'BUILD UP A REVERSE OF THE FINAL HEX
    ANSWER
520 GOTO 550 : 'Y$ IS NOW READY TO REVERSE FOR FINAL
    ANSWER
530 J$=CHR$(U+55) : 'GET A HEX CHARACTER FROM A TO F
540 Y$=Y$+J$
550 FOR K=LEN(Y$) TO 1 STEP -1 : 'REVERSE Y$ LEFT
    FOR RIGHT
560 F$=MID$(Y$, K, 1)
570 X$=X$+F$ : 'X$ HOLDS Y$ REVERSED AND IS FINAL
    ANSWER
580 NEXT K
590 'X$ NOW HOLDS THE HEXADECIMAL EQUIVALENT OF U
600 'U NOW HOLDS WHAT REMAINS OF THE ORIGINAL DECIMAL
    INPUT
610 'D$ HOLDS THE ORIGINAL DECIMAL INPUT
620 RETURN
630 P$=""
    : N=0
    : P=0
    : T=0
    : R=0 : 'INITIALIZE
640 M=1: 'BEGIN PEELING H$ AT THE LEFTMOST CHARACTER
650 P=LEN(H$)-1 : '16 TO THE POWER OF P
660 FOR K=1 TO LEN(H$)
670 P$=MID$(H$, M, 1) : 'PEEL THE HEX STRING BY
    CHARACTER
680 IF P$="" THEN 2180 : 'NO CHARACTER, AN ERROR
690 IF ASC(P$)<=47 THEN 2180 : 'LESS THAN 0, AN
    ERROR
700 IF ASC(P$)<=57 THEN 760 : '9 OR LESS
710 IF ASC(P$)<=64 THEN 2180 : 'LESS THAN A, AN
    ERROR
720 IF ASC(P$)<=70 THEN 740 : 'F OR LESS
730 IF ASC(P$)>=71 THEN 2180 : 'GREATER THAN F, AN
    ERROR
740 N=ASC(P$)-55 : 'HEX CHARACTER FROM A TO F
750 GOTO 770
760 N=ASC(P$)-48 : 'HEX CHARACTER FROM 0 TO 9
770 GOSUB 850 : 'FIND THE HEX POWER
780 P=P-1 : 'NEXT LOWER POWER OF 16
790 T=T+R : 'TOTAL UP THE FINAL HEX NUMBER
800 M=M+1 : 'INCREMENT THE PEELING OF H$
810 NEXT K
820 'H$ NOW HOLDS THE ORIGINAL HEX INPUT
830 'T NOW HOLDS THE CONVERTED DECIMAL
840 RETURN
850 IF P=0 THEN 980
860 IF P=1 THEN 1000
870 IF P=2 THEN 1020
880 IF P=3 THEN 1040
890 IF P=4 THEN 1060
900 IF P=5 THEN 1080
910 IF P=6 THEN 1100
920 IF P=7 THEN 1120
930 IF P=8 THEN 1140
940 IF P=9 THEN 1160
950 IF P=10 THEN 1180
960 R=N*(16^P) : 'FIND A HEX POWER GREATER THAN 10
970 RETURN
980 R=N
```

```
99Ø GOTO 119Ø
1ØØØ R=N*16 :  '1ST POWER
1Ø1Ø GOTO 119Ø
1Ø2Ø R=N*256 :  '2ND POWER
1Ø3Ø GOTO 119Ø
1Ø4Ø R=N*4Ø96 :  '3RD POWER
1Ø5Ø GOTO 119Ø
1Ø6Ø R=N*65536 :  '4TH POWER
1Ø7Ø GOTO 119Ø
1Ø8Ø R=N*1Ø48576 :  '5TH POWER
1Ø9Ø GOTO 119Ø
11ØØ R=N*16777216 :  '6TH POWER
111Ø GOTO 119Ø
112Ø R=N*268435456 :  '7TH POWER
113Ø GOTO 119Ø
114Ø R=N*4294967296 :  '8TH POWER
115Ø GOTO 119Ø
116Ø R=N*68719476736 :  '9TH POWER
117Ø GOTO 119Ø
118Ø R=N*1Ø99511627776 :  '1ØTH POWER
119Ø RETURN
12ØØ CLS
121Ø N$=""
     :  Z1=Ø
     :  H$=""
     :  EQ$=""
122Ø PRINT @ 64, "FORMAT:  (HEX)(1 SPACE)(+, -, X OR
     *, /)(1 SPACE)(HEX)
123Ø PRINT "FOR EXAMPLE:  AØFF / 2
124Ø PRINT LN$
125Ø U=Ø
     :  X$=""
     :  K3=Ø
     :  Y$=""
     :  J$=""
     :  B4=Ø
126Ø H=Ø
     :  L=Ø
     :  M=Ø
127Ø PRINT @ 32Ø, ""
128Ø INPUT "THE HEX EQUATION IS:    "; EQ$ :  'THIS
     WILL HOLD THE EQUATION
129Ø IF EQ$="" THEN 12ØØ
13ØØ FOR K=1 TO LEN(EQ$) :  'FIND FIRST HEX OPERAND
131Ø N$=MID$(EQ$,K,1)
132Ø Z1=Z1+1 :  'SAVE POSITION IN EQ$
133Ø IF ASC(N$)=32 THEN 136Ø
134Ø H$=H$+N$ : 'BUILD THE HEX INPUT STRING
135Ø NEXT K
136Ø GOSUB 63Ø: 'GET A DECIMAL
137Ø H=T : 'FIRST CONVERSION
138Ø Z1=Z1+1 : 'POSITION EQ$ TO FIND OPERATOR
139Ø H$="" : 'RESET FOR HEX CONVERSION
14ØØ O$=MID$(EQ$,Z1,1) : 'GET ARITHMETIC OPERATOR
141Ø IF O$="" THEN 12ØØ
142Ø Z1=Z1+2 : 'ADVANCE TO SECOND HEX OPERAND
143Ø FOR K=Z1 TO LEN(EQ$) : 'GET SECOND HEX OPERAND
144Ø N$=MID$(EQ$,K,1)
145Ø IF N$=CHR$(32) THEN 148Ø
146Ø H$=H$+N$ : 'BUILD SECOND HEX INPUT STRING
147Ø NEXT K
148Ø GOSUB 63Ø: 'GET A DECIMAL
149Ø L=T : 'SECOND CONVERSION
15ØØ IF O$="+" THEN 156Ø
151Ø IF O$="-" THEN 162Ø
152Ø IF O$="*" THEN 175Ø
153Ø IF O$="X" THEN 175Ø
154Ø IF O$="/" THEN 181Ø
155Ø GOTO 12ØØ
156Ø M=H+L
157Ø U=M
158Ø GOSUB 39Ø
159Ø PRINT @ 512, "THE HEX ANSWER IS:       "; X$
16ØØ PRINT @ 64Ø, H; O$; L; "="; M
161Ø GOTO 189Ø
162Ø M=H-L
163Ø IF M<Ø THEN 169Ø
164Ø U=M
165Ø GOSUB 39Ø
166Ø PRINT @ 512, "THE HEX ANSWER IS:       "; X$
167Ø PRINT @ 64Ø, H; O$; L; "="; M
168Ø GOSUB 189Ø
169Ø M=ABS(M)
17ØØ U=M
171Ø GOSUB 39Ø
172Ø PRINT @ 512, "THE HEX ANSWER IS: NEGATIVE "; X$
173Ø PRINT @ 64Ø, H; O$; L; "="; M
174Ø GOTO 189Ø
175Ø M=H*L
176Ø U=M
177Ø GOSUB 39Ø
178Ø PRINT @ 512, "THE HEX ANSWER IS:       "; X$
179Ø PRINT @ 64Ø, H; O$; L; "="; M
18ØØ GOTO 189Ø
181Ø M=H/L
182Ø M=M+.5
183Ø M=INT(M)
184Ø U=M : 'GET ROUNDED ANSWER
185Ø GOSUB 39Ø
186Ø PRINT @ 512, "THE HEX ANSWER IS:       "; X$;
     "(TO NEAREST INTEGER)"
187Ø PRINT @ 64Ø, H; O$; L; "="; M; "(TO NEAREST
     INTEGER)"
188Ø GOTO 189Ø
189Ø PRINT @ 832, "     SIMPLY HIT ENTER IF YOU WISH
     TO CONTINUE, OR"
19ØØ E$=""
     : INPUT "     TYPE THE LETTER 'M' IF YOU WISH
     THE MENU: "; E$
191Ø IF E$="M" THEN 2Ø9Ø
192Ø GOSUB 218Ø
193Ø CLS
194Ø PRINT @ 64, "ENTER H TO CONVERT HEX TO DECIMAL"
195Ø PRINT @ 192, "ENTER D TO CONVERT DECIMAL TO HEX"
196Ø PRINT LN$
197Ø E$=""
     : PRINT @ 448, "NEXT: ";
     : INPUT E$
198Ø IF E$="H" THEN 2Ø1Ø
199Ø IF E$="D" THEN 2Ø5Ø
2ØØØ GOTO 193Ø
2Ø1Ø PRINT @ 448, "HEX TO DECIMAL: HEX= ";
     : INPUT H$
2Ø2Ø GOSUB 63Ø
2Ø3Ø PRINT @ 576, "DECIMAL VALUE="; T
2Ø4Ø GOTO 189Ø
2Ø5Ø PRINT @ 448, "DECIMAL TO HEX: DECIMAL=";
     : INPUT D$
2Ø6Ø GOSUB 27Ø
2Ø7Ø PRINT @ 576, "HEX VALUE= "; X$
2Ø8Ø GOTO 189Ø
2Ø9Ø IND=Ø
     : CLS
21ØØ PRINT @ 89, "MENU:"
211Ø PRINT @ 192, "A: HEX ARITHMETIC"
212Ø PRINT @ 256, "B: DECIMAL TO HEX CONVERSION"
213Ø PRINT @ 32Ø, "C: HEX TO DECIMAL CONVERSION"
214Ø E$=""
     : PRINT @ 448, "YOUR CHOICE IS: ";
     : INPUT E$
215Ø IF E$="A" THEN IND=1
216Ø IF E$="B" THEN IND=2
217Ø IF E$="C" THEN IND=3
218Ø ON IND GOSUB 12ØØ, 227Ø, 22ØØ
219Ø GOTO 2Ø9Ø
22ØØ CLS
221Ø PRINT @ 64, "HEX TO DECIMAL CONVERSIONS:"
222Ø PRINT @ 128, LN$;
223Ø PRINT @ 32Ø, "YOUR HEX NUMBER IS: ";
     : INPUT H$
224Ø GOSUB 63Ø
225Ø PRINT @ 448, "THE DECIMAL ANSWER IS:"; T
226Ø GOTO 189Ø
```

```
227Ø CLS
228Ø PRINT @ 64, "DECIMAL TO HEX CONVERSIONS:"
229Ø PRINT @ 128, LN$;
23ØØ PRINT @ 32Ø, "YOUR DECIMAL NUMBER IS: ";
     : INPUT D$
231Ø GOSUB 27Ø
232Ø PRINT @ 448, "THE HEX ANSWER IS: "; X$
233Ø GOTO 189Ø
```

Modem II Autodial for Model III

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Once the user has set the system clock and invoked SETCOM, this BASIC program enables the user to select from a menu of frequently called services. The modem is programmed and the user is able to further choose to either call at that moment, or at a later time. When the system time equals the desired calling time, the modem will be instructed to dial. If a Carrier Detect is read, the BASIC program drops into the user's communication program.

```
1 '************************************************
2 '* F/S=SMTMODEM/BAS AUTODIAL PROGRAM FOR MODEM II *
3 '* VERSION 5.Ø LAST REVISION FEBRUARY 19, 1983    *
4 '* REFER TO TRS-8Ø NEWSLETTER DECEMBER 1982       *
5 '* MODIFIED BY MARK L. SILLS                      *
6 '************************************************
7 '* INITIALIZE *
8 CLS
     : CLEAR 1ØØ
9 DIM I!, IK$, SN%, EC%, L!, PG$, TR!, A!, DT$, PN$,
     ED$, H$, T$, I$$
1Ø '* CREATE SPECIAL CHARACTER MODEL III *
11 POKE 16420, 1
12 H$ = CHR$ (244) + CHR$ (245) + CHR$ (246) +CHR$
     (32)
13 '* GET TELEPHONE NUMBER DATA *
14 PRINT @1Ø, "AUTODIAL SYSTEM        SYSTEM TIME
     ";
     : PRINT H$
15 '* INSERT DESIRED CALLING NAMES IN PRINT
     STATEMENTS *
16 PRINT @133, "1)"
17 PRINT @153, "2)"
18 PRINT @197, "3)"
19 PRINT @217, "4)"
2Ø PRINT @261, "5)"
21 PRINT @281, "6)"
22 PRINT @325, "7)"
23 PRINT @345, "8)" MANUAL DIAL
24 PRINT
     : PRINT
25 PRINT "Please Make Your Choice : ";
     : GOSUB 72
     : A = VAL (IK$)
     : PRINT A
26 ON A GOTO 65, 66, 67, 68, 69, 7Ø, 71, 27
27 LINE INPUT "Enter Telephone Number:    ";PN$
28 PG$ = "D" + "T" +PN$
29 '* ENTER PROGRAM MODE OF MODEM II BY SENDING AN
     "*" *
3Ø TR = Ø
31 SN% = CINT (ASC("*"))
32 OUT $HEB, SN%
33 FOR I = 1 TO 5Ø
     : NEXT I
34 EC% = INP (&HEB)
35 TR = TR + 1
36 IF EC% < > SN% AND TR < 3 THEN 31
37 IF TR = 3 THEN CLS
     : PRINT "Can Not Program The Modem ! !"
     : STOP
38 '* SEND THE PHONE NUMBER DATA STRING TO THE MODEM
     II *
39 FOR L = 1 TO LEN (PG$)
4Ø SN% = CINT (ASC(MID$(PG$, L, 1)))
41 OUT &HEB, SN%
42 FOR I = 1 TO 5Ø
     : NEXT I
43 EC% = INP (&HEB)
44 IF SN% < > EC% THEN PRINT "Can Not Program The
     Modem ! !"
     : STOP
45 NEXT L
46 '* GET THE TIME FOR THE NUMBER TO BE DIALED *
47 '* SEND "X" TO MODEM AT CORRECT TIME *
48 LINE INPUT "Modem Programmed, Enter the Time to
     dial (HH:MM) ";DT$
     : IF LEN (DT$) = Ø THEN 5Ø
49 TS$ = LEFT$ (RIGHT$(TIME$, 8), 5)
     : IF DT$ < > TS$ THEN 49
5Ø SN%  = CINT (ASC("X"))
51 OUT &HEB, SN%
52 FOR I = 1 TO 5Ø
     : NEXT I
53 ED% = INP (&HEB)
54 '* TIMING LOOP FOR MODEM II PROTOCOL *
55 FOR I = 1 TO 3ØØØ
     : NEXT I
56 '* TEST FOR CARRIER DETECT *
57 FOR I = 1 TO 25ØØ
     : IF (INP(&HØE8) AND &H2Ø) = Ø THEN 59
     : ELSE NEXT I
58 GOTO 8
59 CLS
     : PRINT "Connection Made !"
     : FOR I = 1 TO 3ØØ
     : NEXT I
6Ø '* IF DESIRED DELETE REM IN LINE 62 FOR BUZZER
     ALERT *
61 '* RING BUZZER IN PRINTER AND LOAD COMMUNICATION
     PROGRAM *
62 ' FOR I = 1 TO 5Ø
     : LPRINT CHR$(7)
     : NEXT I
     : CMD"S=MODEM"
     : REM CHANGE THIS FOR YOUR COMM PROGRAM
63 CMD "S=MODEM"
     : REM CHANGE THIS FOR YOUR COMM PROGRAM
64 '* INSERT DESIRED PHONE NUMBERS BETWEEN QUOTES *
65 PN$ = ""
     : GOTO 28
66 PN$ = ""
     : GOTO 28
67 PN$ = ""
     : GOTO 28
68 PN$ = ""
     : GOTO 28
69 PN$ = ""
     : GOTO 28
7Ø PN$ = ""
     : GOTO 28
71 PN$ = ""
     : GOTO 28
72 IK$ = INKEY$
     : IF IK$ = "" THEN 72
     : ELSE RETURN
73 END
```

Various Programs

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I have written several programs for the Model III computer. The first two programs, Multiplication and Math are written to help the user with his/her math. The second program, Grader, helps to average several grades together. And the third program, Age, is just a fun program. It calculates how many days and minutes old someone is, simply by entering your birthdate information.

MULTIPLICATION

```
Ø CLS
     : T=Ø
     : C=Ø
1Ø CLS
2Ø INPUT "HOW MANY PROBLEMS"; Q
3Ø FOR O=1 TO Q
32 T=Ø
4Ø CLS
5Ø A=RND(1Ø)-1
     : B=RND(1Ø)-1
6Ø PRINT TAB(23); A
65 C=C+1
66 T=T+1
7Ø PRINT TAB(21); "X "; B
8Ø PRINT TAB(2Ø); "-----"
9Ø INPUT "           "; W
1ØØ IF W=(A*B) THEN 5ØØ
11Ø T=RND(5)
12Ø IF T=1 THEN PRINT "WRONG"
13Ø IF T=2 THEN PRINT "INCORRECT"
14Ø IF T=3 THEN PRINT "YOU NEED TO STUDY"
15Ø IF T=4 THEN PRINT "STUDY YOUR FACTS"
16Ø IF T=5 THEN PRINT "SORRY , NOT RIGHT"
17Ø FOR X=1 TO 75Ø
     : NEXT X
18Ø IF T=4 THEN 7ØØ
19Ø CLS
     : GOTO 6Ø
5ØØ R=RND(5)
51Ø IF R=1 THEN PRINT "GREAT"
52Ø IF R=2 THEN PRINT "SUPER"
53Ø IF R=3 THEN PRINT "TERRIFIC"
54Ø IF R=4 THEN PRINT "CORRECT"
55Ø IF R=5 THEN PRINT "RIGHT"
56Ø FOR X=1 TO 75Ø
561 NEXT X
57Ø IF O=Q THEN 9ØØ
58Ø CLS
585 T=Ø
59Ø NEXT O
7ØØ PRINT "THE ANSWER IS "; (A*B)
71Ø FOR X=1 TO 75Ø
     : NEXT X
72Ø NEXT O
9ØØ INPUT "WANT TO TRY AGAIN "; P$
915 PRINT
92Ø PRINT "IT TOOK YOU "; C; " GUESSES TO DO "; Q;"
     MUTI. PROBLEMS"
     : PRINT
921 PRINT "YOU GOT "; C-Q; " WRONG"
925 FOR X=1 TO 75Ø
     : NEXT X
926 IF LEFT$(P$, 1)="Y" THEN RUN
93Ø END
```

MATH

```
1Ø CLS
2Ø INPUT "ADDITION OR SUBTRACTION (+ OR -)"; Q$
3Ø INPUT "HOW MANY PROBLEMS"; Q
4Ø IF Q$="+" THEN 1ØØØ
5Ø FOR O=1 TO Q
6Ø CLS
7Ø A=RND(11)-1
     : B=RND(11)-1
8Ø IF A>B THEN PRINT TAB(23); A ELSE PRINT TAB(23); B

9Ø IF A<B THEN PRINT TAB(21); "- "; A ELSE PRINT
     TAB(21); "- "; B
1ØØ PRINT TAB(2Ø); "-----"
11Ø INPUT "           "; W
12Ø IF A=B THEN IF W=(A-B) OR W=(B-A) THEN 5ØØ
13Ø IF A>B THEN IF W=(A-B) THEN 5ØØ
14Ø IF A<B THEN IF W=(B-A) THEN 5ØØ
15Ø T=RND(5)
16Ø IF T=1 THEN PRINT "WRONG"
17Ø IF T=2 THEN PRINT "INCORRECT"
18Ø IF T=3 THEN PRINT "YOU MADE A MISTAKE"
19Ø IF T=4 THEN PRINT "THAT IS NOT RIGHT"
2ØØ IF T=5 THEN PRINT "YOU NEED TO STUDY YOUR FACTS"
21Ø FOR X=1 TO 75Ø
     : NEXT X
22Ø CLS
23Ø GOTO 8Ø
5ØØ Y=RND(5)
51Ø IF Y=1 THEN PRINT "GREAT"
52Ø IF Y=2 THEN PRINT "SUPER"
53Ø IF Y=3 THEN PRINT "TERRIFIC"
54Ø IF Y=4 THEN PRINT "VERY GOOD"
55Ø IF Y=5 THEN PRINT "CORRECT"
56Ø FOR X=1 TO 75Ø
     : NEXT X
57Ø IF O=Q THEN 5ØØØ
58Ø CLS
59Ø NEXT O
1ØØØ CLS
     : FOR O=1 TO Q
1Ø1Ø A=RND(11)-1
     : B=RND(11)-1
1Ø2Ø PRINT TAB(23); A
1Ø3Ø PRINT TAB(21); "+ "; B
1Ø4Ø PRINT TAB(19); "-----"
1Ø5Ø INPUT "           "; W
1Ø6Ø IF W=(A+B) THEN 15ØØ
1Ø7Ø T=RND(5)
1Ø8Ø IF T=1 THEN PRINT "INCORRECT"
1Ø9Ø IF T=2 THEN PRINT "SORRY, THAT'S WRONG"
11ØØ IF T=3 THEN PRINT "YOU NEED TO STUDY YOUR FACTS"

111Ø IF T=4 THEN PRINT "YOU NEED PRACTICE"
112Ø IF T=5 THEN PRINT "THAT'S WRONG"
113Ø FOR X=1 TO 75Ø
     : NEXT X
114Ø CLS
115Ø GOTO 1Ø2Ø
15ØØ T=RND(5)
151Ø IF T=1 THEN PRINT "GREAT"
152Ø IF T=2 THEN PRINT "TERRIFIC"
153Ø IF T=3 THEN PRINT "SUPER"
154Ø IF T=4 THEN PRINT "GOOD WORK"
155Ø IF T=5 THEN PRINT "VERY GOOD"
156Ø FOR X=1 TO 75Ø
     : NEXT X
157Ø IF O=Q THEN 5ØØØ
158Ø NEXT O
5ØØØ INPUT "DO YOU WANT TO TRY AGAIN"; R$
5Ø1Ø IF LEFT$(R$, 1)="Y" THEN RUN
5Ø2Ø END
```

GRADER

```
1Ø CLS
2Ø INPUT "HOW MANY GRADES ARE YOU AVERAGING "; G
3Ø IF G<Ø THEN GOTO 2Ø
4Ø FOR X=1 TO G
5Ø PRINT "INPUT THE "; X; " GRADE ";
```

```
60 INPUT A(X)
70 C=C+A(X)
80 NEXT X
```

AGE

```
0 CLS
10 INPUT "HOW MANY YEARS OLD ARE YOU "; AG
20 INPUT "WHAT MONTH IS IT:(USE THE NUMBER OF THE
   MONTH) "; MO
30 DY=AG*365
40 FOR X=1 TO MO-1
50 READ A
60 DY=DY+A
65 PL=PL+A
70 NEXT X
80 INPUT "WHAT DAY IS IT OF THAT MONTH "; FG
90 DY=DY+FG
100 INPUT "WHAT HOUR OF THE DAY IS IT "; HD
110 INPUT "IS IT AM OR PM "; AP$
120 IF AP$="PM" THEN HD=HD+12 ELSE HD=HD+0
130 MN=HD*60
135 INPUT "HOW MANY MINUTES PAST THE HOUR "; MH
140 MN=MN+MH-60
150 CLS
    : PRINT "YOU ARE "DY" DAYS OLD"; ""
160 ML=MN*60*60*24*365*AG+PL+FG
170 PRINT "YOU ARE ";
171 PRINT USING"###,###,###,###,###, "; ML;
172 PRINT " MINUTES OLD"
900 DATA 31, 28, 31, 30, 30, 30, 31, 31, 30, 31, 30,
    31
```

Schedule

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Schedule, is a Model III program that will print a schedule to meet daily, weekly, monthly, or semester needs. First, it will ask you for the number of columns and rows you plan to use. Then, it will ask for the column headings, row headings, and asks whether you wish to fill in each cell of the schedule. If you do, it will loop a routine to fill each (non-heading) cell. Next, you will be asked if you wish a hard copy or not; finally whether you wish another copy.

The limitation of the program is the size of each cell (which is set for 15 spaces). Changing the cell size (CS) to another value will expand or contract each cell to allow for more cells or more data in each cell.

```
10 REM # SCEDPRNT/BAS # TO PRINT SCHEDULE
20 CLEAR 1000
    : CLS
    : DEFINTA-Z
    : L$=" "+CHR$(124)+" "
    : CS=15
    : INPUT "HOW MANY COLUMNS"; NC
    : INPUT "HOW MANY ROWS..."; NR
    : DIMC$(NC, NR)
    : NC=NC-1
    : INPUT "DO YOU WISH TO WRITE IN THE CELLS
    (Y/N)"; Q1$
    : FOR I=0 TO NC
    : PRINT "ENTER HEADINGS FOR COLUMN #"; I+1;
    : INPUT C$(I, 0)
    : NEXT I
30 FOR J=1 TO NR
    : PRINT "ENTER HEADINGS FOR ROW #"; J;
    : INPUT C$(0, J)
    : NEXT J
    : IF LEFT$(Q1$, 1)="Y" THEN FOR I=1 TO NR
    : FOR J=1 TO NC
    : PRINT "ENTER DATA FOR ROW "; I; " COLUMN "; J;
    : INPUT "DATA ... "; C$(J, I)
    : NEXT J
    : NEXT I
40 INPUT "DO YOU WANT HARD COPY (Y/N)"; Q2$
    : IF LEFT$(Q2$, 1)="Y" THEN GOSUB 60 ELSE GOSUB
    90
50 INPUT "DO YOU WANT ANOTHER (Y/N)"; Q3$
    : IF LEFT$(Q3$, 1)="Y" THEN GOTO 40   ELSE END
60 FOR J=0 TO NR
    : T=10
    : FOR I=0 TO NC
    : LPRINT C$(I, J); TAB(T); L$;
    : T=T+CS
    : NEXT I
70 LPRINT
    : IF J=0 THEN ST$=CHR$(61) ELSE ST$=CHR$(45)
80 LPRINT STRING$(T-CS+1, ST$)
    : NEXT J
    : LPRINT STRING$(T-CS+1, 61)
    : RETURN
90 CLS
    : FOR J=0 TO NR
    : T=10
    : FOR I=0 TO NC
    : PRINT C$(I, J); TAB(T); L$;
    : T=T+CS
    : NEXT I
    : PRINT
    : NEXT J
    : RETURN
```

Grading Program

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I have just written this Model III program which I believe will be of interest and use to your educator-readers. The program assists the classroom teacher in the calculation of grades throughout the academic year.

The program makes it possible for the classroom teacher to enter daily and weekly quiz, essay, test, and project grades on a quarterly basis for each student. Should a specific grade merit greater weight, it is merely entered as many times as it is to be weighted. When ENTER is pressed in lieu of a grade entry, the program immediately calculates an integral value for the quarterly grade, stores it in memory, and displays it on the screen.

Subsequent quarter grades are entered in the same manner. Then the final examination grade is entered, and the term score is calculated to the nearest tenth, stored and displayed.

Hard copy output is then provided, listing:

1) Name of School
2) Name of Course
3) Name of Teacher
4) Date
5) Name of each student, together with:
   a) grades for each quarter
   b) final examination grade
   c) final grade for course

It can easily be adapted to maintaining disk files for all scores.

```
1Ø CLS
2Ø '*********************************
3Ø '*  SUPERGRADE GRADING PROGRAM *
4Ø '*                 *
5Ø '*       SAM SELTZER      *     FOR TRS-8Ø, MODEL III

6Ø '*   LOCKPORT, NEW YORK 14Ø94  *
7Ø '*       MAY, 1983       *
8Ø '*********************************
9Ø '
99 CLEAR 1ØØØØ
1ØØ DIMS$(1ØØ), Q1(1ØØ), Q2(1ØØ), Q3(1ØØ), Q4(1ØØ),
     Q5(1ØØ), F$(2Ø)
11Ø FOR X=1 TO 5
     : PRINT
     : NEXT
12Ø PRINT TAB(16)"*********************************"
13Ø PRINT TAB(16)"*  SUPERGRADE GRADING PROGRAM *"
14Ø PRINT TAB(16)"*                 *"
15Ø PRINT TAB(16)"*       SAM SELTZER      *"
16Ø PRINT TAB(16)"*   LOCKPORT, NEW YORK 14Ø94  *"
17Ø PRINT TAB(16)"*********************************"
18Ø GOSUB 14ØØ
19Ø CLS
1ØØØ '
1Ø1Ø '*****************
1Ø2Ø '*  DATA INPUT *
1Ø3Ø '*****************
1Ø4Ø '
1Ø5Ø LINE INPUT "COURSE TITLE: "; C$
     : PRINT
1Ø6Ø INPUT "HOW MANY STUDENTS"; N
     : PRINT
1Ø7Ø LINE INPUT "TEACHER'S NAME: "; T$
     : PRINT
1Ø8Ø LINE INPUT "DATE: "; D$
     : PRINT
1Ø9Ø FOR J=1 TO N
11ØØ CLS
     : PRINT "ENTER STUDENT #"; J;
     : LINE INPUT "NAME: "; S$(J)
111Ø PRINT
     : GOSUB 2ØØØ
112Ø IF F=Ø THEN CLS
     : GOTO 111Ø
113Ø Q1(J)=INT(FT/F)
114Ø PRINT
     : PRINT "FIRST QUARTER MARK = "; Q1(J)
115Ø GOSUB 14ØØ
     : CLS
116Ø GOSUB 2ØØØ
117Ø IF F=Ø THEN CLS
     : GOTO 116Ø
118Ø Q2(J)=INT(FT/F)
119Ø PRINT
     : PRINT "SECOND QUARTER MARK = "; Q2(J)
12ØØ GOSUB 14ØØ
     : CLS
121Ø GOSUB 2ØØØ
122Ø IF F=Ø THEN CLS
     : GOTO 121Ø
123Ø Q3(J)=INT(FT/F)
124Ø PRINT
     : PRINT "THIRD QUARTER MARK =  "; Q3(J)
125Ø GOSUB 14ØØ
     : CLS
126Ø GOSUB 2ØØØ
127Ø IF F=Ø THEN CLS
     : GOTO 126Ø
128Ø Q4(J)=INT(FT/F)
129Ø PRINT
     : PRINT "FOURTH QUARTER MARK = "; Q4(J)
13ØØ GOSUB 14ØØ
     : CLS
131Ø PRINT
     : LINE INPUT "ENTER FINAL EXAM MARK: "; FE$
132Ø Q5(J)=VAL(FE$)
133Ø PRINT
     : PRINT
     : PRINT
134Ø PRINT S$(J); "'S FINAL GRADE IS: ";
     (Q1(J)+Q2(J)+Q3(J)+Q4(J)+Q5(J))/5
135Ø GOSUB 14ØØ
136Ø NEXT
137Ø GOSUB 14ØØ
138Ø GOSUB 3ØØØ
139Ø END
14ØØ A$=INKEY$
     : IF A$="" THEN 14ØØ ELSE RETURN
2ØØØ '
2Ø1Ø '*********************************
2Ø2Ø '*  ENTERING QUARTERLY GRADES *
2Ø3Ø '*********************************
2Ø4Ø '
2Ø5Ø F=Ø
     : FT=Ø
     : FOR K=1 TO 2Ø
2Ø6Ø PRINT "ENTER QUARTERLY GRADE # "; K;
     : LINE INPUT": "; F$(K)
2Ø7Ø IF LEN(F$(K))=Ø THEN 21ØØ
2Ø8Ø F=F+1
     : FT=FT+VAL(F$(K))
2Ø9Ø NEXT
21ØØ RETURN
3ØØØ '
3Ø1Ø '**********************
3Ø2Ø '*  PRINTING ROUTINE *
3Ø3Ø '**********************
3Ø4Ø '
3Ø5Ø CLS
     : PRINT "HOW MANY COPIES";
     : INPUT C
3Ø6Ø PRINT @4ØØ, "RESULTS ARE NOW BEING PRINTED"
3Ø7Ø FOR Z=1 TO C
3Ø8Ø LPRINT CHR$(14)TAB(9)"BARKER CENTRAL SCHOOL"
3Ø9Ø LPRINT
     : LPRINT CHR$(14)CHR$(15)TAB(2Ø)"GRADE LIST FOR
     "; C$
31ØØ LPRINT
     : LPRINT CHR$(18)TAB(33)T$
311Ø LPRINT
     : LPRINT TAB(35)D$
312Ø FOR R=1 TO 3
     : LPRINT
     : NEXT R
313Ø FOR J=1 TO N
314Ø LPRINT "STUDENT'S NAME: "; S$(J)
     : LPRINT
315Ø LPRINT "FIRST QUARTER MARK : ";
     : LPRINT USING "###"; Q1(J)
316Ø LPRINT "SECOND QUARTER MARK : ";
     : LPRINT USING "###"; Q2(J)
317Ø LPRINT "THIRD QUARTER MARK : ";
     : LPRINT USING "###"; Q3(J)
318Ø LPRINT "FOURTH QUARTER MARK : ";
     : LPRINT USING "###"; Q4(J)
319Ø LPRINT "FINAL EXAM MARK : ";
     : LPRINT USING "###"; Q5(J)
32ØØ LPRINT
321Ø LPRINT S$(J)"'S FINAL COURSE GRADE IS :";
     (Q1(J)+Q2(J)+Q3(J)+Q4(J)+Q5(J))/5
     : LPRINT
     : LPRINT
322Ø NEXT
323Ø PRINT @86Ø, Z; "COPIES PRINTED; "; C-Z; "COPIES
     TO GO"
324Ø NEXT Z
325Ø RETURN
```

Big Math

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Here is a Color Computer math program written for children.

```
1 '***BIG MATH***
2 '
3 ' BY DAVID MORROW
5 CLS
1Ø PRINT @ 128, STRING$(32, "*")
     : PRINT @ 288, STRING$(32, "*")
15 PRINT @ 2Ø3, "BIG MATH"
2Ø FOR X=1 TO 6ØØ
     : NEXT X
     : CLS
25 PRINT @ 65, "(1) ADDITION"
3Ø PRINT @ 97, "(2) SUBTRACTION"
35 PRINT @ 129, "(3) MULTIPLICATION"
4Ø PRINT @ 161, "(4) DIVISION"
45 INPUT "WHICH EXERCISE (1-4)";R
49 IF R<1 OR R>4 THEN 2Ø
5Ø IF R=4 THEN 61
55 PRINT @ 288, "FOR SINGLE DIGIT PROBLEMS ENTER A
     (1)"
6Ø INPUT OD
61 CLS
62 PRINT @ 64, "YOU WILL BE GIVEN THREE CHANCES TO
     GIVE THE CORRECT ANSWER.  AT WHICH TIME THE
     COMPUTER WILL    TELL YOU THE ANSWER.
63 PRINT @ 224, "PRESS ENTER"
64 INPUT D
65 CLS(Ø)
7Ø EC=Ø
     : B=Ø
     : F=Ø
     : J=Ø
     : L=Ø
95 AS=RND(1Ø)
1ØØ IF AS=1Ø THEN AS=Ø
1Ø5 AO=RND(1Ø)
11Ø IF AO=1Ø THEN AO=Ø
115 B2=RND(1Ø)
12Ø IF B2=1Ø THEN B2=Ø
125 BO=RND(1Ø)
13Ø IF BO=1Ø OR OD=1 THEN BO=Ø
135 IF OD=1 THEN AO=Ø AND BO=Ø
14Ø IF R=4 THEN BO=Ø
145 Z=AO*1Ø+AS
15Ø Y=BO*1Ø+B2
155 IF Y=Ø THEN 65
16Ø IF R=2 AND Y>Z THEN 65
165 IF R=4 AND B2=Ø THEN 65
17Ø IF R=4 AND Z/Y-INT(Z/Y)<>Ø THEN 65
175 IF R=4 AND Z/Y >9 THEN 65
18Ø RL=Ø
     : UD=Ø
185 ON AS GOSUB 3ØØ, 31Ø, 32Ø, 33Ø, 34Ø, 35Ø, 36Ø,
     37Ø, 38Ø
19Ø IF AS<>Ø THEN 2ØØ
195 GOSUB 39Ø
     : GOSUB 425
     : GOSUB 465
     : GOSUB 485
2ØØ RL=12
     : UD=Ø
2Ø5 ON AO GOSUB 3ØØ, 31Ø, 32Ø, 33Ø, 34Ø, 35Ø, 36Ø,
     37Ø, 38Ø
21Ø UD=11
     : RL=Ø
215 ON B2 GOSUB 3ØØ, 31Ø, 32Ø, 33Ø, 34Ø, 35Ø, 36Ø,
     37Ø, 38Ø
22Ø IF B2<>Ø THEN 23Ø
225 GOSUB 39Ø
     : GOSUB 425
     : GOSUB 465
     : GOSUB 485
23Ø IF R=4 THEN BO=Ø
235 RL=12
     : UD=11
24Ø ON BO GOSUB 3ØØ, 31Ø, 32Ø, 33Ø, 34Ø, 35Ø, 36Ø,
     37Ø, 38Ø
245 ON R GOSUB 66Ø, 715, 74Ø, 8ØØ
25Ø FOR X=18 TO 63
255 SET (X, 21, 5)
26Ø NEXT X
265 IF EC=3 THEN SA=CA
     : GOSUB 835
     : PRINT @ 192, "THE  ";
     : PRINT @ 224, "CORRECT ";
     : PRINT @ 256, "ANSWER IS ";
     : GOTO 29Ø
27Ø GOSUB 955
275 IF SA><CA THEN PRINT @ 192, "WRONG ";
     : SOUND 5, 5
     : EC=EC+1
     : GOTO 265
28Ø GOSUB 835
285 IF SA=CA THEN PRINT @ 192, "CORRECT ";
     : FOR X=245 TO 255
     : SOUND X, 1
     : NEXT X
29Ø PRINT @ 32, "PRESS ENTER ";
291 A$=INKEY$
292 IF A$<>"" THEN 65
293 FOR X=1 TO 2ØØ
     : NEXT X
     : PRINT @ 32, "             ";
     : FOR X=1 TO 2ØØ
     : NEXT X
     : GOTO 29Ø
3ØØ GOSUB 39Ø
3Ø5 RETURN
31Ø GOSUB 425
     : GOSUB 445
     : GOSUB 465
     : GOSUB 555
     : GOSUB 52Ø
315 RETURN
32Ø GOSUB 39Ø
     : GOSUB 425
     : GOSUB 445
     : GOSUB 465
325 RETURN
33Ø GOSUB 39Ø
     : GOSUB 445
     : GOSUB 59Ø
335 RETURN
34Ø GOSUB 425
     : GOSUB 445
     : GOSUB 465
     : GOSUB 59Ø
     : GOSUB 625
345 RETURN
35Ø GOSUB 445
     : GOSUB 465
     : GOSUB 485
     : GOSUB 625
355 RETURN
36Ø GOSUB 39Ø
     : GOSUB 425
365 RETURN
37Ø GOSUB 39Ø
     : GOSUB 425
     : GOSUB 445
     : GOSUB 465
     : GOSUB 485
375 RETURN
```

```
380 GOSUB 390
    : GOSUB 425
    : GOSUB 445
    : GOSUB 590
385 RETURN
390 FOR U=UD TO UD+8
395 SET (60-RL, U, 5)
400 NEXT U
405 FOR U=UD TO UD+8
410 SET (61-RL, U, 5)
415 NEXT U
420 RETURN
425 FOR TS=54-RL TO 61-RL
430 SET (TS, UD, 5)
435 NEXT TS
440 RETURN
445 FOR MS=54-RL TO 61-RL
450 SET (MS, UD+4, 5)
455 NEXT MS
460 RETURN
465 FOR BS=54-RL TO 61-RL
470 SET (BS, UD+8, 5)
475 NEXT BS
480 RETURN
485 FOR LS=UD TO UD+8
490 SET (54-RL, LS, 5)
495 NEXT LS
500 FOR LS=UD TO UD+8
505 SET (55-RL, LS, 5)
510 NEXT LS
515 RETURN
520 FOR TR=UD TO UD+4
525 SET (60-RL, TR, 5)
530 NEXT TR
535 FOR TR=UD TO UD+4
540 SET (61-RL, TR, 5)
545 NEXT TR
550 RETURN
555 FOR BL=UD+4 TO UD+8
560 SET (54-RL, BL, 5)
565 NEXT BL
570 FOR BL=UD+4 TO UD+8
575 SET (55-RL, BL, 5)
580 NEXT BL
585 RETURN
590 FOR TL=UD TO UD+4
595 SET (54-RL, TL, 5)
600 NEXT TL
605 FOR TL=UD TO UD+4
610 SET (55-RL, TL, 5)
615 NEXT TL
620 RETURN
625 FOR BR=UD+4 TO UD+8
630 SET (60-RL, BR, 5)
635 NEXT BR
640 FOR BR=UD+4 TO UD+8
645 SET (61-RL, BR, 5)
650 NEXT BR
655 RETURN
660 FOR X=30 TO 39
665 SET (X, 15, 5)
670 NEXT X
675 FOR X=12 TO 18
680 SET (35, X, 5)
685 NEXT X
690 FOR X=12 TO 18
695 SET (34, X, 5)
700 NEXT X
705 CA=Z+Y
710 RETURN
715 FOR X=30 TO 39
720 SET (X, 15, 5)
725 NEXT X
730 CA=Z-Y
735 RETURN
740 P=32
    : PP=12
745 SET (P, PP, 5)
750 IF P=39 THEN 765
755 P=P+1
    : PP=PP+1
760 GOTO 745
765 P=39
    : PP=12
770 SET (P, PP, 5)
775 CA=Z*Y
780 P=P-1
    : PP=PP+1
785 IF P=31 THEN 795
790 GOTO 770
795 RETURN
800 FOR X=29 TO 39
805 SET (X, 15, 5)
810 NEXT X
815 CA=Z/Y
820 SET (35, 13, 5)
    : SET (34, 13, 5)
825 SET (35, 17, 5)
    : SET (34, 17, 5)
830 RETURN
835 IF SA>999 THEN 855
840 IF SA>99 THEN D=SA
    : GOTO 875
845 IF SA>9 THEN H=SA
    : GOTO 895
850 L=SA
    : GOTO 940
855 A=SA/1000
860 B=INT(A)
865 C=B*1000
870 D=SA-C
875 E=D/100
880 F=INT(E)
885 G=F*100
890 H=D-G
895 I=H/10
900 J=INT(I)
905 K=J*10
910 L=H-K
915 IF B<>0 THEN RL=36
    : UD=23
    : ON B GOSUB 300, 310, 320, 330, 340, 350, 360,
    370, 380
920 IF B=0 AND F=0 THEN 930 ELSE RL=24
    : UD=23
    : ON F GOSUB 300, 310, 320, 330, 340, 350, 360,
    370, 380
925 IF F=0 THEN GOSUB 390
    : GOSUB 425
    : GOSUB 465
    : GOSUB 485
930 IF B=0 AND F=0 AND J=0 THEN 940 ELSE RL=12
    : UD=23
    : ON J GOSUB 300, 310, 320, 330, 340, 350, 360,
    370, 380
935 IF J=0 THEN GOSUB 390
    : GOSUB 425
    : GOSUB 465
    : GOSUB 485
940 RL=0
    : UD=23
    :  ON L GOSUB 300, 310, 320, 330, 340, 350, 360,
    370, 380
945 IF L=0 THEN GOSUB 390
    : GOSUB 425
    : GOSUB 465
    : GOSUB 485
950 RETURN
955 A$=INKEY$
960 IF A$<>"" THEN AL=ASC(A$)-48
    : GOTO 970
965 GOTO 955
```

```
970 A$=INKEY$
975 IF A$<>"" THEN BL=ASC(A$)-48
    : GOTO 985
980 GOTO 970
985 IF BL=-35 THEN SA=AL
    : RETURN
990 A$=INKEY$
995 IF A$<>"" THEN CL=ASC(A$)-48
    : GOTO 1005
1000 GOTO 990
1005 IF CL=-35 THEN SA=AL*10+BL
    : RETURN
1010 A$=INKEY$
1015 IF A$<> "" THEN DL=ASC(A$)-48
    : GOTO 1025
1020 GOTO 1010
1025 IF DL=-35 THEN SA=(AL*100)+(BL*10)+CL
    :  RETURN
1030 A$=INKEY$
1035 IF A$<>"" THEN EL=ASC(A$)-48
    : GOTO 1045
1040 GOTO 1030
1045 SA=(AL*1000)+(BL*100)+(CL*10)+DL
    : RETURN
```

Clock

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In *Going Ahead With Extended Color BASIC* it says to store a graphics rectangle, a two-dimensional array with elements equal to the sides of the rectangle needed. In other words, an 8×8 rectangle needs an 8×8 array. I have found this to be a great waste of memory. In PMODE 4, an 8×8 rectangle only uses 8 bytes of display memory and in PMODE 3, an 8×8 rectangle only uses 16 bytes of display memory. When ever an 8×8 array is dimensioned, it grabs a lot more than 16 bytes, and all that memory cannot be used by BASIC.

When ever I write a graphics program that uses the GET and PUT statements, I compute the arrays as follows:

MODE	FORMULA FOR ARRAY
2 Color	INT(WIDTH/8)+1,INT(HEIGHT/8)+1
4 Color	INT(WIDTH/4)+1,INT(HEIGHT/4)+1

EXAMPLE: PMODE 4

AREA = 10×6
INT(10/8)+1=2
INT(6/8)+1=1
ARRAY= (2,1)

So, an area 10×6 only needs a statement like "DIM ARRAY (2,1)" instead of "DIM ARRAY (10,6)", in PMODE 4. I have included a program which uses this technique to store 5×7 matrix characters (0-9). This allows the program to run on a 16K machine instead of the 32K, which would be needed otherwise.

The program can be used to teach children to tell time. It draws a clock face, picks a random time, and prompts for the answer. If the wrong answer is pressed it will not be displayed. If the right number is pressed it is displayed. After the correct time is entered, there is a slight delay, and a new clock is drawn.

```
10 'CLOCK TEACHER
20 'BY PAUL OBERHOLTZER
30 'DATE DECEMBER 6, 1982
100 '*** SETUP ***
110 DIM N1(1, 1), N2(1, 1), N3(1, 1)
120 DIM N4(1, 1), N5(1, 1), N6(1, 1)
130 DIM N7(1, 1), N8(1, 1), N9(1, 1), N0(1, 1)
140 N1$="R1; U1; D6; L1; R2"
150 N2$="E1; R2; F1; D1; G1; L1; G2; D1; R4"
160 N3$="E1; R2; F1; D1; G1; L1; R1; F1; D1; G1; L2;
    H1"
170 N4$="L4; U1; E3; D6"
180 N5$="L4; D2; R3; F1; D2; G1; L2; H1"
190 N6$="H1; L2; G1; D4; F1; R2; E1; U1; H1; L2"
200 N7$="R4; D1; G3; D2"
210 N8$="R2; F1; D1; G1; F1; D1; G1; L2; H1; U1; E1;
    R2; L2; H1; U1"
220 N9$="F1; R2; E1; U4; H1; L2; G1; D1; F1; R2"
230 N0$="R2; F1; D4; G1; L2; H1; U4"
240 '** DRAW NUMBERS **
250 PMODE 4, 1
    : COLOR 0, 1
260 PCLS(1)
    : SCREEN 1, 1
270 DRAW "BM152, 53; XN1$; "
280 DRAW "BM170, 69; XN2$; "
290 DRAW "BM180, 94; XN3$; "
300 DRAW "BM174, 122; XN4$; "
310 DRAW "BM154, 134; XN5$; "
320 DRAW "BM129, 141; XN6$; "
330 DRAW "BM102, 134; XN7$; "
340 DRAW "BM83, 118; XN8$; "
350 DRAW "BM72, 98; XN9$; "
360 DRAW "BM86, 68; XN0$; "
370 DRAW "BM80, 69; XN1$; "
380 DRAW "BM99, 53; XN1$; "
390 DRAW "BM105, 53; XN1$; "
400 DRAW "BM123, 46; XN1$; "
410 DRAW "BM128, 46; XN2$; "
420 GOSUB 1000
430 '*** DRAW CLOCK FACE ***
440 CIRCLE (128, 96), 5
450 CIRCLE (128, 96), 3
460 CIRCLE (128, 96), 65, , .85
470 CIRCLE (151, 75), 9, , .5
480 CIRCLE (107, 75), 9, , .5
490 CIRCLE (128, 65), 60,   1, .16, .35
500 CIRCLE (151, 75), 4
510 CIRCLE (107, 75), 4
520 HR=RND(12)
    : TM=RND(12)
530 ON HR GOSUB 303O, 305O, 307O, 309O, 311O, 313O,
    315O, 317O, 319O, 321O, 323O, 301O
540 ON TM GOSUB 403O, 405O, 407O, 409O, 411O, 413O,
    415O, 417O, 419O, 421O, 423O, 401O
550 MIN=TM*5
    : IF MIN=60 THEN MIN=0
560 '*** WHAT TIME IS IT? ***
570 DRAW "BM76, 12; D6; E2; U1; D1; F2; U6"
580 DRAW "BM83, 12; D6; U3; R4; U3; D6"
590 DRAW "BM90, 18; U4; E2; F2; D2; L3; R3; D2"
600 DRAW "BM97, 12; R4; L2; D6"
610 DRAW "BM111, 12; R4; L2; D6"
620 DRAW "BM119, 12; R2; L1; D6; L1; R2"
630 DRAW "BM125, 18; U6; F2; E2; D6"
640 DRAW "BM137, 12; L4; D3; R2; L2; D3; R4"
650 DRAW "BM148, 12; R2; L1; D6; L1; R2"
660 DRAW "BM159, 13; H1; L2; G1; F4; G1; L2; H1"
670 DRAW "BM169, 12; R2; L1; D6; L1; R2"
680 DRAW "BM175, 12; R4; L2; D6"
690 DRAW "BM183, 13; E1; R1; F1; D1; G1; L1; D1"
    : PSET(184, 18)
700 '*** ANSWER ROUTINE ***
710 IF HR<10 GOTO 770
720 X=110
    : Y=162
    : HR=HR-10
```

```
73Ø GOSUB 7ØØØ
74Ø IF VAL(A$)= 1 THEN 76Ø ELSE GOSUB 6ØØØ
75Ø GOTO 73Ø
76Ø GOSUB 5ØØØ
77Ø GOSUB 7ØØØ
78Ø IF VAL(A$)=HR THEN 8ØØ ELSE GOSUB 6ØØØ
79Ø GOTO 77Ø
8ØØ X=118
     : Y=162
     : GOSUB 5ØØØ
81Ø PSET (127, 164)
     : PSET (127, 167)
82Ø ML=INT(MIN/1Ø)
     : MR=MIN-ML*1Ø
83Ø GOSUB 7ØØØ
84Ø IF VAL(A$)=ML THEN 86Ø ELSE GOSUB 6ØØØ
85Ø GOTO 83Ø
86Ø X=131
     : GOSUB 5ØØØ
87Ø GOSUB 7ØØØ
88Ø IF VAL(A$)=MR THEN 9ØØ ELSE GOSUB 6ØØØ
89Ø GOTO 87Ø
9ØØ X=139
     : GOSUB 5ØØØ
91Ø FOR T=1 TO 1ØØØ
     : NEXT T
92Ø GOTO 26Ø
99Ø '*** SUBROUTINES ***
1ØØØ '** GET NUMBERS **
1Ø1Ø GET (15Ø, 52)-(154, 58), N1, G
1Ø2Ø GET (17Ø, 68)-(174, 74), N2, G
1Ø3Ø GET (18Ø, 93)-(184, 99), N3, G
1Ø4Ø GET (17Ø, 118)-(174, 124), N4, G
1Ø5Ø GET (15Ø, 134)-(154, 14Ø), N5, G
1Ø6Ø GET (125, 14Ø)-(129, 146), N6, G
1Ø7Ø GET (1Ø2, 134)-(1Ø6, 14Ø), N7, G
1Ø8Ø GET (82, 118)-(86, 124), N8, G
1Ø9Ø GET (72, 93)-(76, 99), N9, G
11ØØ GET (85, 68)-(89, 74), NØ, G
111Ø RETURN
2ØØØ '** PUT NUMBERS **
2Ø1Ø PUT (X, Y)-(X+4, Y+6), N1, PSET
     : RETURN
2Ø2Ø PUT (X, Y)-(X+4, Y+6), N2, PSET
     : RETURN
2Ø3Ø PUT (X, Y)-(X+4, Y+6), N3, PSET
     : RETURN
2Ø4Ø PUT (X, Y)-(X+4, Y+6), N4, PSET
     : RETURN
2Ø5Ø PUT (X, Y)-(X+4, Y+6), N5, PSET
     : RETURN
2Ø6Ø PUT (X, Y)-(X+4, Y+6), N6, PSET
     : RETURN
2Ø7Ø PUT (X, Y)-(X+4, Y+6), N7, PSET
     : RETURN
2Ø8Ø PUT (X, Y)-(X+4, Y+6), N8, PSET
     : RETURN
2Ø9Ø PUT (X, Y)-(X+4, Y+6), N9, PSET
     : RETURN
21ØØ PUT (X, Y)-(X+4, Y+6), NØ, PSET
     : RETURN
3ØØØ '** LITTLE HAND **
3Ø1Ø LINE (123, 94)-(129, 68), PSET
3Ø2Ø LINE -(133, 94), PSET
     : RETURN
3Ø3Ø LINE (125, 92)-(145, 75), PSET
3Ø4Ø LINE -(133, 97), PSET
     : RETURN
3Ø5Ø LINE (127, 92)-(155, 83), PSET
3Ø6Ø LINE -(131, 1ØØ), PSET
     : RETURN
3Ø7Ø LINE (129, 92)-(161, 98), PSET
3Ø8Ø LINE -(129, 1ØØ), PSET
     : RETURN
3Ø9Ø LINE (132, 93)-(155, 113), PSET
31ØØ LINE -(125, 1ØØ), PSET
     : RETURN
311Ø LINE (133, 94)-(143, 124), PSET
312Ø LINE -(126, 1Ø1), PSET
     : RETURN
313Ø LINE (132, 95)-(127, 127), PSET
314Ø LINE -(124, 95), PSET
     : RETURN
315Ø LINE (131, 1ØØ)-(1Ø8, 123), PSET
316Ø LINE -(124, 94), PSET
     : RETURN
317Ø LINE (125, 94)-(97, 1Ø9), PSET
318Ø LINE -(126, 1Ø1), PSET
     : RETURN
319Ø LINE (126, 92)-(93, 95), PSET
32ØØ LINE -(126, 1ØØ), PSET
     : RETURN
321Ø LINE (127, 92)-(1Ø1, 78), PSET
322Ø LINE -(125, 1ØØ), PSET
     : RETURN
323Ø LINE (13Ø, 93)-(112, 69), PSET
324Ø LINE -(124, 99), PSET
     : RETURN
4ØØØ '** BIG HAND **
4Ø1Ø LINE (126, 93)-(128, 52), PSET
4Ø2Ø LINE -(13Ø, 93), PSET
     : RETURN
4Ø3Ø LINE (127, 93)-(151, 57), PSET
4Ø4Ø LINE -(131, 99), PSET
     : RETURN
4Ø5Ø LINE (128, 94)-(17Ø, 73), PSET
4Ø6Ø LINE -(129, 98), PSET
     : RETURN
4Ø7Ø LINE (128, 94)-(18Ø, 96), PSET
4Ø8Ø LINE -(128, 98), PSET
     : RETURN
4Ø9Ø LINE (129, 94)-(17Ø, 119), PSET
41ØØ LINE -(127, 98), PSET
     : RETURN
411Ø LINE (131, 97)-(15Ø, 134), PSET
412Ø LINE -(126, 97), PSET
     : RETURN
413Ø LINE (126, 96)-(127, 14Ø), PSET
414Ø LINE -(13Ø, 96), PSET
     : RETURN
415Ø LINE (126, 95)-(1Ø6, 134), PSET
416Ø LINE -(13Ø, 97), PSET
     : RETURN
417Ø LINE (126, 94)-(86, 118), PSET
418Ø LINE -(129, 98), PSET
     : RETURN
419Ø LINE (128, 94)-(76, 96), PSET
42ØØ LINE -(128, 98), PSET
     : RETURN
421Ø LINE (127, 94)-(89, 72), PSET
422Ø LINE -(126, 98), PSET
     : RETURN
423Ø LINE (13Ø, 94)-(1Ø3, 58), PSET
424Ø LINE -(125, 96), PSET
     : RETURN
5ØØØ '*** CORRECT KEY ***
5Ø1Ø IF A$="1" THEN GOSUB 2Ø1Ø
5Ø2Ø IF A$="2" THEN GOSUB 2Ø2Ø
5Ø3Ø IF A$="3" THEN GOSUB 2Ø3Ø
5Ø4Ø IF A$="4" THEN GOSUB 2Ø4Ø
5Ø5Ø IF A$="5" THEN GOSUB 2Ø5Ø
5Ø6Ø IF A$="6" THEN GOSUB 2Ø6Ø
5Ø7Ø IF A$="7" THEN GOSUB 2Ø7Ø
5Ø8Ø IF A$="8" THEN GOSUB 2Ø8Ø
5Ø9Ø IF A$="9" THEN GOSUB 2Ø9Ø
51ØØ IF A$="Ø" THEN GOSUB 21ØØ
511Ø SOUND 2ØØ, 1
     : RETURN
6ØØØ '*** INCORRECT KEY ***
6Ø1Ø SOUND 5Ø, 3
     : RETURN
7ØØØ '*** INPUT ***
7Ø1Ø A$=INKEY$
     : IF A$="" THEN 7Ø1Ø
```

```
7020 RETURN
9999 END
```

Counting on the Color Computer

Ralph Delperdang
5624 Wagon Train Road
Austin, TX 78749

I wrote this counting program for my 4-year-old daughter. She could count up to 100 with a little help, but she did not know what numbers over 10 looked like. To run this program once loaded, just start typing the numbers: 1, 2, 3, 4, etc. You can shorten this program by leaving out steps 394 through 530. This will allow you to count from 1 to 99 instead of 1 to 999. This program requires only 4K.

```
10 'COUNTING PROGRAM FOR THE     TRS-80 COLOR
    COMPUTER          RALPH DELPERDANG
    5624 WAGON TRAIN RD            AUSTIN, TEXAS
    78749            24 AUGUST 1982
20 'THIS PROGRAM MONITORS A      CHILD'S ABILITY TO
    COUNT FROM   1 TO 999. IF THE CHILD MAKES A
    MISTAKE THE COMPUTER WILL       "BEEP" THEN WAIT
    FOR THE        CORRECT RESPONSE.
30 'AFTER 10 MISTAKES THE        PROGRAM WILL STOP
    AND DISPLAY   ALL THE NUMBERS THE CHILD
    MISSED.
100 DIMD(10)
110 CLS
114 '
115 'SUBROUTINE FOR THE ONE      DIGIT NUMBERS
116 '
120 FOR A=1 TO 9
130 B$=INKEY$
140 IF B$="" THEN 130
150 IF VAL(B$)=A  THEN SOUND 170, 1
    : PRINT "  "; B$; " "; ELSE GOSUB 1000
    : GOTO 130
160 NEXT A
194 '
195 'SUBROUTINE FOR THE TWO      DIGIT NUMBERS
196 '
200 FOR A=10 TO 99
210 B$=INKEY$
220 IF B$="" THEN 210
230 C=INT(A/10)
240 IF VAL(B$)=C  THEN SOUND 170, 1
    : PRINT " "; B$; ELSE GOSUB 1000
    : GOTO 210
250 B$=INKEY$
260 IF B$="" THEN 250
270 H=1
280 C=A-(INT(A/10)*10)
290 IF VAL(B$)=C  THEN SOUND 170, 1
    : PRINT B$; " "; ELSE GOSUB 1000
    : GOTO 250
300 H=0
310 NEXT A
394 '
395 'SUBROUTINE FOR THE THREE    DIGIT NUMBERS
396 '
400 FOR A=100 TO 999
410 B$=INKEY$
420 IF B$="" THEN 410
430 C=INT(A/100)
440 IF VAL(B$)=C  THEN SOUND 170, 1
    : PRINT B$; ELSE GOSUB 1000
    : GOTO 410
450 B$=INKEY$
460 IF B$="" THEN 450
470 C=INT(A/10)-(INT(INT(A/10)/10)*10)
480 IF VAL(B$)=C THEN SOUND 170, 1
    : PRINT B$; ELSE GOSUB 1000
    : GOTO 450
490 B$=INKEY$
500 IF B$="" THEN 490
510 C=A-(INT(A/10)*10)
520 IF VAL(B$)=C  THEN SOUND 170, 1
    : PRINT B$; " "; ELSE GOSUB 1000
    : GOTO 490
530 NEXT A
594 '
595 'SUBROUTINE THAT LISTS THE   MISTAKES
596 '
600 PRINT
    : PRINT "ERRORS:"
610 FOR G=1 TO E
620 PRINT D(G);
640 NEXT G
650 END
994 '
995 'SUBPROGRAM THAT COLLECTS    THE MISTAKES
996 '
1000 IF A<10 THEN PRINT " ";
1010 IF A<100 AND H=0 THEN PRINT " ";
1020 PRINT B$;
1030 SOUND 89, 16
1040 E=E+1
1050 D(E)=A
1060 PRINT CHR$(8);
1070 IF A<10 THEN PRINT CHR$(8);
1080 IF A<100 AND H=0 THEN PRINT CHR$(8);
1090 IF E=10 GOTO 600
1100 H=0
1110 RETURN
```

Matrix

Robert E. Cutter
2505 West 6th Street, #701
Los Angeles, CA 90057

Sometimes in life it is necessary to do unpleasant tasks, one of which is finding the product of two matrices. To avoid this little chore I decided to teach my Color Computer how to do this for me. It seems to enjoy doing repetitive operations of this nature.

The program first asks you to decide what type of numbers you will be using (integer, decimal, etc.). For the purpose of demonstration, press [ENTER] (format will be integers). You are now asked for the number of rows in the first matrix (M). Enter [3]. Now you are asked for the number of columns. Enter [3]. The program now requests the number for row one, column one M(1,1). Enter [1]. Now, you are asked for the number in row one, column two M(1,2). Enter [2]. Enter [3] in M(1,3) for row one, column three. For M(2,1), enter [4]. For M(2,2), enter [5]. For M(2,3) enter [6]. For M(3,1) enter [7]. For M(3,2) enter [8], and for M(3,3) enter [9]. You should now see the matrix you just entered displayed on the screen.

```
1  2  3
4  5  6
7  8  9  MATRIX M
```

If it is not correct, input "N" for "NO" and do it over. If it is correct, press [ENTER] and the program will ask if the second matrix (N) has been entered. Press [ENTER]. You are now asked to supply the same information for the second matrix (N) as you did for the first matrix (M). Enter the following matrix.

```
1  1  1
2  2  2
3  3  3
```

Rows: 3 Columns:3 N(1,1) = 1, N(2,1) = 1, . . . N(3,3) = 3

Again, you are asked to verify the matrix. If it is incorrect, enter "NO" and do it over. If it is correct, press ENTER. You should see the product displayed.

```
MATRIX P    14  14  14
            32  32  32
            50  50  50
```

It beats pencil and paper every time.

```
1 'MATRIX MULT.'
2 'ROBERT E CUTTER'
3 '2505 W 6TH ST  APT 701'
4 'LOS ANGELES, CA 90057'
5 'EXTENDED COLOR BASIC 1.0'
6 '3/11/83  V. III'
10 DIMS(100), T(30)
     : F=1
20 CLS
     : PRINT STRING$(32, 175);
30 PRINT "   THIS PROGRAM WILL FIND THE       PRODUCT
     OF TWO MATRICES."
40 F$(0)=" ####"
     : F$(1)=" ###.#"
     : F$(2)=" ##.##"
     : F$(3)=" #.###"
     : F$(4)=" .####"
50 PRINT STRING$(32, 175);
60 PRINT TAB(9)"CHOOSE FORMAT"
70 PRINT TAB(11)"0: ####"
     : PRINT TAB(11)"1: ###.#"
     : PRINT TAB(11)"2: ##.##"
     : PRINT TAB(11)"3: #.###"
     : PRINT TAB(11)"4: .####"
     : PRINT
     : PRINT
80 PRINT TAB(6)
     : INPUT "ENTER CHOICE (0 - 4)"; V
90 CLS
     : PRINT TAB(5)"MATRIX ONE M(RXC):"
100 INPUT "NUMBER OF ROWS="; A
     : SOUND 100, 1
110 INPUT "NUMBER OF COLUMNS="; B
     : SOUND 100, 1
120 FOR R=1 TO A
     : FOR C=1 TO B
     : PRINT "M("R", "C")=";
     : INPUT M(R, C)
     : SOUND 175, 1
     : NEXT C, R
     : SOUND 100, 4
     : CLS
130 FOR R=1 TO A
     : PRINT
     : FOR C=1 TO B
     : PRINT USING F$(V); M(R, C);
     : NEXT C, R
     : PRINT " MATRIX M"
140 PRINT
     : PRINT
     : INPUT "IS THIS CORRECT--YES OR NO"; Q$
     : CLS
150 IF Q$="N" OR Q$="NO" THEN 90 ELSE 160
160 CLS
     : INPUT "HAS MATRIX N BEEN ENTERED"; Q$
170 IF Q$="Y" OR Q$="YES" THEN 250 ELSE 180
180 CLS
     : PRINT TAB(5)"MATRIX TWO N(RXC):"
190 INPUT "NUMBER OF ROWS="; D
     : SOUND 100, 1
200 INPUT "NUMBER OF COLUMNS="; E
     : SOUND 100, 1
210 FOR R=1 TO D
     : FOR C=1 TO E
     : PRINT "N("R", "C")=";
     : INPUT N(R, C)
     : SOUND 175, 1
     : NEXT C, R
     : SOUND 100, 4
     : CLS
220 FOR R=1 TO D
     : PRINT
     : FOR C=1 TO E
     : PRINT USING F$(V); N(R, C);
     : NEXT C, R
     : PRINT " MATRIX N"
230 PRINT
     : PRINT
     : INPUT "IS THIS CORRECT--YES OR NO"; Q$
240 IF Q$="N" OR Q$="NO" THEN 180 ELSE 250
250 CLS
     : IF (B)<>(D) THEN PRINT @(160+3),
     "MULTIPLICATION NOT DEFINED"
     : SOUND 100, 30
     : CLS
     : GOTO 90
260 FOR R=1 TO A
     : FOR X=1 TO E
     : FOR C=1 TO B
270 S(F)=M(R, C)*N(C, X)
     : F=F+1
280 NEXT C, X, R
290 K=1
     : L=D
300 FOR Z=1 TO A*E
310 FOR X=(K) TO (L)
320 T(Z)=T(Z)+S(X)
330 NEXT X
     : K=K+D
     : L=L+D
340 NEXT
350 X=1
360 FOR R=1 TO A
     : FOR C=1 TO E
     : P(R, C)=T(X)
     : X=X+1
     : NEXT C, R
370 FOR R=1 TO A
     : PRINT
     : FOR C=1 TO E
     : PRINT USING F$(V); P(R, C);
     : NEXT C, R
380 PRINT
390 PRINT "MATRIX P M*N"
400 FOR Z=1 TO 460*5
     : NEXT
410 FOR R=1 TO A
     : PRINT
     : FOR C=1 TO B
     : PRINT USING F$(V); M(R, C);
     : NEXT C, R
     : PRINT " MATRIX M"
420 FOR R=1 TO D
     : PRINT
     : FOR C=1 TO E
     : PRINT USING F$(V); N(R, C);
     : NEXT C, R
     : PRINT " MATRIX N"
430 FOR Z=1 TO 100
     : S(Z)=0
     : NEXT
     : F=1
440 FOR Z=1 TO 30
     : T(Z)=0
     : NEXT
450 PRINT
     : PRINT
     : INPUT "IF YOU WISH TO ALTER MATRIX M  OR N:
     ENTER M OR N"; Q$
     : CLS
460 IF Q$="M" THEN 90 ELSE 180
470 END
```

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SPRINGFIELD 1985 Main St., Northgate Plz., (413) 732-4745
WORCESTER Lincoln Plaza, (617) 852-6844

MICHIGAN
ANN ARBOR 2515 Jackson Rd., (313) 761-6266
BIRMINGHAM 3620 W. Maple Rd., (313) 647-2151
DEARBORN Westborn Shop. Ctr., 23161 Michigan Ave., (313) 274-6161
DETROIT DWNTN 1559 Woodward Ave., (313) 961-6855
FLINT G3298 Miller Rd., Yorkshire Plaza, (313) 732-2530
GRAND RAPIDS 3142 28th St. SE., (616) 957-2040
KALAMAZOO 25 Kalamazoo Center, (616) 343-0780
LANSING 2519 S. Cedar St., (517) 372-1120
PLAINFIELD North Kent Mall, (616) 364-7558
PONTIAC North Oak Plaza-Pontiac Mall, 2436 Elizabeth Lake Rd., (313) 682-6800
LIVONIA 33470 W. 7 Mile Rd., (313) 476-6800
ROSEVILLE 31873 Gratiot Ave., (313) 296-6210
SOUTHFIELD 17651 West 12 Mile Rd., (313) 569-1027
TROY Oakland Plaza, 322 John R. Rd., (313) 585-3900
WARREN 29038 Van Dyke Ave., (313) 573-3870

MINNESOTA
BLOOMINGTON 10566 France Ave. S., (612) 884-1641
GOLDEN VALLEY Golden Valley S/C, 8016 Olson Memorial Hwy., (612) 542-8471
MINNEAPOLIS 830 Marquette Ave., (612) 340-0788
ST. PAUL 6th & Wabasha, (612) 291-7230

MISSISSIPPI
GULFPORT 516A Courthouse Rd., (601) 896-9295
JACKSON 979 Ellis Ave., (601) 352-5001

MISSOURI
DES-PERES 11960 Manchester Rd., (314) 965-5911
FLORISSANT 47 Florissant Oaks S/C, (314) 921-7722
INDEPENDENCE 1325 S. Noland Rd., (816) 254-3701
KANSAS CITY 4025 N. Oak Trafficway, (816) 455-3381
ST. ANN 10472 St. Charles Rock Rd., (314) 428-1400
ST. LOUIS 500 No. Broadway (Commerce Bank Bldg., Downtown), (314) 241-4335
SPRINGFIELD 2684 S. Glenstone, (417) 883-4320

NEBRASKA
LINCOLN 4601 "O" St., (402) 483-7841
OMAHA 3006 Dodge St., (402) 346-4003; 1318 72nd St. at Pacific, (402) 397-1086

NEVADA
LAS VEGAS Commercial Center, 953 E. Sahara #31-B, (702) 731-3956
RENO 3328 Kietzke Lane, (702) 826-6327

NEW HAMPSHIRE
MANCHESTER Hampshire Plaza, 1000 Elm St., (603) 625-4040
NASHUA 429 Amherst St., Rt. 101A, (603) 881-8588

NEW JERSEY
BRIDGEWATER 1472 U.S. Highway 22 East, (201) 469-3232
E. BRUNSWICK 595 A Rt. 18, (201) 238-7142
E. HANOVER Rt. 10, Hanover Plaza, (201) 884-1200
LAWRENCEVILLE Rt. 1 & Texas Ave., (609) 771-8113
NEWARK 595 Broad, (201) 622-1339
NORTHFIELD 322-24 Tilton Rd., (609) 645-7676
PARAMUS 175 Rt. 17 S., (201) 262-1920
SPRINGFIELD Rt. #22 Center Isle, (201) 467-9827
TOMS RIVER 700 Rt. 18 West, (201) 349-3010
VOORHEES 35 Eagle Plaza, (609) 346-0600

NEW MEXICO
ALBUQUERQUE 2108 San Mateo NE., (505) 265-9587

NEW YORK
ALBANY Shoppers Pk. Wolf Rd., (518) 459-5527
BAYSHORE 1751 Sunrise Hwy., (516) 666-1800
BETHPAGE 422 N. Wantagh Ave., (516) 822-6403
BROOKLYN 531 86th St., (212) 238-3576
BUFFALO 839 Niagara Falls Blvd., (716) 837-2590
FRESH MEADOWS 187-12 Horace Harding Exp., (212) 454-1075
GARDEN CITY 960 Franklin Ave., (516) 294-3350
JOHNSON CITY Giant Shopping Center, Harry L. Drive, (607) 729-6312
KINGSTON Kings Mall, Rt. 9W, (914) 336-6262
MELVILLE TSS Mall, Rt. 110, (516) 673-4646
NEWBURGH Zayre Plaza, Rt. #17K, (914) 561-2960
NEW ROCHELLE 242 North Ave., (914) 636-0700
NEW YORK 385 Fifth Ave., (212) 889-1345, 139 E. 42nd St., (212) 953-6053; 19 W. 23rd St., (212) 691-1861; 347 Madison Ave., (212) 867-8650; 270 Park Ave. South, (212) 533-0470; 1282 Broadway, (212) 279-9260; 9 Broadway, (212) 482-8200
NIAGARA FALLS Pine Plaza, 8351 Niagara Falls Blvd., (716) 283-2041
REGO PARK 97-77 Queens Blvd., (212) 897-5200
ROCHESTER 3080 Winton Rd., (716) 244-9160
SCARSDALE 365 Central Park Ave., (914) 472-2520
SPRING VALLEY White House Center, 88 W. Rt. 59, (914) 425-2828
STATEN ISLAND 2409 Richmond Ave., (212) 698-3100
SYRACUSE 2544 Erie Blvd., (315) 446-3017; Hotel Syracuse, 510 S. Warren St., (315) 471-6663
UTICA Riverside Mall, (315) 735-1933
VALLEY STREAM Green Acres Shop. Ctr., (516) 872-6460
YONKERS Cross Country Shop. Ctr., (914) 964-0471

NORTH CAROLINA
ASHEVILLE K-Mart Shopping Center, Tunnel Rd., (704) 298-6233
CHARLOTTE 3732 Independence Blvd., (704) 535-6320; Tyvola Mall, 5401 South Blvd., (704) 527-3373
DURHAM South Square Mall, (919) 493-4025
FAYETTEVILLE Eutaw Shopping Center, 815 Elm St., (919) 483-2418
GREENSBORO 3718 High Point Rd., (919) 294-5529
RALEIGH Townridge Sq., Hwy. 70 W., (919) 781-9380
WINSTON-SALEM 629 Peters Creek Pkwy., (919) 722-0030

OHIO
AKRON Fairlawn Plaza, 2727 W. Market St., (216) 836-9303
BEDFORD HEIGHTS 5217 Northfield Rd., (216) 662-2477
CANTON 5248 Dressler Rd. NW., (216) 494-7230; Mellet Plaza, 3826 W. Tuscarawas, (216) 478-1878
CENTERVILLE 2026 Miamisburg-Centerville Rd., (513) 435-5167
CINCINNATI 9725 Montgomery, (513) 793-8688; 16-18 Convention Way (on Skywalk), (513) 381-4664
CLEVELAND 419 Euclid (Dwntwn), (216) 575-0800, 27561 Euclid Ave., (216) 289-6823
COLUMBUS 862 S. Hamilton, Great Eastern S/C, (614) 864-2806; The Patio Shop. Ctr., 4661 Karl Rd., (614) 436-4666; 400 N. High St., (614) 464-2781
DAYTON Northwest Plaza, 3279 West Siebenthaler, (513) 277-6500
ELYRIA 286 Midway Blvd., (216) 324-7741
FAIRFIELD 7255 Dixie Hwy. (1¼ Mi. North of I-275), (513) 874-5964
NORTH OLMSTED Great Northern S/C, (216) 734-2255
PARMA 7551 W. Ridgewood Dr., (216) 842-4030
TOLEDO 5844 W. Central Ave., (419) 531-5797; Brownstone Plaza, 1724 S. Reynolds Rd., (419) 867-9153
YOUNGSTOWN Union Square Plaza, 2543 Belmont Ave., (216) 744-4541

OKLAHOMA
OKLAHOMA CITY 4732 SE 29th St., (405) 670-4561; Springdale S/C, 4469 NW 50th, (405) 943-8712; 1101 SW 59th St., (405) 634-2406
TULSA 7218 & 7220 E. 41st St., (918) 663-2190

OREGON
EUGENE 390 Coburg Rd., (503) 687-0082
PORTLAND 7463 SW Barbur Blvd., (503) 246-1157, 9131 SE Powell, (503) 777-2223, 3rd and Washington Sts. (Downtown), (503) 241-7024
SALEM Salem Plaza, 403 Center, (503) 588-7095

PENNSYLVANIA
ALLENTOWN Crest Plaza S/C, Cedar Crest Blvd. US 22, (215) 395-7155
BALA CYNWYD 67 E. City Line Ave., (215) 668-9950
EASTON 25th St. Shopping Center, (215) 250-0160
ELKINS PARK Elkins Park Square, 808 Old York Rd (215) 635-5460
ERIE 5755 Peach St., (814) 868-5541
HARRISBURG Union Deposit Mall, Union Deposit Rd. #17, (717) 564-6753
LANCASTER Park City Plaza, US 30, (717) 393-5617
MONROEVILLE 3828 Wm. Penn. Hwy., (412) 823-3400
MONTGOMERYVILLE Airport Sq., Rt. 309, (215) 362-1200
PHILADELPHIA 7542 Castor Ave., (215) 342-2217; 1002 Chestnut St., (215) 923-3080; 1801 Market St., 10 Penn Center, (215) 568-0901
YORK York County Shopping Center, (717) 757-2786
PITTSBURGH 5775 Baptist Rd., Hills Plaza, (412) 831-9694; 303 Smithfield St., (412) 391-3150; 4643 Baum Blvd., (412) 681-4000; 4768 McKnight Rd., (412) 364-4342
SCRANTON 206 Meadow Ave., (717) 348-1801
WYOMISSING Berkshire Mall West, 1101 Woodland Rd., (215) 372-8610

PUERTO RICO
HATO REY 243 Franklin D. Roosevelt Ave., (809) 759-8248

RHODE ISLAND
E. PROVIDENCE 850 Waterman Ave., (401) 438-2860
PROVIDENCE 177 Union St., (401) 831-0320

SOUTH CAROLINA
COLUMBIA Old Sears Bldg., 1001 Harden St., (803) 799-2065
GREENVILLE N. Hills S/C, (803) 292-1835
N. CHARLESTON 5900 Rivers Ave., (803) 747-5580

SOUTH DAKOTA
SIOUX FALLS 1700 S. Minnesota at 25th, (605) 331-3801

TENNESSEE
CHATTANOOGA 636 Northgate Mall, (615) 870-1386
JOHNSON CITY Peerless Center, (615) 282-6829
KNOXVILLE Cedar Bluff S/C, 9123 Executive Park Dr., (615) 690-0520
MEMPHIS 4665 American Way, (901) 795-4963; 1997 Union Ave., (901) 278-7935
NASHVILLE 2115 Franklin Pike, (615) 298-5484; Rivergate Plaza, (615) 859-3414

TEXAS
AMARILLO Wellington Sq. S/C, 1619 S. Kentucky, (806) 358-4567
ARLINGTON 2500 E. Randol Mill, Suite 113, (817) 274-3127
AUSTIN 8764 E. Research Blvd., (512) 459-4238; Southwood Mall 1501 Ben White Blvd., (512) 447-0371
BROWNSVILLE 1639 Price Rd. (Hwy. 77), (512) 544-6800
BEAUMONT 5330 Eastex Frwy., (409) 898-7000
COLLEGE STATION 2414 Texas Ave., South, (409) 764-8171
CORPUS CHRISTI 1711 S. Staple St., (512) 887-8901
DALLAS 15340 Dallas Pkwy., Suite 1100, (214) 934-0275; 2930 W. Northwest Hwy., (214) 350-4144; 1517 Main St., (214) 760-8601; 2588 Royal Ln., (214) 484-9947
EL PASO 9515 Gateway West, (915) 594-8211; Kern Plaza Shopping Center, 3100 N. Mesa, (915) 544-8156
FT. WORTH 231 One Tandy Center, (817) 335-7198; 2801 Alta Mere, (817) 738-0251
GALVESTON 5924 Broadway, (409) 740-3566
HARLINGEN 1514 S. Hwy 77 Sunshine Strip, (512) 425-8890
HUMBLE 19300 "B" Hwy. 59 (at FM 1960), (713) 446-6314
HOUSTON 2110-C FM 1960, (713) 444-7006; 10543 Gulf Fwy., (713) 943-9310; 5900 North Fwy., (713) 699-1932; 6813 SW Fwy., (713) 777-7907; 809 Dallas St., (713) 651-3002; Holland Square Center, 10920 East Freeway, (713) 453-0600; Champion Forest Plaza, Champion Forest Dr. and F.M. 1960 West, (713) 580-1404; 1018 Gessner, (713) 984-9600; 3278 South Loop West (So. Main at 610) (713) 661-5250
HURST Northeast Mall, (817) 284-1518
LAREDO 102 East Calton Rd., (512) 727-4768
LUBBOCK 3625 34th St., (806) 793-1467
ODESSA 1613 "A" East 8th Street, (915) 334-6355
RICHARDSON Fleetwood Sq. S/C, 202 W. Campbell Rd., (214) 669-1494
SAN ANTONIO 6018 West Ave., (512) 344-8792; 4249 Centergate, (512) 657-3958; Riverbend Parking Garage, 211 W. Market St. (Downtown), (512) 225-0345
WICHITA FALLS 1720-A 9th St., (806) 322-3841

UTAH
OGDEN K-Mart Shopping Center, 3672 Wall Ave., (801) 394-1666
OREM Grand Central Plaza, 384 East & 1300 South, (801) 226-8651
MURRAY 6051 S. State Ave., (801) 268-8978
SALT LAKE CITY 301 South State St., (801) 322-5526

VIRGINIA
ALEXANDRIA 3425 King St. at Quaker Ln., (703) 820-2600
ARLINGTON Crystal City, 2301 So. Jefferson Davis Hwy., (703) 521-7479
FAIRFAX Westfair Center, 11027 Lee Hwy., (703) 273-6500
LYNCHBURG Hill's Plaza, Ward's Rd., (804) 237-1664
NEWPORT NEWS Newmarket South Shop. Ctr., (804) 245-8203
NORFOLK 5731 Poplar Hall Dr., (804) 461-0798; Wards Corner, 122 E. Little Creek Rd., (804) 588-7548
RICHMOND Willow Lawn S/C, 1617 Willow Lawn Dr., (804) 282-3453; 7728 Midlothian Turnpike, (804) 272-8803
ROANOKE Franklin Bldg., 3561 Franklin Rd. S.W., (703) 342-6335
ROSSLYN 1911 N. Ft. Myer Dr. at Rt. 29, (703) 243-5955

WASHINGTON
BELLEVUE Crossroads Mall, North East 8th & 156 St., (206) 644-1804
BELLINGHAM 1111 Cornwall Ave., Suite B & C, (206) 676-0811
FEDERAL WAY 33505 Pacific Hwy. South, (206) 838-6830
OLYMPIA 106 N. Wilson, (206) 754-6111
SEATTLE 18405 Aurora Ave. N., (206) 542-6184; 1521 3rd Ave., (206) 447-1959; 5030 Roosevelt Way NE., (206) 527-1019
SPOKANE 7702 N. Division, (509) 484-7000; E. 12412 Sprague, (509) 922-2800
TACOMA 7030 S. Sprague, (206) 473-7333
TUKWILA 15425 53rd Ave. S., (206) 248-3710
YAKIMA 1111 N. First St., (509) 248-9667

WEST VIRGINIA
HUNTINGTON 2701½ 5th Ave., (304) 523-3527

WISCONSIN
APPLETON 2310 West College Ave., (414) 731-6424
MADISON 57 West Towne Mall, (608) 833-6130
MILWAUKEE 6450 N. 76th St., (414) 353-6790; 729 N. Milwaukee (Downtown), (414) 272-2920
WEST ALLIS 2717 South 108th St., (414) 327-4240