JANUARY, 1982
ISSUE NUMBER 41

PRICE $3.00

THE ORIGINAL MAGAZINE FOR TRS-80™* OWNERS

H&E COMPUTRONICS INC.

*TRS-80™ IS A TRADEMARK OF TANDY CORPORATION

Cover Photo by Harry Peterson

Hayes Stack™

Microcomputer Component Systems

A beautiful match, the Smartmodem and the TRS-80. *Your TRS-80 can talk with other computers,* over the telephone lines. And with no acoustic losses or distortions. *Access time-sharing systems and information utilities* such as the Source,* CompuServe† and MicroNet.
Direct hook-up with no interference noises. The Smartmodem hooks to the telephone line just like a modular telephone, simply insert in a wall jack.
"Love at first sight" – your TRS-80 and the Smartmodem!

Brawny – because it does so many things. *Auto-dial and auto-answer features built in.* With the Smartmodem, your TRS-80 can *automatically* dial the telephone, answer the telephone, receive and transmit, and hang up the telephone. Completely unattended.
*Pulse dialing or Touch-Tone.*** The Smartmodem can be connected to any telephone system in the U.S. because it allows pulse-dialing, Touch-Tone dialing or a combination of the two. FCC approved.
Program controllable in any language using ASCII character strings. This is a unique feature of the Hayes Smartmodem.

Brainy – because it does them all so simply. *Seven LED indicators on the front panel* give you visual signals of the status of the Smartmodem: MR – Modem Ready, SD – Send Data, CD – Carrier Detected, etc.
The audio monitor feature lets you "listen in" on the call being dialed and the connection made. You are immediately alerted to busy signals, wrong numbers, etc.
Over 30 different commands can be entered directly from your TRS-80 keyboard, including the unique "Set" commands which allow you to select and change various optional parameters such as dialing speed, escape code character, length of time for a dial tone, and number of rings to answer. There are 17 "Set" commands.
The Smartmodem is completely compatible with the Bell-103 type modems, the type of modem most time-sharing systems have. Operation can be in full or half-duplex, with a transmission speed of 0-300 baud.

The Smartmodem is ready to "get-together" with your TRS-80. TRS-80 Model II and TRS-80 Color Computers have RS-232 serial ports and can immediately interface with the Smartmodem. Expansions that permit use of the Smartmodem with TRS-80 Model I and Model II are available through your TRS-80 dealer.

Match your TRS-80 with a Hayes Smartmodem for a sophisticated, high performanced data communication system. Available at computer stores nationwide (except TRS-80 dealers) – call or write for the location nearest you. And don't settle for anything less than Hayes.

Hayes

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5835 Peachtree Corners East,
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Your TRS-80 computer and the Hayes Stack™ Smartmodem. Beauty, Brains, and Brawn!

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REGULAR DEPARTMENTS

ON THE COVER — The Lonely Computer Owner.
New computer owners shortly find that they are all alone with their computer. Most TRS 80 owners will find that they need to put at least 500 hours of reading manuals, or magazines and other support resources to really learn to use their computer. Our "BEGINNER'S CORNER" helps fill the void.

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BITS AND PIECES

Howard Y. Gosman

Business Computing

This month, H & E Computronics, Inc. has launched a new publication called *Business Computing*. Just like the *Computronics Monthly News Magazine*, the purpose of *Business Computing* is to help average computer owners learn more about their computers. More and more we find that most computer owners find themselves far away from reality and far away from finding out what they can really do with their computers. *Computronics* and *Business Computing* aim to give computer owners a better perspective towards their computers.

Now is the Time to Subscribe

. . . or to renew your subscription. Besides getting the *Computronics Magazine*, we've added some incentives to get you to subscribe: for each new subscription or renewal, you will be able to select one of the following items:

1. *TRS-80 at your Fingertips, the Nanos Systems Corp. Quick Reference Cards to BASIC, Assembly Language and Graphic Codes.* This is a complete summary of all TRS-80 BASIC commands, all Graphic Codes, all Assembly Language Instructions, and many other important TRS-80 facts. The cards are sturdy, and they should last the lifetime of your computer. *TRS-80 at your Fingertips* is FREE with your subscription. You must specify which computer you own (the cards are available for all TRS-80 models).

2. As before, we will give you a FREE CASSETTE containing the Howe BASIC Word Processor (for writing letters, texts, mailing lists,

continued on page 6

The H & E COMPUTRONICS MONTHLY NEWS MAGAZINE is published by H & E Computronics, Inc., 50 North Pascack Road, Spring Valley, New York 10977. *The H & E COMPUTRONICS MONTHLY NEWS MAGAZINE* is not sponsored, nor in any way officially sanctioned by Radio Shack, a division of Tandy Corporation.

The purpose of the *H & E COMPUTRONICS MONTHLY NEWS MAGAZINE* is to provide and exchange information related to the care, use, and application of the TRS-80™ computer systems. H & E COMPUTRONICS, Inc. does not take any financial responsibility for errors in published materials. Users are advised to check and edit vital programs carefully.

The H & E COMPUTRONICS MONTHLY NEWS MAGAZINE encourages comments, questions, and suggestions. H & E COMPUTRONICS will pay contributors for articles and programs published in the magazine.

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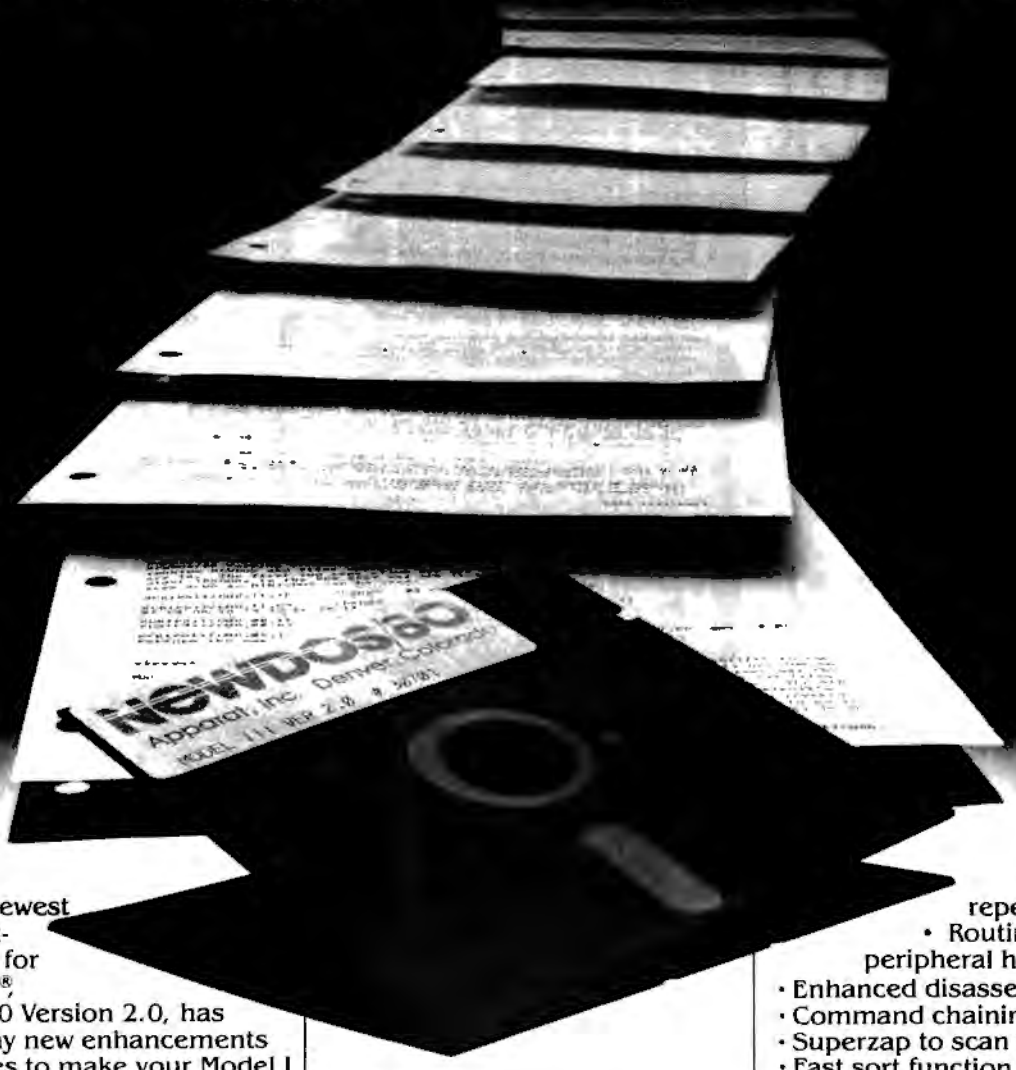
NEWDOS/80 Version 2.0
The Support Keeps Coming.



Apparat's newest disk operating system for the TRS-80®, NEWDOS/80 Version 2.0, has added many new enhancements and features to make your Model I or III computer more powerful. We've kept one thing the same. Our support.

Version 2.0 is our second upgrade of our original NEWDOS for the TRS-80. Each version builds and improves on the capabilities of the preceeding versions. Just as important, Apparat's commitment to supporting our products makes a good product even better. By providing our customers with zaps on an ongoing basis, we're continually making NEWDOS/80 Version 2.0 a more powerful tool.

Version 2.0...
High Performance DOS

NEWDOS/80 Version 2.0 builds even more performance into NEWDOS/80. The versatility and sophistication of Version 2.0 includes features like:

- Double density support on the Model I
- Enhanced compatability between Model I and III
- Triples directory size
- Dynamically merge in basic (also allows merging of non ASC II format files)
- Selective variable clearing
- Can display basic listings page by page
- Automatic repeat function key
- Routing for peripheral handling
- Enhanced disassembler
- Command chaining
- Superzap to scan files
- Fast sort function in basic

These new features, added to the existing capabilities of NEWDOS/80, makes it one of the most powerful additions you can make to your system. And Apparat's commitment to support assures that you've purchased a superior product, both today and tomorrow. At just $149.00 it could be the best investment you will make for your TRS-80.

If you're thinking about upgrading your system, call Apparat today. Dealer inquiries welcome.

303-741-1778

TRS-80 is a registered trademark of Tandy Corp.

VISA

Apparat, Inc.

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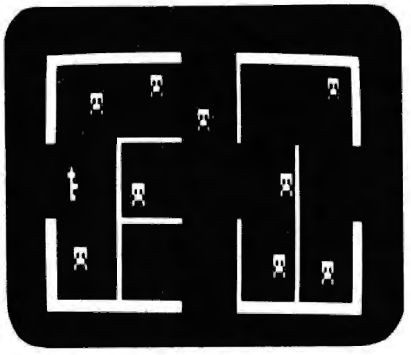
"ON GOING SUPPORT FOR MICROCOMPUTERS"

WHY IS THE ALPHA JOYSTICK SUCH A SUCCESS ?

Because of games like these:

NEW! TALKING ROBOT ATTACK



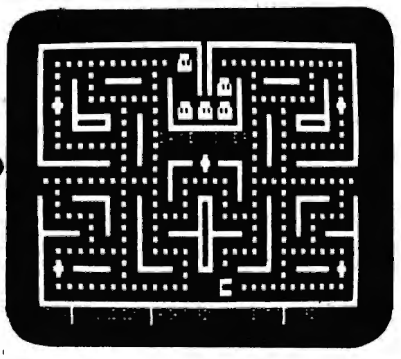
ALL GAMES:
16K Level 2, Mod 1 + Mod 3 Cassette: $15.95
32k Level 2, Mod 1 + Mod 3 Diskette: $19.95
10% discount for 2 games, 15% for 3 or more
Games may be played with or without joystick.

TALKING ROBOT ATTACK

INCREDIBLE! This amazing game actually **TALKS** without a speech synthesizer, through the cassette AUX plug.

You are armed with just a hand held laser. In a remote section of the space station you encounter armed robots, some march towards you, some wait around corners. Watch out, the walls are electrified. Zap as many robots as you dare before escaping into a new section where more robots await you. The struggle continues. With Joystick action and **VOICE OUTPUT**, this game will amaze you.

NEW! SCARFMAN



SCARFMAN

THE LATEST ARCADE CRAZE now runs on your TRS-80.

It's eat or be eaten. You control Scarfman around the maze, gobbing up everything in your path. You attempt to eat it all before the monsters devour you. Difficulty increases as game progresses. Excellent high speed machine language action game. From The Cornsoft Group. With sound.

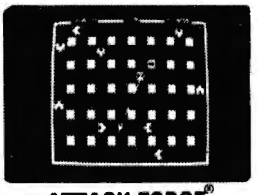
CAUTION: Played with the Alpha Joystick, Scarfman may become addictive.

SUPER NOVA®

Asteroids float ominously around the screen. You must destroy the asteroids before they destroy you! (Big asteroids break into little ones.) Your ship will respond to thrust, rotate, hyperspace and fire. Watch out for that saucer with the laser! As reviewed in May 1981 Byte Magazine.

GALAXY INVASION®

The sound of the klaxon is calling you! Invaders have been spotted warping toward Earth. You shift right and left as you fire your lasers. A few break formation and fly straight at you! You place your finger on the fire button knowing that this shot must connect! With sound effects!



ATTACK FORCE®

As your ship appears on the bottom of the maze, eight alien ships appear on the top, all traveling directly at you! You move toward them and fire missiles. But the more aliens you destroy, the faster the remaining ones become. If you get too good you must endure the "Flag-ship"... With sound effects!

COSMIC FIGHTER®

Your ship comes out of hyperspace under a convoy of aliens. You destroy every one. But another set appears. These seem more intelligent. You eliminate them, too. Your fuel supply is diminishing. You must destroy two more sets before you can dock. The space station is now on your scanner. With sound!

METEOR MISSION II®

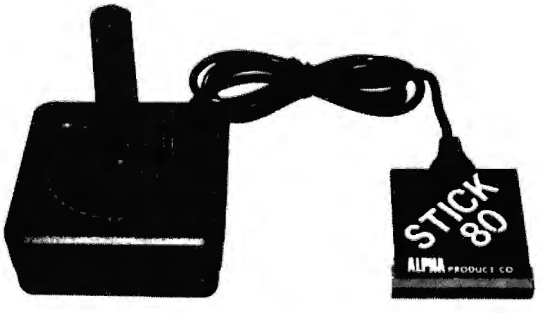
As you look down on your view, astronauts cry out for rescue. You must maneuver through the asteroids & meteors. (Can you get back to the space station?) Fire lasers to destroy the asteroids, but watch out, there could be an alien FLAGSHIP lurking. Includes sound effects!

THE ALPHA JOYSTICK: REAL ARCADE ACTION

ONLY $39.95

- Features the famous ATARI JOYSTICK
- Works with any Level II or disk system Model I
- Plugs directly into KB or E/I (next to printer port)
- Compatible with any other TRS-80 accessories
- Saves your keyboard
- Fun to experiment in BASIC. Simply use A=INP(0) to read the joystick
- Fully assembled, ready to plug in and use.

Price includes Atari Joystick + Alpha Interface + instructions + demo program. The Alpha Joystick is backed by an unconditional money back guarantee. If you are not delighted with it, return it within 14 days for a prompt and courteous refund.



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1027

THE CRYSTAL BALL

(News and Rumors of Interest to TRS-80™ Owners)

1. The **IBM Personal Computer** appears to be catching on big. IBM has already produced 15,000 of them, and retail outlets such as Computerland stores have them in stock. Computer clubs around the country have had them demonstrated at their meetings. Industry insiders feel that the 15,000 units will be snapped up fast and demand will far outstrip availability. IBM says that it plans to market 100,000 of them the first year! This will make IBM one of the leaders almost immediately.

Although expandable to 256K bytes of RAM, three configurations seem to be more or less standard:

(1) The computer (Intel 8088 16-bit microprocessor) with 40K bytes of ROM, 16K bytes of RAM, keyboard, audio cassette and modulator to hook up to your black and white or color TV set. Cost: $1600.

(2) Same as above, but with 48K bytes of RAM, one 5-1/4 inch 160K byte capacity disk drive (instead of cassette recorder) with RS-232-C communications adapter. Cost: $2385.

(3) Same as (2), but with 64K bytes of RAM and an extra disk drive, providing 320K bytes of storage. Cost: $3045.

Service will be provided by IBM, Computerland, or Sears, depending on where you bought it. There is an additional charge ($40) for the system software and another one-time charge for the communications software. One of the biggest advantages of the IBM personal computer is also one of its disadvantages. The 16-bit processor is far more powerful than any of the leading competitors, but software compatibility will be a problem. The disk operating system is simply a Microsoft "Advanced DOS", but a special 16-bit version of CP/M is coming. The printer is a thinly disguised Epson MX-80.

Another interesting point is that IBM did not give it a catchy name or model number. It is simply the IBM Personal Computer. This may mean that the standards and specs for this computer will be around for a long time to come, eliminating the worry of most computer buyers that their machine will shortly be obsolete.

2. The big thing nowadays seems to be personal computing industry studies, which are sold by research firms at big bucks, predicting the vastness of the coming information age and its effect on the common man. The results are so varied that you might as well throw darts and save your money!

Future Computing (Texas) says that sales of IBM personal computers will exceed $1 billion within three years, and that the "big two" (Apple and Radio Shack) will be hurt! Venture Development Corporation (Massachusetts) says that Apple and Radio Shack have nothing to worry about, since IBM does not have the distribution channels and software support they have! Furthermore, IBM will expand the total market. Systems under $20,000 will show the highest compound annual growth rate, with shipments increasing 33.5% annually through 1984. International Resource Development (Connecticut) says that the public could totally desert home computers much in the same way it has abandoned video games, and that 90% of low end computers bought by individuals lie unused on dusty shelves!

One thing the research firms seem to agree on is that small businessmen will be the big market for small computers. Both Apple and Radio Shack have new

direct marketing plans to businessmen to compete with IBM's strategy—much to the dismay of some of their retail outlets.

3. **The market share leaders in personal computing:** Apple (23%), Tandy/Radio Shack (16%) and Commodore/PET/CBM (10%) sell half of all the microcomputers sold in this country. That could change now that IBM is in the picture and that little known Sinclair Research Ltd. (Cambridge, England) is coming on strong. Is it ever! The ZX-81 personal computer will soon become the world's leading selling microcomputer. Production, at 10,000 units a month, is at a former Timex watch plant in Dundee, Scotland. As IBM increases its market share, insiders predict that Atari and Commodore will be squeezed from widespread distribution. Sinclair is sold only by mail order in the United States.

According to the Wall Street Journal, Sinclair's ZX-81 will be test-marketed by American Express. AX does $140 million in mail order business through its 9.5 million card holders, and the $149.95 computer might prove popular. Clive Sinclair, the English electronic inventor/wizard, says he has sold 100,000 of the ZX-81 personal computers in the past six months, and "we'll sell 40,000 this month alone!" That's more than Radio Shack and Apple put together! Sinclair says he invented the first pocket calculator, the first digital watch on a chip, and the first pocket television. He also has a flat screen television in development and is working on an electric car!

Clive Sinclair (like most electronic geniuses) started young (age 22) and has no college degree—just guts and confidence. Sinclair has only about 30 employees world-wide but expects to do between $40 and $50 million in sales this year alone. The ZX-81 can be produced cheaply since it has only four (custom) IC chips in it. A $100 printer is coming next year, and floppy disk drives and color capabilities are being looked into.

4. Call is TRASH-80 if you want to, but the fact remains that 1,000 shares of Radio Shack (Tandy) stock at $15 a share in 1967 are worth $2.35 million today! ■

continued from page 2

etc.) and the Howe Data Management System (a complete file management system). These two programs will be supplied, with instructions, on cassette. (Add $3.00 for Model I or Model III diskettes; add $5.00 for the Model II version; not available for the Color Computer or Pocket Computer.)

3. Our 64-page Software Catalogue #8 containing the latest products available for your TRS-80.

New Problems at Radio Shack?

Recent corporate decisions by Tandy/Radio Shack, and rumors of more to come, seem to indicate that Radio Shack has been struggling with unusual problems. For example:

- Radio Shack is planning to sue Personal Micro Computers, Inc., claiming that the PMC-80 has made infringements of proprietary hardware inside the TRS-80.
- It is rumored that Radio Shack is planning to sue Apparat, Inc., Randy Cook, and Instant Software, Inc., claiming infringement of its copyright on DOS modules. RS will claim that Cook was only an employee of the corporation, not even the author of the original version of TRSDOS, and hence guilty of using proprietary information for personal gain.
- RS now requires both new and old computer division employees to sign a statement that they will not work in the computer field within a year of leaving the company.
- RS refuses to sell Extended

Not all Spelling Checkers are the same.

MICROPROOF T.M. stands out!

EASY TO USE: Prepare your text on any Z-80 based microcomputer, using any of a number of popular word processing programs. When you are finished, enter the appropriate command, and MICROPROOF proofreads your document, displaying misspellings and typos on the screen. Then correcting MICROPROOF can display each error separately, requesting you to enter the correct spelling for each. You are also given the option of displaying errors in context or adding words to MICROPROOF's 50,000 word vocabulary. Finally, MICROPROOF corrects your document. All in less than a minute.

```
SELECT APPROPRIATE RESPONSE:

CORRECT MISSPELLED WORD:    ENTER CORRECT WORD
LEAVE WORD "AS IS":         HIT <ENTER> KEY
DISPLAY WORD IN CONTEXT:    ?
ADD WORD TO DICTIONARY:     +
EXIT:                       !

WORD:          (Your error)
RESPONSE:
```

Correcting MICROPROOF Screen Display

SPEED is the single most important factor in a dictionary program. All dictionary programs will find your potential errors but if the program is too slow, you are not likely to use it. MICROPROOF's speed is outstanding. It can proofread a several page letter in 20 seconds.

LOW PRICES: Standard MICROPROOF is available for either $89.50 (TRS-80® Models I or III) or $149.50 (CP/M®, TRS-80® Model II and all others). The optional correction feature can be added at any time for an additional $60.00. Optional patches to integrate MICROPROOF into your word processing software can also be added at any time for an additional $35.00. (Integration patch not needed for Wordstar®.)

MICROPROOF'S FULL 50,000 WORD VOCABULARY saves you time and allows you greater confidence in the lists of potential errors that MICROPROOF identifies. The mini-dictionary programs, with their 10,000 and 20,000 word vocabularies, have many correctly spelled words omitted from their vocabularies. Consequentially, they identify as potential "errors" many words that are actually spelled correctly; five to ten times as many such words as does MICROPROOF. So, when you use MICROPROOF you will have far fewer extra words to evaluate, a major time savings. There will be less need to look up words in order to verify that they are in fact spelled correctly. The extra 30,000 words in MICROPROOF's vocabulary assures you confidence in the error lists that MICROPROOF generates.

There are other proofreading programs available to choose from. Since MICROPROOF became available in December of 1980, a number of companies have announced programs with small dictionaries. It took us almost two years to develop MICROPROOF. During that time we were able to compress our full 50,000 word dictionary into a manageable size (fits on one single density 5¼ inch disk). And we were able to design a proofing program which operates remarkably fast. The chart below illustrates the comparative advantages of MICROPROOF.

ADVANTAGES OF MICROPROOF

	MICROPROOF DICTIONARY SOFTWARE	OTHERS (Mini-Dictionaries)
DICTIONARY SIZE	50,000 Words	20,000 Words
DISK SPACE REQUIRED FOR DICTIONARY	70,000 BYTES (fits easily on one 5¼" disk)	170,000 BYTES
DICTIONARY ENLARGEMENT	VIRTUALLY UNLIMITED	EXTREMELY LIMITED
SPEED—400 Words	20 Seconds	1 to 5 Minutes
SPEED—3,000 Words	1 Minute	2 to 10 Minutes
CORRECTION FEATURE	Optional	Not Available

See your local microcomputer dealer or write to:

CORNUCOPIA SOFTWARE

Post Office Box 5028, Walnut Creek, California 94596 • (415) 893-0633

Color BASIC ROMs to Color Computer owners without their own installation at extra cost, in spite of "Waiver of Warranty" forms distributed in various areas. Bootleg Extended Color BASIC EPROMs are circulating from the West Coast throughout the country in direct response to Radio Shack's policy.

• RS is now charging half as much for its paltry monthly newsletter as *Computronics.*

• It is rumored that Tandy Corporation/Radio Shack is about to split its profitable computer division from the main Radio Shack group, perhaps into an independent company under the Tandy name.

As TRS-80 owners, all of us have concern for Radio Shack's policies and direction. These policies definitely seem to indicate a company that is running scared, trying to consolidate its interests and wipe out its competition by legal means, if it can't beat them with superior products. All of us must feel that Radio Shack deserves credit, in many important ways, for producing such fine computers and many other products at low cost. But readers of this magazine are also undoubtedly aware that other companies, in some cases, produce superior products, particularly software and peripherals. Think of many of the most outstanding products developed for the Radio Shack computers: the Electric Pencil, NEWDOS, the Percom Data Separator, the Epson Printer, Exatron's Stringy-Floppy, etc.—all developed outside of Radio Shack, many of them explicitly for the TRS-80 computers.

Radio Shack has not been forthright about various problems that have been reported about its original equipment, such as the unavailability of lower case for the Model I and cassette hardware and software problems, and it has also denied rumors, often printed for the first time in our **Crystal Ball** department, of new products under development.

What all this means to *you,* I think, is that you need to get information both from Radio Shack and from sources like *Computronics.* In some ways, the only reason we're in business is because we fill that void. We'll give you straight talk about the problems with Radio Shack (and other companies), and we'll also provide working programs and factual information about all kinds of things each month. What's *more,* we'll listen to your problems, and we're not afraid to admit mistakes when we notice them. Keep those letters coming, folks! ■

LETTERS TO THE EDITOR

Changes for "Biorhythms"

I recently acquired a TRS-80 Model III and have been trying a number of programs to determine their compatibility with this machine.

The program titled "Biorhythms", which appeared in the May 1981 issue, requires some slight changes to run on a Model III. These are as follows:

1. Delete lines 740-760.
2. Delete lines 1460-1480.
3. Change line 210 to read as follows:

```
210ST%=PEEK(14312) AND 240
```

4. Add a new line as follows:

```
211  IF ST%<>48 THEN PRINT @ 711,
"PRINTER NOT READY" ELSE 240
```

I am not sure if the reason for checking the printer status is only to warn the user or not, but these changes allow the program to run on my Model III. The PEEK and POKE value is different than called for in the original program. On a Model III, the value is 48, which results in a "Printer not Ready" message. I assume that the same thing is true of the PEEKs in lines 750 and 1470.

One more thing I found: it is not possible to print the 132 day chart

DOSPLUS

Dosplus 3.4 upgrades will be available for all registered and/or legitimate owner's of Dosplus 3.3 or 3.38 starting January 1st, 1982

Those owner's who have sent in registration cards will receive a letter telling them of the upgrade. Those owner's who did not receive a registration card must use the following procedure if they do not receive an upgrade letter by January the 15th.

1. Send in proof of purchase.
   and
   Your master Dosplus diskette.
2. Send in the upgrade fee.

Registered owner's will only be required to send in the upgrade fee.

The upgrade fee will be $25., and will include a new diskette, AND the new expanded manual. The Dosplus 3.4 manual also includes a new technical section that has complete I/O calls and DCB organizations.

M-ZAL Disk Assembler

THE FINEST MACHINE LANGUAGE DEVELOPMENT PACKAGE MONEY CAN BUY.

A complete development package for the machine language programmer.
Novice and experienced programmer alike will recognize the superior features of this excellent package.

The heart of the system is CAU's M-ZAL disk assembler.
This includes:

1. A full screen text editor.
2. A super fast assembler with optical relocatable code.
3. A linking loader for use with this relocatable code.

Retail price on the M-ZAL package is $149.00, and is available Model I (single or double density) and Model III.

More programming power than you will find
ANYWHERE ELSE IN THE WORLD
Demand will be high so order yours today!

unless you have a 132 column printer. I think the readers should be warned of this.

Thank you for publishing one of the best and most informative magazines for the TRS-80 in the country.

Robert J. Hennessey, President
Calculations Limited
228 Hunting Road
Needham, MA 02194

Beware

I would like your readers to be aware of a problem with a company that sells TRS-80 peripherals.

I ordered a "photo point" light pen from Micro Matrix, P. O. Box 938, Pacifica, CA 94044. It has been two and a half months since I ordered it, and I have not yet received it. I have written two letters of inquiry about the order and have not received an answer to either of them.

These folks may be out of business, but it seems that my letters would have been returned by the U.S.P.S. if that were the case. Whatever the reason, I felt that your readers deserve to know of this situation.

Sherry M. Taylor
322 South 21st Street
Haines City, FL 33844

CLEANUP is Fun

I would like to comment on the quality of your magazine. I have been a subscriber since your birth and have been pleased with the improvements over the years. My renewal check is in the mail, and I am looking forward to receiving the latest free cassette.

The favorite program around our house is CLEANUP. It is extremely addictive, and it is not unusual for the family to play until the wee hours of the morning. I am currently the front runner in the family, having achieved a skill level of 30. Two of our teenagers are right behind me with skill levels of 29 each. Our oldest boy, who doesn't get a chance to play as much, is at skill level 27. After playing for a year, the only change we made to the program was to give a thumbs up sign for anything over 50 per cent. It was quite discouraging to achieve 99 per cent, having missed only one character, and get a thumbs down sign! We have bought quite a few computer games, and this one, which was published in your magazine and included on a free cassette, is the best of all. Thanks again for an excellent magazine!

Patricia M. Finkenbine
4000 Erbbe NE
Albuquerque, NM 87111

South African Computer Club

We thought you might like to know of the first computer club in Johannesburg, South Africa for TRS-80 enthusiasts. Two meetings are held each month at 115 Ferreira Hse., Ferreira Strt., Johannesburg. The PRO for the club is Peter Strauss, who can be contacted at Tel. 836 7078 (during office hours), or you can leave a message at 673 1464 (anytime).

Peter Strauss
TRS-80 Club
P. O. Box 35461
Northcliff, 2115
Republic of South Africa

Enhancement to Digital Clock

This is in reference to a very fine program in the July issue on page 21, called "Digital Clock", by William H. Patrick. If you add the line number 16 shown below, you will have the two dot separation between the hours, minutes, and

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```
16   PRINT @ 531,CHR$(131);: PRINT @
595,CHR$(131);: PRINT @ 555,
CHR$(131),: PRINT @ 619,CHR$(131)
```

I was also delighted with Gordon Speer's program "Engine". I'll bet his friend Steve is still scratching his head on that one!

I have enjoyed your magazine going on two years now, and I am impressed with the progress you have made in a short period of time. Keep up the fine work.

Lindon D. Greer
Walkers Mobile Ct., Lot #69
Liberty, MO 64068

Big Five Programs on Model III

You have requested information of the compatibility of Model I to Model III programs. I have tape versions of NOVA, ATTACK FORCE, and GALAXY by Big Five Software which I had transferred to disk. When I converted them to Model III they ran just fine until the end of the game when it asked the players for their initials. At that point, the display would freeze up and the system would need to be rebooted in order to play another game.

In talking with one of the members of the computer club to which I belong, I was given the following solution to te problem which enables the games to function properly. In each game there are one or two instructions 21 E3 03 which should be changed to 21 24 30. I do not have a specific address, as it would depend on where the code is relocated in order to load from disk. However, the instructions are generally toward the end of the game. I used the NEWDOS disassembler to find the instructions and address. I then used the PATCH utility to fix the game.

U. F. Racine
2520 S. E. Alexander Drive
Topeka, KS 66605

Advancing with *Computronics*

I want to express my appreciation for your magazine. As you know, for the new computer user, computer science is a new and wondrous world. The novice spends ponderous hours solving problems and developing programming techniques that have long since been devised and are as common as "A, B, C" to the advanced practitioner. It is in this area of information exchange that *Computronics* performs the most valuable service to the beginning computerist.

I entered computing with a Model I, Level II, 16K system and upgraded in steps (as the budget permitted) first to a Model III, then with the addition of RAM to 48K and the RS-232 interface and a direct connect modem, along with a subscription to COMPUSERVE, and finally the MX-80 printer. Each advance has opened delightful new doors in computing capability and added untold satisfaction. Upon reflection, I realize the success of my upgrading decisions were brought about because, though thoroughly researched, they were mainly influenced by *Computronics*. Your comprehensive comparison of the Model III vs. the Model I (January 1981) prompted my switch. The excellent series on telecommunication by Douglas Werbeck (February and March 1981) fostered the RS-232 and the modem, and finally your review of the MX-80 printer (April 1981) determined my choice of printers. You can see by this that your magazine is very influential. (In fact, this letter has ben prepared using the new Text Editor compliments of *Computronics.)*

I am now considering the acquisition of disk drives but am at a loss to find definitive information upon which to make the necessary decisions. I think I know what I want to do, which is to install two internal double headed drives in my Model III to have maximum on-line storage in one unit. But, what with double headed/sided, single/double density, 35/70, 40/80 track, soft/hard sectored, flippy/floppy, compatibility to various DOS, Percom, Shugart, etc., etc., ad infinitum, I have so few answers, in fact I'm not even sure of the questions. As for available information, there is little more than the manufacturer's "blurbs". I know that this trail has been blazed before, and I am also sure that others would profit from our forerunners' experience and avoid the pitfalls of wrong choices if we had proper information. Hence, I feel that an article or series on disk hardware would be timely and well received.

Donald P. Bazzurro
26 Winona Drive
West Springfield, MA 01089 ■

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PROGRAM PREVIEWS

A. A. Wicks

This Month: Disk Drive Analysis Programs

When it comes to technical hardware in any activity, users may usually be divided into two classes: those who constantly tinker and "fix" things, and those who believe in, "If it works, don't fix it." Although I am certainly not in the first category, I do believe in preventive maintenance, such as replacing engine oil filters regularly. But ordinarily, I tend to fall in with the second grouping, especially when something appears to be working well.

Such complacency can well lead to insidious problems, ones not at first recognized for what they are; but sometimes of a sudden serious nature—far more costly and difficult to correct than may have been necessary, if taken care of earlier. One of the units that often may be neglected by computer owners is their disk drive. This extremely delicately tuned and intricate device usually plugs along byte after byte doing the many tasks requested of it, usually without complaint. Eventually, as must all equipment, it will suffer a catastrophic failure. But more frequently, it may just start doing "funny" things—usually intermittently, which further tends to lull the unsuspecting person. Read and write errors, incompatibility errors if not written to by the same disk drive as read from, etc. Problems such as these will occur when the read/write head is contaminated. They will occur also if the disk is damaged or dirty. Another possibility is that the operating speed of the drive is not within an acceptable performance tolerance, and this is one problem that is very frequently overlooked in searching for, as we said, "funny" things that are happening. Double-density or high track-number configuration disks are particularly susceptible to input-output errors if the drive speed is not correct, because of the higher amount of "bit-packing."

This review column is not the forum for a discussion regarding the theory of disk drive operation and why a correct drive speed is so important. Enough to say that it is very important, and the means to insure correct speed is readily available for less than the cost of a service check by a technician. Understand though, that if your drive speed is not controllable at all through the internal speed adjustment control, then you do have a more serious problem than just a slight variance caused by normal wear. Motor speed should be checked quite frequently, at least once a month, depending upon use. In using one of the programs about to be reviewed, this may be done in a few minutes without effort. Remember, it is seldom necessary to actually adjust the drive speed, but a check on the speed is a good practice to help prevent future greater problems.

A program called DDT (Disk Drive Timer) produced by Disco-Tech ™ Microcomputer Products, and written by Paul A. Rogers, permits a person totally unskilled in electronics, and only with the mechanical ability to use a screwdriver, to check and adjust a disk drive to the correct speed. Another program, called RPM, by ProSoft™ is available for the same purpose. Both pragrams will now be reviewed on the basis of my experience in using them. You be the judge as to which one appeals to you the most. I remain unbiased—I found that they both work extremely well, and perform the function for which they are intended.

DDT, which uses TRSDOS 2.1 as the operating system, loads automatically from initial power-up or reset. As soon as it enters BASIC, a choice of five functions are presented on-screen. If you have more than one disk drive, a disk must be in each drive other than Drive 0, which has DDT in it. It does not matter whether or not these additional disks are blank or contain data. The five choices are: Analyze motor speed of all drives, analyze speed of one (specific) drive, provide a graphic display of the speed of one drive, exit the program, and display the menu again.

Normally, your first action will be to analyze the speed of all drives ("one" is the same as "all" if you have only one drive, of course). This gives the "big picture,"—you see whether or not any particular drive is off normal speed (300 rpm), and you can then concentrate on those needing attention. After a few seconds the screen presents the results for each drive. For instance, my Drive 0 analysis stated:

```
DRIVE 0 - TOO SLOW
SPEED (RPM) - 297.7
ERROR FROM 300 RPM - % 0.8
```

(I know that 297.7 isn't a 3 rpm difference, but the information is acceptable—it's more than two and less than three.)

A few seconds later, the analysis for Drive 1 appeared. It too was off-speed—too fast by 0.6 rpm. Obviously, two years of "don't fix it," had produced these results.

The next choice selected should then be the graphic display. This may be performed as an item of interest, but it really should be used in conjunction with adjusting the speed, if that is required. Adequate instructions are provided to do this. Removing the

drive cover and locating the speed control potentiometer are detailed for Radio Shack, Vista, Shugart, Pertec and MPI. Tandon is not mentioned, but may be assumed to be the same as Radio Shack.

When you are ready to make a speed adjustment, running the graphic display will give you a constantly visible display of the change of speed that occurs as you adjust the control. The display presents the figures "300" in the center of the screen, with a line across the screen below it. The figure groups that appear on each side of the 300 at intervals depend upon a selection you have made previously. This selection is the "range" with which you wish to work. For instance, if you choose "12" as your rpm range, the display would read across the screen:

294.00 296.00 298.00 300 302.00 304.00 306.00

with (SLOW) above the 294, (CORRECT) over 300, and (FAST) over 306. The program analyzes a disk drive motor speed by taking the average speed over 40 revolutions. This takes about 12 seconds. As you run the graphic display, a "blip" as it is called (I can't think of a better word), appears below the across-screen line. This blip indicates the actual speed by reference to the figures above it. The display, being 60 units wide, allows a fairly large choice of viewing. As the speed is adjusted closer to 300, you will want to have a narrow range—the narrowest range is 1 rpm, and entering less than 1 will result in a request for re-entry. The drive will run as long as you wish, until you press any key.

The actual adjustment can be tricky, especially as you attempt to zero-in on 300. Turning the adjusting screw even slightly can sometimes result in a sudden excursion of speed, because of variations of resistance on the contact points within the control—usually due to minute contaminating factors. Speed changes up and down ("hunting") as indicated by the blip may also be noticeable—particularly at narrow display ranges. Such slight changes are of little importance, but in general, due to the excellent construction of most disk drives changes of this nature should be minimal.

The manual that accompanies this program is very adequate. It assumes no technical knowledge of the part of the reader, and presents each step in a logical and lucid manner. Screen simulations (printed), are given where necessary. No mention is made of the Model III internal drives, so that anyone wishing to adjust them would probably have to be familiar with the method of getting to the adjustment point—not an easy task with the Model III. Either that, or take the complete assembly to a service center, if the speed was found to be outside of tolerance. The manual is an attractive 5- x 7-inch soft cover document of 26 pages, and uses typewriter font reduced to about 8-point (nearly 1/10-inch), is double-spaced for clarity. There are no spelling errors, but one product does not have its trademark indicated. Overall this is a very nice small manual.

DDT, Disk Drive Timer for Model I, 16K minimum. On diskette. Available through H & E Computronics, Inc. - $29.95.

* * * * *

RPM is produced by PROSOFT of North Hollywood, California, and is a disk drive timing program for the Model I and the Model III. The only knowledge required of the user is how to remove the cover from the disk drive and turn the drive speed setting screw slot on the variable control (potentiometer). Even this much knowledge is not needed if you only wish to analyze the speed of your drive, but would prefer someone else to correct it if that is necessary. This may be particularly true in the case of the Model III, for the drives in that equipment are more difficult to reach and work on.

The RPM disk does not have a Disk Operating System on it, but full instructions are provided with the program to permit you to copy it to your own DOS disk, both for the Model I and for the Model III. If you only have a one-drive Model III, PROSOFT will copy the program to your system disk for a service fee of $3.00, if you send it in to them.

Once the RPM disk with a system on it is ready, it is installed in your Drive 0, and, if you have additional drives, any disk may be installed in them, whether they contain data or not. Your computer is then Reset and you call BASIC in the usual manner, answering Memory Size? and Files with "Enter." After BASIC is Ready, RUN is entered, and a screen dialog commences. The first query asks for the number of the drive to be measured. Entering this information will result in the disk drive running and the speed analysis will be provided while the disk is running. For example, the screen will display:

NOW: 298.45, ERROR = −0.52% A LITTLE TOO SLOW
AVG: 298.87, ERROR = −0/38% OBS. = 7

The normal speed for a disk drive is 300 revolutions per minute (rpm). The values shown following "NOW" in the above example are the latest reading, while the values after "AVG" are an average for the most recent readings. "OBS" indicates how many measurements have been made. The "ERROR" values should not exceed 2.00%. A properly functioning drive will be within 0.33% of 300 rpm. (Always make sure that the disk is being "clamped" correctly by the hub—otherwise the disk will slip and grab, resulting in a very severe fluctuation in the readings.)

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Mike Schmidt (EDITOR) *80-US Jan/Feb pg. 94*

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At this point, if you wish to select another drive for measurement, you merely press the figure for that drive, e.g., "1." You may also reset the counters for the drive initially measured by pressing its corresponding figure. At any time, once the drive covers have been removed and the speed control located, you may adjust the speed. Although it is not mentioned in the instructions, this control is a molded plastic rectangular object, about an inch long and one-quarter inch square at the ends. All that I have seen have been identified on the top with the word "Trimpot" (TM Bourns Inc.) The instructions do provide detailed instructions to guide you in locating the speed adjusting control for MPI, VISTA, Matchless, MTI, Pertec, Radio Shack, Tandon, and Shugart drives. Adjustment is made by turning the control screw, using a small screwdriver, clockwise if the speed is too slow, counterclockwise if it is too fast. The target is a speed approximately at 300 rpm. The "current" speed will be hovering in this vicinity, and the "average" speed will be within a few tenths of a percent of zero.

Sudden excursions of speed may be expected, because of contamination or "flat spots" on the potentiometer. This is not unusual, and a position should be found quite easily that still permits a speed adjustment to within tolerance. Severe fluctuations of the speed of a drive may indicate problems, however. The control may indeed be defective and need replacing, the power supply for the drive could have problems, or it might be a simple problem such as a defective disk. If the "average" speed is between 299 and 301 rpm, your drive is operating well, according to the author. If it is under 297 or above 303 rpm, adjustment is indicated. If it is under 294 or over 306, you are in a definite trouble zone, to the extent that you may not be able to run disks prepared on another drive.

The information sheet accompanying RPM is a foldover four pages produced by dot-matrix proportional printing and reduced to six-point type size (.08-inch), but nevertheless sharp and clear in reproduction on buff paper. The information and instructions are well- and clearly written, and very easily understood by anyone. The information regarding how to locate the control is particularly good. The implication regarding Model III disk drives though, is that unless you are quite familiar with what you are doing, you are cautioned to have any adjustments made at a service center.

RPM has an additonal mode that allows you to have a visual representation of the speed of the disk drive being examined. This is called the Speed Variation Graph. The graph in use shows what is technically known as a limited frequency distribution. The limit is six observations at any speed, where speed is rounded to the nearest 0.2 revolutions of the drive. When a given speed has been observed more than six times, the graph no longer changes. A block-type indicator shows the speed position in respect to the maximum and minimum graph speed range, centered on 300 rpm. There are no instructions provided in the pamphlet as to how the user gets into the Speed Variation Graph mode; however, this is very clear from the video display instructions.

This is a very satisfactory analysis program, and performs according to its advertised specifications.

RPM by PROSOFT, Box 839, North Hollywood, Calif. 91603. Model I, Model III, disk included - $24.95.

* * * * *

As a point of interest, one of the programs during my analysis indicated Drive 0 as "Too Slow" with a speed of 296.80 rpm, Error 1.1%. The same drive using the other program showed the drive as "A Little Slow," and the speed as 297.80, an error of -0.74. In a similar manner, Drive 1 was analyzed as "Too Fast" at 300.6 rpm, and "Speed is Correct" at 300.72 on each program respectively.

Although the figures are at variance, at least they are consistent in their direction of variation. In addition, if either one of the programs was used to bring the speed to 300 rpm, the drive would be within tolerance.

As a further comment on the subject of disk drive maintenance, although the following is not strictly within the scope of a review column, it is felt that it may be useful to persons not too familiar with disk operations.

At the beginning of this review, the possibility of disk input-output errors occurring due to head contamination was mentioned. In order to complete your disk drive maintenance program following getting your motor speed adjusted correctly, you are urged to clean your disk drive heads.

Although this can be done while the covers are off using materials normally used for cleaning cassette recorder heads, it usually means more disassembly, and is fairly awkward at best. A far more satisfactory and easy method is to use a disk drive head cleaner kit. Using one of these, it is hardly more difficult than inserting a disk in a drive, after applying cleaning fluid to a pad in the disk cleaning envelope. The frequency for doing this will depend upon your use of the drive, but it should be done at least once per month in normal use; however, you may do it at any time without removing the drive cover. Kits are available from computer stores or mail order companies, including H & E Computronics, Inc. (which offers 3M Company Head Cleaning Diskette Kit at $29.95).

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PRACTICAL BUSINESS PROGRAMS

S. M. Zimmerman, Ph.D. and L. M. Conrad

AMORTIZATION OF LOANS

Almost every business and real estate transaction involves the act of financing at least some aspect of the operation. It is hard for the novice to realize the *significance of* the financing consideration of a business transaction. The tax system in which we exist requires us to pay taxes on our net income rather than our gross income. By net income, we mean profit and other earnings above the normal costs of doing business. Amortization tables are important because they identify for us that part of our loan payment that is interest and the part that is repayment of loan. We pay interest with pre-tax dollars and we pay for the reduction of the loan with money that has been taxed.

Accuracy to the nearest penny is necessary when working with an accounting system. The sum of the interest and the reduction of loan amounts must add up to the total payment made every month. This requirement places a difficult burden upon the abilities of the TRS-80 computer. We have made several attempts to develop an operating amortization program and have been unable to satisfy the requirement of absolute accuracy. This version has been tested extensively and we believe it solves the problem. It may be that some combination of factors will still result in a penny error; however we have not been able to find that combination.

In order to solve the accuracy problem it was necessary to work with the several types of numbers allowed on the TRS-80. These types include real numbers, both single and double precision, and integers. Complex numbers available on some computers are not available on our TRS-80. We will detail how the availability of double precision and integer type numbers aided us in the creation of our program.

USES AND APPLICATIONS

Many of us leave the calculations of our taxes and interest expenses to some other person, such as our accountant or banker. It is very difficlt to check on the accuracy of a bank that has a collection of computers with a hand calculator. It is also unusual for a bank to make an error, but they do. After developing the enclosed program we decided to check on the interest expense calculations sent to us by our banks for all our business and real estate loans. In every case except one we checked out to the penny. In one case the results sent to us by the bank and our computer run were no where near each other. The interest expense as calculated by the bank was much lower than the interest expense as calculated by our TRS-80.

Besides checking on bank calculations, the amortization program has proven very useful in *evaluating* proposed business deals. The cash flow of a business transaction is often determined by the financing arrangement. It is much easier to make a better business deal if you understand the consequence of the deal you are negotiating at the outset. It is almost impossible to renegotiate a financing arrangement after you have run into trouble.

THEORY OF APPLICATION

The calculation procedure on the three types of business loans selected for this effort are very simple. We have included only those loans which charge interest on the remaining balance of the principal and have not considered either the discounted interest loan or the add on interest loan procedure. The add on and discounted interest procedures are commonly used and may be covered in another article.

The most common procedure for the amortization of a loan is one in which an equal payment is made each month. The interest charge goes down and the reduction of loan goes up month after month. The sum of the interest and loan reduction are always equal to the same number except the last payment which is usually a little different than all of the other payments because of round off errors. The only complex part of the procedure is to determine the amount of payment. The following equation may be used for that purpose.

$$R=(1*(1+I)\uparrow N)/((1+I)\uparrow N-1)$$

where:

R=period payment
I=interest per period
N=number of periods
↑=to a power

This equation has been programmed into the program. It needs to be used only once to determine the monthly (period) payment. The interest expense each period is calculated by multiplying *the yearly* nominal interest rate which has been divided by the periods per year times the remaining balance of the loan.

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Has things that other programs should have, but don't. Upper and lower case output to your printer (if your printer accepts lower case) without having your computer modified. ON UPPER CASE ONLY MACHINES: This program marks the capital letters so you can see which letters are CAPITALS and which are not. / Will change all upper characters text to lower case or all lower case to upper, A SINGLE COMMAND / Will capitalize the first letter of all sentences and all proper noun I's, WITH A SNGLE COMMAND / LOADS ANY ELECTRIC PENCIL FILE / ASCII SAVED FILES. EDTASM FILES or BASIC PROGRAMS SAVED ASCII / Permits installing special control characters in your text for your printers special features, like double wide or condensed print / Definable screen length and definable print length to 255 characters wide / Screen editing that is not final till your command. This means that you can edit your file on the screen and if you don't like how it reads you can cancel and leave it the way it was / You can append files (which means that you can put one file to the end of another file) / No lost characters at the end of the line, even for the fastest typist / A directory of all your files is available to the user without leaving the program / Saving programs to disk easy enough for the non-computer user / To save memory, not all the program modules are in memory at one time but are called from the disk as needed / You can set tab positions like on a typewriter / 10 CUSTOM COMMAND KEYS for the experienced user there is a command file that permits many special functions that are all user defined (not enough space for better explanation in ad, send for complete overview) / Program has HELP file that is a short review of the commands that are available /

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Communication Package. RS232 COMMUNICATION TERMINAL PROGRAM permits you to communicate with other computers. Transfer files from one machine to another. Permits dumping memory across the phone lines. Receive files from other TRS-80's and "Shake Hands" with larger computers. This is the complete system called LAZY WRITER. There is no package written for the TRS-80* that is as comprehensive. This package is available for the TRS-80* MOD I, 32K or larger with at least a single disk drive. List price is from

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Printing chaining feature. This permits having more than one file on disk and create one printed letter, contract, or book *without* having to reset the printer commands.

Mandatory space command. This is necessary when you are writing letters or papers that have certain words that are not to be broken-up. eg.: John P. Andhouser. This name can be made to be unbreakable to justify routines in the program.

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Interest expense= (APR / P) * BALANCE
Where
APR=Annual percentage rate (nominal interest)
P=number periods per year
BALANCE=balance of the loan

Since the monthly payment is fixed the reduction of loan may be calculated simply by subtracting the interest expense from the fixed monthly payment. The remaining balance of the loan is then reduced by the reduction of loan. This sounds a little cumbersome to explain but it is simple to do except it must be done for every period of a loan. For a ten year loan payable monthly this set of calculations would have to be done 120 times.

In the case of an equal reduction loan the calculations are very similar to the above except the reduction is fixed rather than the total payment. The interest is calculated on the remaining balance of the loan and then added to the reduction of loan to calculate the payment. It is normal practice to have equal payment loans payable monthly and equal reduction loans payable yearly. The program can handle any period for either type of loan.

The third type of loan is an interest only loan. In this case we need only determine the interest expense per period. The interest rate is usually calculated by dividing the nominal rate by the number of periods per year.

For those of you in the field of banking and financing, you may find some of our terms old fashioned and academic. We find the terms now used in the banking field a little confusing. Simple interest used to mean interest payable at the end of an year only. Bankers now call interest on the remaining balance simple interest. We wonder whether our terms are academic or if the present trade terms are simply imprecise.

PROGRAM OUTPUT

The output of an amortization program is standard. A period by period record of each transaction is needed. Our program yields some additional information which we believe is relatively unique. The program sums the annual interest expense and reduction of loan as well as the total payments made in any given year. It is possible to control the length of the first year so that the summations fall at the end of an individual's tax year.

PROGRAM INPUT

For any given loan, the computer must be told the amount of the loan, the life of the loan, the type of loan, the annual interest rate, the number of periods per year, and whether it is a balloon note or if it runs its full time. The user may also select to have the results printed on the CRT or the printer.

RUNNING THE PROGRAM

The program starts by printing out some identifying material and credits followed by an output menu as follows:

```
AMORTIZATION OF LOANS
DEVELOPED BY:
STEVEN M. ZIMMERMAN, PH.D. & LEO M. CONRAD 1981

OUTPUT MENU
  CRT, PRINTER, BOTH, END (C/P/B/E)?
```

The first option C for the CRT or screen means the program may be run by those individuals who do not have a printer available. In this case the output will produce a screen full of results and then ask for an ENTER to continue. In the case of P for PRINTER output, the results will still be printed on the CRT but the paging question will not appear. B for BOTH result in printer output and the paging function being used. We selected P to obtain the hard copy for this article.

The next question is relative to the possibility of a balloon note. A balloon note is one which has payments as if the loan will last, say, 30 years but is terminated after perhaps five years. The remaining balance of the loan is due and payable at the end of the five years. In our program the payment number of the balloon must be specified. For our example we selected to use a balloon and then specified payment 16 as the balloon payment. The two questions are:

```
BALLOON (Y/N) ?
PAYMENT # OF BALLOON ?
```

In the program three types of loans are considered. Type one is the conventional real estate equal payment loan. Type two is the equal reduction load. The final type is an interest only loan. The PAYOUT MENU follows:

```
PAYOUT MENU
  EQUAL PAYMENT, EQUAL REDUCTION, INTEREST
ONLY (P/R/I) ?
```

We ran two examples, one for equal payment and one for equal reduction. The two runs are included. For this discussion, assume we selected the equal payment option.

```
LOAN,APR,PAYMENTS PER YEAR,PAYMENT (0 TO
CALCULATE), YEARS
?
```

An equal payment loan requires the above information. We specified 1000 for loan, .12 for the annual

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percentage rate, 12 payments per year, 0 for the computer to calculate the payment, and 4 year payout. The computer then returned our input information for us to check:

LOAN = 1000 APR= .12 PAYMENTS PER YEAR = 12
YEARS = 4 PERIOD PAYMENT = 26.33

PERIOD INTEREST REDUCTION LOAN PAYMENT

ENTER TO PAGE?

The computer is now ready to proceed. After you check the above and hit ENTER the runs shown will be produced.

TECHNICAL NOTES

As we noted earlier the programming of this problem forced us to dig deeply into our knowledge of the two types of real numbers and the integer numbers available on our TRS-80. An integer is a counting number. There is no integer number between 1 and 2. In the real number system there is always some number between any two numbers you wish to name. Between 1.222 and 1.223 is a number 1.2225 as well as a bunch of other numbers.

The single precision variable is stored with 7 digits of precision and printed out with 6 digits. The double precision variable has 17 digits of accuracy and prints out with 16 digits. If you are converting our program to some equipment other than the TRS-80, you may find your numbers defined in some other manner. Be careful.

Our problem is that the monetary system is an integer penny system and we do not want a number that looks like 1.223423 but rather we want $1.22 i.e. one dollar and twenty two cents. We decided to attack our problem by converting any payments to integer pennies and then checking to see if more or less than a half a cent had been lost. If more than an half cent was lost we added a penny; if less, we drop the remaining value. We expect that some of the commerical programs use the approach we have just outlined, while some use the approach of simply working with double precision, so you may not get an exact match up. We note there is no theoretically correct way to handle this problem.

SUMMARY

In this time of unusual financing, it is necessary for all lenders and borrowers to understand loans and how they work. This program is for the conventional type of loan where interest is charged on the amount borrowed for a period at the end of a period. It is the type of loan most commonly found in real estate in the past.

With this program you can run off your own tables and will also be able to check on the bank. For individuals who are now going into the finance business of necessity, in order to sell their homes, the program will also find use.

```
10 CLEAR 500: CLS : REM    "MORTG"
20 A$="### ###,###,###.## ###,###,###.## ###,###,###.##
###,###,###.##"
25 PRINT "AMORTIZATION OF LOANS": PRINT "DEVELOPED BY: ":
PRINT "STEVEN M. ZIMMERMAN, PH.D. & LEO M. CONRAD  1981":
PRINT
30 PRINT "OUTPUT MENU": INPUT" CRT, PRINTER, BOTH, END
(C/P/B/E)";P$: IF P$="E" END
40 B$="LOAN, APR, PAYMENTS PER YEAR, PAYMENT (0 TO CALCULATE),
YEARS": B1$="LOAN, APR, PAYMENTS PER YEAR, REDUCTION, YEARS":
B2$="LOAN, APR, PAYMENTS PER YEAR, YEARS"
50 INPUT "BALLOON (Y/N)";BL$: IF BL$="Y" INPUT "PAYMENT # OF
BALLOON";BB%
60 INPUT "MONTH NUMBER IN WHICH PAYMENT STARTS";M%
70 PRINT "PAYOUT MENU": INPUT "EQUAL PAYMENT, EQUAL REDUCTION,
INTEREST ONLY (P/R/I)";T$
80 IF T$<>"P" THEN 230
90 PRINT B$: INPUT LO#,APR#,PP%,PAY#,YEAR: IF PAY#<>0 THEN 130
100 R#=APR#/PP%: II#=(1.00000000+R#)>(PP%*YEAR):
FF#=(R#*II#)/(II#-1):PAY#=FF#*LO#
110 D#=100*PAY#-INT(100*PAY#): IF D#>.50000 THEN
PAY#=PAY#-D#/100.00000+0.0100000000
ELSE PAY#=PAY#-D#/100.000000
130 GOSUB 1000
140 R#=APR#/PP%: N%=PP%*YEAR: IF BL$="Y" LET N%=BB%
150 IS#=0:RS#=0:K%=M%-2
160 FOR B=1 TO N%-1: K%=K%+1: IF K%=12 LET K%=0: GOSUB 1500
170 IN#=R#*LO#: D#=100*IN#-INT(100*IN#): IF D#>.50000000 THEN
IN#=IN#-D#/100.00+.0100000000 ELSE IN#=IN#-D#/100.00000
180 RE#=PAY#-IN#:LO#=LO#-RE#: IS#=IS#+IN#: RS#=RS#+RE#: C=B:
GOSUB 3000
190 NEXT
200 C=N%: IN#=R#*LO#:RE#=LO#: LO#=0.000: IS#=IS#+IN#:
RS#=RS#+RE#: GOSUB 3000
210 GOSUB 1500
220 GOTO 30
230 IF T$<>"R" THEN 320
240 PAY#=0: PRINT B1$: INPUT LO#,APR#,PP%,RE#,YEAR: GOSUB 1000
250 R#=APR#/PP%:N%=PP%*YEAR: IF BL$="Y" LET N%=BB%
260 IS#=0:RS#=0:K%=M%-2:SS#=RE#
270 FOR B=1 TO N%-1:K%=K%+1: IF K%=12 LET K%=0: GOSUB 1500
280 RE#=SS#:IN#=R#*LO#: D#=100*IN#-INT(100*IN#):
IF D#>.50000000 THEN IN#=IN#-D#/100.00+.0100000 ELSE
IN#=IN#-D#/100.00000
290 LO#=LO#-RE#: IS#=IS#+IN#: RS#=RS#+RE#: C=B: GOSUB 3000
300 NEXT
310 GOTO 200
320 IF T$<>"I" THEN 30
330 PRINT B2$: INPUT LO#,APR#,PP%,YEAR: RE#=0: PAY#=0:
GOSUB 1000
340 R#=APR#/PP%: N%=PP%*YEAR: IF BL$="Y"N%=BB%
```

continued on page 45

NEW !!

SUPER UTILITY PLUS

— OVERVIEW —

SUPER UTILITY PLUS was written by Kim Watt of Breeze Computing, Inc. and is the most powerful program of its kind on the market at this time. This program is a machine language, stand alone program that has its own I/O routines, does not use any ROM or DOS calls, and works on SINGLE or DOUBLE DENSITY systems. SUPER UTILITY PLUS performs such a wide range of varied tasks, that it may truly be called "The King of Utilities". It is not required that the disk be in any drive after initialization of the program and user may custom configure the program to suit his individual system requirements.

ZAP does everything your present "zapping" utility does plus many additional enhancements. It will operate on SINGLE or DOUBLE DENSITY systems and will work with most major operating systems that are presently on the market. It has dual cursors (one for ASCII and one for HEX side of the readout) and allows the user to go to the heart of the disk and read and/or modify data in HEX, ASCII, DECIMAL, BINARY, or OCTAL, regardless of whether it is a standard disk or not. The screen printout on Zap displays one sector at a time in HEX and ASCII (as other "zapping" utilities), but also tells user the true and relative track and whether the disk is IBM format or not. Zap also has a search routine that will locate the highest or lowest configured track on the disk and others that will search the disk for a byte list, ASCII string, word list, or even encripted code. Zap also allows you to display disk sectors, compare disk sectors, copy sector data, zero disk sectors, copy disk sectors, reverse sector data, sector searches, read ID address marks, or alter data address marks.

PURGE has a full screen editing kill control that allows you to kill files by positioning cursor and pressing one key. Also, Purge has several sub-utilities that allow you to zero out unused directory entries or zero out unused disk granules. In addition, user may kill files by naming the common category of the files (Example: /CMD/BAS/TXT <I>nvisible, <V>isible, etc. or even kill files that begin with a specified letter), and also may compute existing passwords, change the disk name, date, passwords, auto command, or even file parameters (name, passwords, protection levels). Lastly, Purge contains a complete disk directory that indicates all active and non-active files on the disk.

FORMAT is a utility that allows the user to format a disk with; standard format, format without erasing existing data, special format (custom format your disk most any way you want it), build a format track and optionally write it back to any track on your disk, and even contains a software bulk erase utility. The total formatting capabilities of this program are just about UNLIMITED and you may even reformat over a disk or add tracks to an existing disk without destroying existing disk data.

DISK COPY will copy most any standard disk, with or without formatting. The Special Disk Copy enables the user to make a backup of most TRS-80® readable disks that are presently on the market, regardless of any efforts that have been made to protect them from being "backed up". (NOTE: This program WILL NOT copy itself). This program's only intended use is for you to make backups of your legally purchased programs. Please DO NOT use this utility to make "bootleg copies" for others as authors of quality programs deserve their royalities.

TAPE COPY enables the user to perform a wide variety of actions that include the ability to read, write, or verify tapes and even includes a Bit by Bit copying routine that will back up most ANY TRS-80® readable tape regardless of protection attempts made by authors. This utility also is for your own use only.

DISK REPAIR allows you to automatically repair the HIT and GAT sectors, and will automatically repair a Boot. This utility also does a complete Directory Check and will advise you of errors that exist. In addition, this utility allows the user to recover killed files (if the file was killed by this utility or by NEWDOS), read protect or un-read protect the directory, move it to a different location on the disk, or clear unused entries. Lastly, this utility advises you of all inactive files that are on the disk.

MEMORY supplies the ability to display, move, test, compare, zero, exchange, input or output a byte to any port, exchange, jump to, reverse, fill, string search, or even load/write and entire track or sectors to/from memory.

FILE contains the abilities to display file sectors, compare files, copy files, disk directory, free space, file locations, drive status, create files, and clear files from disk. These utilities give you a wide range of powerful commands at your disposal to perform just about any function that you want with files up and including the complete reorganization of your entire disk with all the files re-written in their most contigious order.

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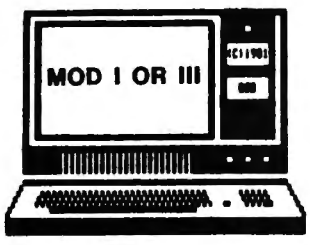

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MODEL III CORNER

Hubert S. Howe, Jr.

This month we will review some of the disk operating systems presently available for the Model III, and discuss some other aspects of the disk system as well.

Facilities Available

If you look upon the Radio Shack computers from a business viewpoint, or for any professional (as opposed to recreational) purposes, the primary difference between the TRS-80 Model II and Model III is the amount of on-line storage available. A Model III with two built-in drives has 378K, which is more than a Model I with four drives, whereas a Model II with one built-in drive has over 500K, and when you add the three external drives you can have over 2 megabytes.

If you walk into a Radio Shack Computer Center or store and express interest in professional computing applications, they will try to steer you in the direction of a Model II rather than a Model III. This is well and good, except that you'll be paying over $1,000 more for the Model II. The reason for emphasizing this is that all these figures about disk storage capacity are about to go out the window with the introduction of inexpensive hard disk drives. Non-Radio Shack retailers are already selling TRS-80 Model IIIs with built-in 6.3 megabyte hard disk drives for under $5,000, and add-on winchester drives with the same storage capacity can be purchased for under $3,000. Other drives with more capacity are available for higher prices.

Radio Shack is known to be developing a hard disk for the Model II, but apparently not for the Model III. Furthermore, the company is making threatening noises about not servicing computers that have non-RS disk drives or other modifications in them. Since service is one of the most important considerations to professional users, this must be a deterrent to buying non-RS equipment, except for add-on devices that can be detached when the machine is in for service!

Disk Hardware Problems

So you think you're the only one having disk errors on your Model III? Wrong! We are getting so many reports of problems from users that this must be an indication of a much greater range of problems than we ever experienced with the Model I. Almost all the complaints I have heard, however, indicate normal problems rather than any design flaws in the computer, although there may also be some problems with the disk operating system which I'll mention later. Therefore, I thought it would be instructive to review why we seem to be getting so many problems and what to do about them.

The first important point to mention about the Model III disks is that reading and writing data in double density places significantly greater strain on the media than did the single density on the Model I. You have to be extremely careful in handling the diskettes, inserting them in and taking them out of the drives, and in storing them under proper conditions. You should use only the best quality diskettes you can buy, and make sure that they are tested in double density. Occasionally we have slightly bent a diskette while inserting it into the drive, only to discover that it is forever ruined for the Model III, even though we can still use it on the Model I! It is important to emphasize this point, because many users of TRS-80 computers are inexperienced in handling such media. You can throw cassettes against the wall and still use them successfully, but not diskettes.

The second important point about the Model III disk drives is that they must be serviced regularly. The main problem seems to be disk alignment. This is a complicated procedure that can only be carried out by a technician with an oscilloscope. It is just not the kind of thing you can do for yourself. Thus, if you are contemplating using a TRS-80 (or any computer) for professional purposes, you should budget for servicing and do it regularly. The fact that Radio Shack maintains a network of computer centers with service departments is one of the strong reasons it has been so successful with its computers, and this is an important incentive for buying from RS rather than another company.

How often should you have your disk drives aligned? One RS technician claims that this should be done every 60 days. This is probably more often than necessary, but it should probably be at least once or twice a year. With the Model I, you could expect to need disk alignment once every year or two, and we have some original Model I disk drives that are still working fine and have never needed alignment since we bought them. The disk drives seem to be the only components of the Model III that need such regular service. Don't wait for problems to develop before taking your computer in!

Model III Disk Operating Systems

There are presently at least three different disk operating systems for the TRS-80 Model III: TRSDOS, presently in version 1.3, from Radio Shack; DOS PLUS, from Micro Systems Software; and NEWDOS/80 version 2, from Apparat. All of these are different in some significant ways; unfortunately, all of them are incompatible. Other systems exist, but we have not yet seen

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- Super fast sort by alph. or zip order (8 sec. for 1000 entries)...both orders can exist simultaneously on disk.
- High speed recovery of entries from disk...speed of sort is meaningless if retreival from disk is slow...ours pulls in over 11 per sec!
- Transfers old files over to our system.
- In zip order all entries with same zip code are also arranged alphabetically.
- Four digit zips have a leading "O" appended on labels.
- Backup data disks are easily updated as entries are created, edited, or sorted...extremely useful!!
- Optional reversal of name about comma for that non-computer, personalized look.
- Master printouts of your list in several formats (not just a rehash of the labels). Optionally continuous or page oriented...Your customers will want this!
- All Ø's in address labels are replaced by easier to read 0's.
- All labels optionally support an "Attn:" line.
- Many user defined fields with plenty of options for **simultaneous** purging and selecting...even allows for inequalities...powerful and easy to use!!
- Continuous display of how many addresses printed.
- Each disk entry automatically "remembers" how many mailings have been made for that particular entry...Can be tied in with purge/select.
- Primarily written in BASIC for easy modification... embedded machine code for those speed sensitive areas.
- Editing is simple and fast...automatic search.
- Optional 9 digit zip.
- Deleted entries have "holes" on disk filled automatically ...and alph. order is still maintained!
- Test label printing lets you make horizontal and vertical adjustments with ease.
- Optional "one time" mailing for some selected entries
- Extensive use of error traps (both operator and machine induced)...even recovers from a power failure during a printout!...recycling on disk errors.
- Patch program allows you to upgrade the system to any DOS
- Documentation manual available separately for $3.95.
- Hardware requirements: 32K printer, and 1 or 2 drives

Football Scouting Report (Disk only) $89.95

How many high schools and colleges are there within a 75 mile radius of you? Did you know that each is a potential *customer at* the rate of from $500-$1000 per season? Many already subscribe to more expensive (but inferior) computer analysis services of their scouting reports. Using such a service a coach will typically have an opponent scouted several times prior to actually playing them...This series of programs was written to the specifications of a coach with two state championships to his credit. As a result, the emphasis is on producing statistics that will help in predicting what the opponent will do in a given situation...This is a sophisticated set of programs fully equivalent to that used by professional football teams...Hardware requirements...32K, 1 disk driver and printer.

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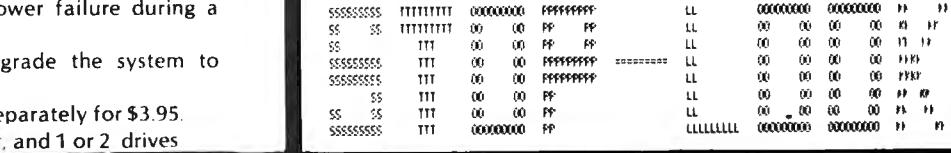
Interfaces to your own basic programs...sort with the speed of machine code but with the convenience of basic. You don't have to know assembly language programming to use these programs. Just use your disk to merge our short basic programs (with embedded machine code) with your own basic program. Follow our simple instructions to poke several values before making the user call from basic. The pokes will set up a sort of string, integer, single, or double precision arrays. Also ascending or descending order is controlled by a single poke. Use one of two programs to sort arrays of the form A(1) or A(Q(1))...The disk includes 8 simple basic programs that are ready to merge with the main sort programs. Use them for learning and evaluation...Also included is a ready to use basic program (already merged with the ORDER program). Use it to obtain a printout of alphabetized names. This program alone is worth $19.95.

Sample Sort Times

8 sec. for 1000 dbl. prec. numbers...50 sec. for 5000 integers. (Ours is one of the only alphabetizers that both ignores non alph. characters and treats upper and lower case alike.)

Sign (Tape only) $9.95

Produce large (reduced 50% here) attention getting signs with your printer...supports most keyboard characters...will print multiple lines...use alone or interface to your own BASIC program...requires just over 16K and a printer.



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them, and probably the most important of all, CP/M, will be available early in 1982. While this article is in no sense a review of these DOSs, I would like to compare some aspects of these systems and the features that they offer Model III users.

TRSDOS 1.3

TRSDOS 1.3 is the standard DOS available from Radio Shack to every owner of a Model III disk system. It is significantly better than TRSDOS 2.3 for the Model I. Radio Shack acknowledges and has issued patches for some of the errors in early releases of the system. Because it is the "standard" DOS, all others will be compared to it, and many users will be struggling with its characteristics.

TRSDOS 1.3 formats the diskette with 40 tracks, numbered 0 to 39, and 18 sectors, numbered 1 to 18. It is a mystery why Radio Shack numbered tracks from zero but sectors from one. This is one of the primary incompatibilities between TRSDOS and all other double-density DOSs. Incidentally, each sector is also formatted with a byte pattern that includes a "(c) 1980 Tandy".

As with the Model I, Radio Shack decided to put the disk directory on track 17, but unlike the Model I, where all of the system except for the "BOOT" sector and directory were organized into system files, much of the TRSDOS system diskette simply reserves certain tracks and sectors for specific information without indicating it in the directory. (This is one of the reasons why it is difficult to patch corrections for certain errors into the system.) Radio Shack's original reason for using track 17 for the directory was that it was exactly in the center of a 35-track diskette, so that the head never had to step more than half the way through the diskette to find the directory. For this reason, you might have thought that RS would usa track 20 for the Model III, since there are now 40 tracks.

Space is allocated in terms of "granules" by TRSDOS 1.3, each granule consisting of three sectors (768 bytes), with six granules to a track. This compares to five-sector granules on the Model I, and the idea here seems to be to make better use of the space available by allocating it in smaller packages. Unfortunately, this is one of the major flaws in TRSDOS, because the system assigns only one granule at a time. When you write a long file to the disk, the system constantly goes back to track 17 to retrieve the directory, get another granule, and update the directory. This means that track 17 gets read and written at a much more frequent rate than any other track in the system, and after a while it can begin to show strain. I have noticed a "groove" in the middle of diskettes that have been used for a long time where track 17 is located, and my system has never had a input/output error (such as ERROR 03 or ERROR 04) on any track except 17, where it has had them frequently.

Another aspect of TRSDOS is that it is compatible only with Radio Shack's disk drives (and a few other models). This is because it has been written in such a way that only the fastest seek times are used for all disk controller commands, and most non-Radio Shack drives cannot respond this fast. Since any drives can work with the slower seek times, it seems that one reason for this feature was simply to make all this other equipment incompatible, even though locating specific tracks and sectors can occur more quickly. The fastest seek time is 3 milliseconds and the slowest rate 15 milliseconds, so any seek time is still pretty fast.

The good features of TRSDOS 1.3 included a greatly expanded library of commands and utilities which give the Model III system capabilities more analogous to the Model II than the Model I. This also means that any competing disk operating system will have to offer as much or more in order to be attractive.

Unfortunately, the errors that have been published to date seem like the tip of an iceberg. There are probably many more, and it is doubtful that Radio Shack will ever be able to fix them all, especially the ones that only occur under some weird combination of circumstances. To say that it contains errors, however, is by no means to say that it will not be a reliable DOS on a day-to-day basis. All systems contain errors, and it is to Tandy's credit that it has established a policy of issuing updates (which have appeared in in the *Radio Shack Microcomputer Newsletter.*).

DOS PLUS

DOS PLUS was the first non-Radio Shack DOS to appear (see our review in the July 1981 issue). There are several different versions of DOS PLUS, to support standard disk drives, 80-track drives, and a new version to support an add-on hard disk drive with file handling commands exactly like the floppies. There are also both single and double density versions for the Model I.

While using DOS PLUS is very similar to using TRSDOS, there are a number of noticeable differences. For one thing, it is very fast. It boots up immediately, and you are not asked the date or time. DOS PLUS comes with many more utilities than TRSDOS, including some fancy ones like "DISKZAP", which allows you to examine and modify the contents of disk sectors.

Unfortunately, the system is not compatible with TRSDOS, although you are offered a CONVERT utility for copying files to DOS PLUS from TRSDOS or even from Model I diskettes. There are (at least) two reasons for the incompatibilities: first, tracks and sectors are formatted from 0 to 39 and 0 to 17 (rather than 1 to 18), and granules are allocated six sectors at a time (1536 bytes) rather than three. There are thus three granules per track, and the format of the disk directory is completely different because of these reasons.

The one specific advantage of DOS PLUS is that it will support non-standard configurations like 80-track

DYNACOMP

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CARD GAMES

BRIDGE 2.0 (Available for all computers) — **Price: $17.95 Cassette/$21.95 Diskette**
An all-inclusive version of this most popular of card games. This program both BIDS and PLAYS either contract or duplicate bridge. Depending on the contract, your computer opponents will either play the offense OR defense. If you bid too high, the computer will double your contract! BRIDGE 2.0 provides challenging entertainment for advanced players and is an excellent learning tool for the bridge novice. See the software review in 80 Software Critique.

HEARTS 1.5 (Available for all computers) — **Price: $15.95 Cassette/$19.95 Diskette**
An exciting and entertaining computer version of this popular card game. Hearts is a trick-oriented game in which the purpose is not to take any hearts or the queen of spades. Play against two computer opponents who are armed with hard-to-beat playing strategies. HEARTS 1.5 is an ideal game for introducing the uninitiated (your spouse) to computers. See the software review in 80 Software Critique.

POKER PARTY (Available for all computers) — **Price: $17.95 Cassette/$21.95 Diskette**
POKER PARTY is a draw poker simulation based on the book, POKER, by Oswald Jacoby. This is the most comprehensive version available for microcomputers. The party consists of yourself and six other (computer) players. Each of these players (you will get to know them) has a different personality in the form of a varying propensity to bluff or fold under pressure. Practice with POKER PARTY before going to that expensive game tonight! Apple C assette and diskette versions require a 32 K (or larger) Apple II.

CRIBBAGE 2.0 (TRS-80 only) — **Price: $14.95 Cassette/$18.95 Diskette**
This is simply the best cribbage game available. It is an excellent program for the cribbage player in search of a worthy opponent as well as for the novice wishing to improve his game. The graphics are superb and assembly language routines provide rapid execution. See the software review in 80 Software Critique.

EDUCATION

TEACHER'S PET I (Available for all computers) — **Price: $11.95 Cassette/$15.95 Diskette**
This is the first of DYNACOMP's educational packages. Primarily intended for pre-school to grade 3, TEACHER'S PET provides the young student with counting practice, letter-word recognition and three levels of math skill exercises.

MORSE CODE TRAINER (TRS-80 only) — **Price: $12.95 Cassette/$16.95 Diskette**
MORSE CODE TRAINER is designed to develop and improve your speed and accuracy in deciphering Morse Code. As such MCT is an ideal software package for FCC test practice. The code sound is obtained through the earphone jack of any standard cassette recorder. You may choose the pitch of the tones as well as the word rate. Also, various modes of operation are available including number, punctuation and alphabet tests, as well as the keying of your own message. A very effective way to learn code!

THOUGHT PROVOKERS

FLIGHT SIMULATOR (Available for all computers) — **Price: $17.95 Cassette/$21.95 Diskette**
A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTRONICS.

VALDEZ (Available for all computers) — **Price: $15.95 Cassette/$19.95 Diskette**
VALDEZ is a computer simulation of supertanker navigation in the Prince William Sound Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 × 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modelled mathematically. The simulation also contains a model for the tidal patterns in the region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor! See the software review in 80 Software Critique.

NOMINOES JIGSAW (Atari, Apple and TRS-80 only) — **Price: $16.95 Cassette/$20.95 Diskette**
A jigsaw puzzle on your computer! Complete the puzzle by selecting your pieces from a table consisting of 60 different shapes. NOMINOES JIGSAW is a virtuoso programming effort. The graphics are superlative and the puzzle will challenge you with its three levels of difficulty. Scoring is based upon the number of guesses taken and by the difficulty of the board set-up. The NOMINOES JIGSAW is available for TRS-80 color computer.

CHESS MASTER (North Star and TRS-80 only) — **Price: $19.95 Cassette/$23.95 Diskette**
This complete and very powerful program provides five levels of play. It includes castling, en passant captures and the promotion of pawns. Additionally, the board may be preset before the start of play, permitting the examination of "book" plays. To maximize execution speed, the program is written in assembly language (by SOFTWARE SPECIALISTS of California). Full graphics are employed in the TRS-80 version, and two widths of alphanumeric display are provided to accommodate North Star users.

STARTREK 3.2 (Available for all computers) — **Price: $11.95 Cassette $15.95 Diskette**
This is the classic Startrek simulation, but with several new features. For example, the Klingons now shoot at the Enterprise without warning while also attacking starbases in other quadrants. The Klingons also attack with both light and heavy cruisers and move when shot at! The situation is hectic when the Enterprise is besieged by three heavy cruisers and a starbase S O S is received! The Klingons get even! See the software reviews in A N A L O G, 80 Software Critique and Game Merchandising.

GAMES PACK I (Available for all computers) — **Price: $10.95 Cassette $14.95 Diskette**
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSERACE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection is worth the price just for the DYNACOMP version of BLACKJACK.

GAMES PACK II (Available for all computers) — **Price: $10.95 Cassette $14.95 Diskette**
GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.

Why pay $* 95 or more per program when you can buy a DYNACOMP collection for just $10.95*?

STATISTICS and ENGINEERING

DIGITAL FILTER (Available for all computers) — **Price: $39.95 Cassette $33.95 Diskette**
DIGITAL FILTER is a comprehensive data processing program which permits the user to design his own filter function or choose from a menu of filter forms. The filter forms are subsequently converted into non-recursive convolution coefficients which permit rapid data processing. In the explicit design mode the shape of the frequency transfer function is specified by directly entering points along the desired filter curve. In the menu mode, ideal low pass, high pass and bandpass filters may be approximated to varying degrees according to the number of points used in the calculation. These filters may optionally also be smoothed with a Hanning function. In addition, multi-stage Butterworth filters may be selected. Features of DIGITAL FILTER include plotting of the data before and after filtering, as well as display of the chosen filter functions. Also included are convenient data storage, retrieval and editing procedures.

FOURIER ANALYZER (Available for all computers) — **Price: $16.95 Cassette $20.95 Diskette**
Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

TFA (Transfer Function Analyzer) — **Price: $19.95 Cassette $23.95 Diskette**
This is a special software package which may be used to evaluate the transfer functions of systems such as hi fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

HARMONIC ANALYZER (Available for all computers) — **Price: $24.95 Cassette $28.95 Diskette**
HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage/retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.

FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of $44.95 (three cassettes) and $56.95 (three diskettes).

REGRESSION I (Available for all computers) — **Price: $19.95 Cassette/$23.95 Diskette**
REGRESSION I is a unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy, an automatic degree determination option, an extensive internal library of fitting functions, data editing, automatic data and curve plotting, a statistical analysis (eg. standard deviation, correlation coefficient etc.) and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.

REGRESSION II (PARAFIT) (Available for all computers) — **Price: $19.95 Cassette $23.95 Diskette**
PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A(1), A(2), etc.) as one or more BASIC statement lines. Data and results may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

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drives, and this remains one of the strongest reasons for buying it.

NEWDOS/80 Version 2

NEWDOS/80 Version 2 is a completely rewritten disk operating system, similar to the older NEWDOS/80 for the Model I but with many new features. There is also a version for the Model I, and both versions are completely compatible from the user's standpoint.

More than any other DOS, NEWDOS/80 version 2 seems to have been written for users familiar with the Model I who don't want to have to learn entirely new procedures on the Model III. This method has advantages and disadvantages, but the most noticeable aspect of the system are these differences with other Model III DOSs.

NEWDOS/80 version 2 diskettes are formatted with 40 tracks and 18 sectors, numbered 0-39 and 0-17 respectively, like DOS PLUS. There the similarity ends. Space is allocated exactly as on the Model I, in terms of five-sector units. The trouble is that granules now sometimes span more than one track, which causes extra bookkeeping for the people who wrote the system but not for users. All the sectors on the diskette can be numbered, from 0 to 719, and utilities like "SUPERZAP" can access and display sectors according to this method.

Another interesting and intelligent aspect of NEWDOS/80 version 2 is that *everything* is allocated in terms of files. The directory itself is a file, called "DIR/SYS", and it is located on the original diskette exactly where you would expect it on the Model I: sectors 170-179, even though this is now in the middle of track 9 rather than on track 17. No special address marks are needed to identify the directory track, and for larger disk drives the directory can be increased in size. All the system routines are also organized into files, as on the Model I, and the details of the disk directory, such as file primary directory entries, etc., seem to be identical to the Model I.

One important result of these procedures is that you can actually run your Model III just as if it were a Model I. You can take old diskettes from the Model I, stick them into the Model III, and continue running your programs just as if it were the old computer. (You must first define the characteristics of a drive as being single density.) You won't be able to do this with a Model I system diskette, and if you do it you won't be making use of the double density capacity of the Model III. This seems by far the best solution for users who are having a tough time adapting their programs to the Model III.

There are also many new utilities for NEWDOS/80 version 2, and a greatly expanded list of disk equipment that can be interfaced to the Model III and treated just as another disk drive as far as the system is concerned. The documentation is also much expanded, and Apparat seems to be the most responsible company in the business when it comes to providing patches or "zaps" for errors or incompatibilities with other programs or systems.

Summary

At this point, one of the main problems with the disk operating systems for the Model III is that all these incompatibilities exist between them. A user who makes a choice to go with one of them may find that he or she must undergo substantial reprogramming later in order to change. Probably at least some of the reason for this situation is that manufacturers want user to be dependent upon them for future updates or new products, although providing the new and expanded features was also doubtless just as important to the authors of the non-Radio Shack disk operating systems.

In this context it is important to mention CP/M, for CP/M is not only the oldest disk operating system for microcomputers in general, but also the only system for which reasonable industry standards exist. One of the main problems with Radio Shack's disk operating systems is that they have either had so many errors in them, or they have redefined the ways in which certain features work, so that authors of programs for Radio Shack computers have had to come out with a new version in order to implement the program on a new computer or under a new system. This type of problem really doesn't exist with CP/M. The system itself is so low-level that, once it is written, almost any programs, including programs developed on entirely different computers with 8080 microprocessors rather than Z-80s, will run on another computer with no changes. For this reason there is a very large program library of CP/M programs that can be run on any number of different computers in exactly the same way. (Also, it is important to mention that most CP/M implementations are on systems employing 8-inch disk drives, and almost all single density 8-inch diskettes are compatible.)

As an examxle of what this means, consider the SCRIPSIT program. Radio Shack has had to issue a new version for each computer (the Models I, II, and III). Anyone who has wanted to use the program with a different system configuration, such as a serial printer, has had to resort to complicated patches to make it work. If SCRIPSIT had been introduced under CP/M, there would be exactly one version. All of its interfaces to the outside world would be handled by the system. There would have to be different versions of CP/M for each computer, but once it was installed, all programs would run. If you wanted to use something like a serial printer, you would have to get a modification to your version of CP/M, but then all programs would be able to use the serial printer, not just SCRIPSIT. Furthermore,

continued on page 41

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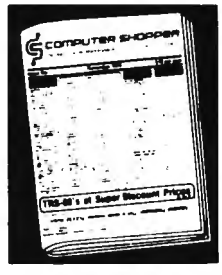

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DETERMINANT CHALLENGE ACCEPTED

C. Brian Honess

The February 1981 issue (#31) had an interesting little program for solving two simultaneous linear equations, in two unknowns, using the determinant. The author then issues a challenge to "see if you can write a similar program for third-order determinants, to solve three equations in three unknowns." Well, OK, but it turns out that this is a fairly trivial problem. Why not "think BIG"—how about 10 simultaneous equations in 10 unknowns? How about 25? Maybe even 50? Well, I got up to 55 in my Level II, 16K machine with no disk or printer, and I had lots of fun doing it! You just can't imagine how 55 simultaneous equations in 55 unknowns look until you see them, especially if you have been brought up on the 2 or 3 unknowns problems from your high school and college math courses!

Before we tackle the big sets, though, let's get a little terminology over with, by looking at 2 equations:

$$2 * X_1 + 3 * X_2 = 8$$
$$X_1 + 4 * X_2 = 9$$

The numbers in front of the X_1's and X_2's are called the coefficients, and they can be written in what is called a "coefficient matrix", as follows:

$$\begin{vmatrix} 2 & 3 \\ 1 & 4 \end{vmatrix}$$

and it was this matrix that was used as the basis of the program issuing the "challenge". We can add in the values found to the right of the equals sign in the two equations and form a so-called "augmented Matrix", which looks like this:

$$\begin{vmatrix} 2 & 3 & 8 \\ 1 & 4 & 9 \end{vmatrix}$$

By inspection, or possibly by running the equations through the program in the February issue, you can easily determine that the "answers" are:

$$X_1 = 1 \qquad X_2 = 2$$

and the determinant is 5.

I'll confess that I dreamed up those values for X_1 and X_2 first, and then I dreamed up the coefficients, and finally I calculated the answers, 8 and 9. Usually, of course, you know the coefficients and the answers, but not the values for X_1 and X_2. To test my program, I knew I was going to need some big-sets of equation. Coming up with them "by hand" is OK when you have just 2 or 3, but it gets a little old quickly when you get up to the big numbers of 10 or more. So, the first program I wrote generated sets of simultaneous linear equations. The program first asks you how many equations you want, and then prceeds to generate the XXsi values. These are the values you would be solving for in the usual set of simultaneous linea equations. I just arbitrarily decided that I would like values from 0.1 to 1.0, but this can easily be altered by changing line 150. Next, I generate the coefficient matrix. You'll notice, in line 200, that I've chosen to have my coefficients be between 0 and 1 inclusive. Again, you might alter this line. I got tired of all those positive coefficients too, so I put in line 210 to make about 25% of them negative.

After I had generated my vector full of X_i values, and my coefficient matrix, it was a simple task to calculate what the values to the right of the equals sign in my equations should be. This is done in the 250 to 300 loop, after which the program simply prints the coefficient matrix, the answer vector, and the solution vector.

You might type in and run this short program, and generate some 3 x 3, or maybe a 5 x 5 or two, to see how it works, and convince yourself that the program does indeed generate simultaneous linear equations. Incidentally, you should note that it is an *extremely* remote possibility that one of the equations might be the same as another one, or maybe one of them is an even multiple of another one. For example:

$$2X_1 + 3X_2 = 7$$
$$\text{and } 4X_1 + 6X_2 = 14$$

This equation will throw a wrench into the program which solves the equations, but the situation is *very* rare. When this happens, it is easy just to generate another set of equations.

```
100 REM  ***   GENERATE LARGE SYSTEMS OF 'N' LINEAR
101 REM          EQUATIONS IN 'N' UNKNOWNS
102 REM
110 CLS : PRINT : INPUT "DESIRED 'N' "; N
120 DIM M(N,N), X(N), A(N)
130 REM  ***   GENERATE X(I) VECTOR
140 FOR I = 1 TO N
150 X(I) = RND(10) / 10
160 NEXT I
170 REM  ***   GENERATE COEFFICIENT MATRIX
180 FOR R = 1 TO N
190 FOR C = 1 TO N
200 M(R,C) = ( RND(11) - 1 ) / 10
210 IF RND(4) = 4 THEN M(R,C) = -1 * M(R,C)
220 NEXT C
230 NEXT R
240 REM  ***   CALCULATE ANSWER VECTOR
250 FOR R = 1 TO N
260 A(R) = 0
```

```
270 FOR C = 1 TO N
280 A(R) = A(R) + M(R,C) * X(C)
290 NEXT C
300 NEXT R
310 REM  ***   PRINT COEFFICIENT MATRIX
320 PRINT : PRINT "COEFFICIENT MATRIX --" : PRINT
330 FOR R = 1 TO N
340 FOR C = 1 TO N
350 PRINT M(R,C);
360 NEXT C
370 PRINT
380 NEXT R
390 REM  ***   PRINT ANSWER VECTOR
400 PRINT : PRINT "ANSWER VECTOR --" : PRINT
410 FOR I = 1 TO N
420 PRINT A(I);
430 NEXT I
440 REM  ***   PRINT SOLUTION VECTOR
450 PRINT : PRINT : PRINT "SOLUTION VECTOR --" : PRINT
460 FOR I = 1 TO N
470 PRINT X(I);
480 NEXT I
490 PRINT : PRINT : STOP
500 END
```

Program #2 is a fairly short program which will solve any set of simultaneous linear equations you can get into your memory. It will also calculate and print the determinant. The program uses a technique called Gauss Elimination. After you've generated some large sets of equations and tried them, you'll probably be using this program without the equation-generating program we've just discussed, so I'm coding this one separately. (In a minute, we'll look at a combined program for both generating and solving sets of equations.)

A few comments on the program:

(1) ET in line 130 stands for "Error Term" and is necessary since we don't want to get caught in an endless loop that just oscillates back and forth between two values. This way, if we get within 0.0001 of zero, we don't bother with trying to get closer.

(2) The program is written very simply in the "data entry department"! In fact, for the sample matrix, the six values would have to be entered one at a time, since you have to press "ENTER" after each value. This is OK for testing the program with a few small 2 x 3 or 3 x 4 augmented matrices, but it can get pretty old with the bigger problems.

To solve this problem, you might want to convert to the use of DATA statements. Remove lines 150 through 165 and insert, in their place, the following:

```
150 FOR C=1 TO N+1
155 READ M(R,C)
160 NEXT C : NEXT R
501 DATA 2,3,8
502 DATA 1,4,9
```

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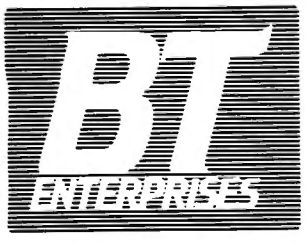

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Of course, for different augmented matrices, you'll change lines 501 and 502, and add more lines of data as needed.

(3) If you key in a fairly large set of equations, say 25 or 30, you might reach the limit of the machine long before the 50 or 55 that I claim to have run. This is because my equations were very carefully selected, in that they had relatively small coefficients. If your equations have large coefficients, or a relatively large range of coefficients, the determinant might get too big for your computer before the answer vector has been calculated. This will probably happen in line 280. The determinant, D, is limited, of course, to the maximum value that TRS-80 BASIC can handle, which is 1.701411E+38. If you have a fairly large system of equations and does get too big and you get an overflow in line 280, a good way to handle this problem is to "scale" your coefficients—that is, try dividing each by 10, or 100, etc. and then reenter the matrix.

```
1 REM  ***          GAUSS ELIMINATION          ***
2 REM  ENTER AUGMENTED COEFFICIENT MATRIX BY ROW
3 REM  EXAMPLE:
4 REM    FOR      2 X(1) + 3 X(2) = 8
5 REM               X(1) + 4 X(2) = 9
6 REM
7 REM    ENTER    2, 3, 8
8 REM             1, 4, 9
9 REM
11Ø CLS : PRINT : INPUT "DESIRED 'N' "; N
12Ø DIM M(N,N+1)
13Ø ET = Ø.ØØØ1 : D = 1
14Ø FOR R = 1 TO N
15Ø PRINT "INPUT AUGMENTED ROW NO "; R
16Ø FOR C = 1 TO N+1 : INPUT M(R,C) : NEXT C
165 PRINT : NEXT R
169 REM  ***   FIND PIVOT ROW
17Ø R = 1 : C = 1
18Ø P = M(R,C) : PP = R
19Ø FOR I = R TO N
2ØØ IF ABS( M(I,C) ) <= ABS(P) GOTO 21Ø
2Ø5 P = M(I,C) : PP = I
21Ø NEXT I
219 REM  ***   INTERCHANGE ROWS
22Ø IF ABS(P) <= ET GOTO 43Ø
23Ø IF PP = R GOTO 28Ø
24Ø D = -D
25Ø FOR J = C TO N+1
26Ø MM=M(PP,J) : M(PP,J)=M(R,J) : M(R,J)=MM
27Ø NEXT J
279 REM  ***   NORMALIZE PIVOT ROW
28Ø D = D * P
29Ø FOR J = C TO N+1 : M(R,J)=M(R,J)/P : NEXT J
3ØØ IF R = N GOTO 36Ø
3Ø9 REM  ***   REDUCE COLUMNS
31Ø FOR I = R+1 TO N : MM=M(I,C)
32Ø IF ABS(MM) <= ET GOTO 34Ø
33Ø FOR J = C TO N+1 : M(I,J)=M(I,J)-M(R,J)*MM : NEXT J
34Ø NEXT I
35Ø R = R + 1 : C = C + 1 : GOTO 18Ø
359 REM  ***   SUBSTITUTE BACK
36Ø FOR I = 1 TO N-1 : FOR J = 1 TO I
37Ø M(N-I,N+1)=M(N-I,N+1)-M(N-I,N+1-J)*M(N+1-J,N+1)
38Ø NEXT J : NEXT I
39Ø PRINT "SOLUTION VECTOR --" : PRINT
4ØØ FOR R = 1 TO N : PRINT M(R,N+1); : NEXT R
41Ø PRINT : PRINT : PRINT "DETERMINANT ="; D : PRINT
42Ø STOP
43Ø PRINT:PRINT"DETERMINANT = Ø, SO THERE'S NO UNIQUE
SOLUTION"
44Ø END
```

OK, you've gotten the Gauss Elimination program going and tried a few fairly small matrices—now for some real FUN with BIG systems of equations! Since you probably don't have any large sets of simultaneous linear equations on hand, we'll simply combine the two programs and generate the equation and then solve them. I'm going to list this combined program without REM statements, and I'll be compressing and combining some of the lines a little so that the program can be shortened somewhat. You always have the first two programs to study if there are any problems.

```
11Ø CLS:PRINT:INPUT"DESIRED 'N' ";N
12Ø DIM M(N,N+1),X(N),A(N)
14Ø FOR I=1 TO N
15Ø X(I)=RND(1Ø)/1Ø
16Ø NEXT I
18Ø FOR R=1 TO N
19Ø FOR C=1 TO N
2ØØ M(R,C)=(RND(11)-1)/1Ø
21Ø IF RND(4)=4 THEN M(R,C)=-1*M(R,C)
22Ø NEXT C
23Ø NEXT R
25Ø FOR R=1 TO N
26Ø A(R)=Ø
27Ø FOR C=1 TO N
28Ø A(R)=A(R)+M(R,C)*X(C)
29Ø NEXT C
3ØØ NEXT R
31Ø FOR R=1 TO N:M(R,N+1)=A(R):NEXT R
32Ø PRINT:PRINT"COEFFICIENT MATRIX --":PRINT
33Ø FOR R=1 TO N
34Ø FOR C=1 TO N:PRINT M(R,C);:NEXT C
37Ø PRINT:NEXT R
4ØØ PRINT:PRINT"ANSWER VECTOR --":PRINT
41Ø FOR I=1 TO N:PRINT A(I);: NEXT I
45Ø PRINT:PRINT:PRINT"SOLUTION VECTOR --":PRINT
46Ø FOR I=1 TO N:PRINT X(I);:NEXT I
47Ø PRINT:PRINT:PRINT"STARTING GAUSS ELIMINATION"
48Ø ET=Ø.ØØØ1:D=1
49Ø R=1:C=1
5ØØ P=M(R,C):PP=R
51Ø FOR I=R TO N
52Ø IF ABS(M(I,C)) <= ABS(P) GOTO 54Ø
53Ø P=M(I,C):PP=I
54Ø NEXT I
55Ø IF ABS(P) <= ET GOTO 76Ø
```

```
560 IF PP=R GOTO 610
570 D=-D
580 FOR J=C TO N+1
590 MM=M(PP,J):M(PP,J)=M(R,J):M(R,J)=MM
600 NEXT J
610 D=D*P
620 FOR J=C TO N+1:M(R,J)=M(R,J)/P:NEXT J
630 IF R=N GOTO 690
640 FOR I=R+1 TO N:MM=M(I,C)
650 IF ABS(MM) <= ET GOTO 670
660 FOR J=C TO N+1:M(I,J)=M(I,J)-M(R,J)*MM:NEXT J
670 NEXT I
680 R=R+1:C=C+1:GOTO 500
690 FOR I=1 TO N-1:FOR J=1 TO I
700 M(N-I,N+1)=M(N-I,N+1)-M(N-I,N+1-J)*M(N+1-J,N+1)
710 NEXT J:NEXT I
720 PRINT:PRINT"SOLUTION VECTOR --":PRINT
730 FOR I=1 TO N:PRINT M(I,N+1);:NEXT I:PRINT
740 PRINT:PRINT"DETERMINANT = ";D:PRINT
750 STOP
760 PRINT"DETERMINANT = 0, NO UNIQUE SOLUTION"
770 END
```

One of the first things I was anxious to find out, after I got the combined program working, was how long it takes to solve large systems of equations. I don't know about you, but I was really surprised at how fast the program did solve the large arrays. Maybe I just didn't fondly remember the struggles with 3 x 3 sets when I was in school! I can tell you too that there were some *extremely* surprised people at work the morning I went in and announced that I had solved 55 simultaneous linear equations in 55 unknowns on a TRS-80 entirely in memory, without any "scratchpad" tape or disk input/output, and that my times for solving "modest" systems of 30 equations were less than 7 minutes!

N	No. of Seconds to Generate	No. of Seconds to Solve	Total Time (seconds)
5	2	5	7
10	8	22	30
15	16	61	77
20	27	33	160
25	42	238	280
30	60	395	455

I'll leave the bigger ones as an exercise for you—I'm tired and am going to bed! It's not that I expect the times to be all that long—in fact, I plotted the above times on some semi-log graph paper, and I would estimate that 45 equations should take 23 minutes. How good is my estimate?

C. Brian Honess
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Columbia, SC 29209

■

BEGINNER'S CORNER

Sherry M. Taylor

FROM WHENCE COMETH THY COMPUTER?

Since this gathering of the BEGINNER'S CORNER is during the month of January, let me take this opportunity to wish all of you a very Happy Holiday Season. Happy Hanukkah! Merry Christmas!

Have you thought of a gift for your computer yet? You know it is your BEST friend. It plays games with you without spilling rum and coke on everything. It does work for you, but never complains or asks for a coffee break. It is infinitely patient with your slow thinking. You really should get it something nice. A wooly scarf would be nice to keep it warm, but, maybe a nice printer or a set of disk drives would be more to its liking. Whatever you decide, remember how faithful your TRS-80 has been.

With this column I will deviate from the subject of peripherals and go into a subject that I find particularly fascinating. We will pick up the "PERIPHERALS AND PARAPHERNALIA" topic again next month.

I find the fact that I have, in my own home, a real honest-to-goodness computer a total facination. My concept of computers and computer operators goes back to the mammoth gadgets of horror films. There, the operators were all just the mad scientist Frankensteins that could think in 1's and 0's, all the while flipping tiny switches to program the beast. Look how far we have come in such a short time. To realize that the computer is now an integral part of my life and that I actually own and program one is sheer amazement.

Just how did this marvelous tiny beast come into being? What is its ancestry? Let's look at the history of this phenomenon, and maybe we will appreciate our micros even more.

It all started sometime between 1000 and 300 B.C. when the Greeks and the Chinese independently developed the abacus. The abacus is basically a configuration of beads strung on rods set parallel in a frame. In counting with an abacus, the beads in the upper portion count as 5 each and those in the bottom count as 1 each.

The abacus was (and still is) used for thousands of years. However, as the need for speed and more accuaracy came about, the men of vision looked for a better way. So, in 1643 a French mathematician-philosopher, Blaise Pascal, invented the first mechanical calculating machine. His device had a series of toothed wheels. On each of wheels were teeth that represented the numbers 0 through 9. When a wheel rotated past the 9, a small projection on the wheel caused the next wheel to turn. It was this "tens carrying" feature that made the Pascal machine so unique for its time.

Then in 1671, the German mathematician Gottfried Leibnitz invented a machine that was an improvement on the Pascal calculating machine. It followed the same principles, but its one distinguishing characteristic was that it could also multiply and divide. Like Pascal's machine, though, it was not totally reliable. The technology of the time was too crude to produce a machine with moving parts. However, these early tries formed the foundation for the developement of more advanced calculating machines.

Although not a computing machine, the Jacquard loom played an important role in the continuing development of our modern computer. In 1801, Joseph Jacquard developed and patented a weaving loom with an operating characteristic that would prove extremely valuable to computers. This characteristic was the use of punched cards for instructions to control the patterns that were woven into the cloth.

In the operation of the loom, the punched cards where inserted into the mechanism. If there was a hole in the card, the loom lifed the thread. If there was no hole, the loom depressed the thread. It might be said that Jacquard conceived the notion of the zero-one, yes-no, off-on, binary system that would be the heart of our modern computer. And, this idea was conceived more than 100 years before the first computer!

In 1822, the idea of an automatic four function calculating machine was conceived by Charles Babbage, professor at Cambridge University in England. His "difference engine" was produced to compute mathematical tables by adding differences. He received aid from the British government, but after working for 20 years, little progress was achieved. Babbage had a better idea in mind. A machine that would be of a more general purpose than his "difference engine."

When the government dropped the aid for developing the "differece engine," Babbage immediately laid plans for his "analytical engine." This device had some of the same features as today's computers.

The "analytical engine" was comprised of 3 parts: The "store" where numbers were stored and remembered. The "mill" where mathematical operations were performed on the numbers from the "store." And, the "sequence mechanisms" that would select the proper numbers from the "store" and instruct the "mill." He also adapted the punched card idea from the Jacquard loom to the storage of data as well as the guidance of the engine's operations.

Like the "difference engine," the "analytical engine" was never produced commercially. The machine manufacturing industry of the 1820's could not

produce the precise, complex parts that were necessary, therefore creating reliability problems.

In 1887, Dr. Herman Hollerith experimented with the punched card idea and electrical devices to detect the holes and count them. The U.S. Census Bureau hired Dr. Hollerith to develop a more sophisticated method for census taking. With the data punched in the cards, the data could be used over and over. The census for 1890 was completed in roughly 2 1/2 years which was less than one-third the time previously required.

Dr. Hollerith founded the Tabulating Machine Company for the purpose of commercially manufacturing and distributing his invention. In later years, it would be merged with others to become International Business Machines Corporation (IBM).

The first automatic-digital computer that worked as a machine was called the "complex computer" and was constructed at the Bell Telephone Labs in New York in 1939. George R. Stibitz decided that telephone relays wired together would do the task of computation. He represented each decimal digit by a code of 1's and 0's (the binary system). The machine was completed in 1940. Students at Dartmouth College sent problems by teletype to the computing panel in New York and received answers by teletype.

The first general purpose automatic digital computer was a product of a collaboration of a Harvard University professor, Howard Aiken, and the IBM Corporation. It was called an Automatic Sequence-Controlled Calculator and was affectionately known as the Mark I. It could perform an extended series of arithmetic and logic operations without human intervention. It too was made up of electromagnetic relays and mechanical devices. So, it could not be considered an electronic computer, but rather an "electromechanical" one. Mark I could do additions in 1/3 second and multiplications in 6 seconds. Fast, but not fast enough. There was a need for greater speed.

In the years 1942 to 1946, the Moore School of Electrical Engineering at the University of Pennsylvania was headed by John Mauchly. He and his collegues developed the first automatic-electronic digital computer from the research done by Dr. John V. Atanasoff of Iowa State College. This machine used standard radio tubes and parts instead of the electromagnetic relays. Their research was aimed for high speed. In 1946 the ENIAC (Electronic Numerical Integrator and Calculator) was completed. It could add at the rate of 5000 additions per second and multiply at the rate of 360 to 500 multiplications per second. ENIAC was the first to use a ROM (Read Only Memory) storage in the form of function tables that was preset manually with arrays of manual switches.

This monstrous beast, ENIAC, used 18,000 standard vacuum tubes, occupied 1800 feet of floor space and

consumed 180,000 watts of electrical power. The beast weighed in at 30 TONS! The vacuum tubes produced so much heat that special air-cooling was necessary. Should the air-cooling devices fail, it was advisable to leave the area at once before you were fried!

In 1946, John von Neumann, a noted mathematician, developed the idea of the "stored program." He suggested that the "binary numbering system" be used and that the job instructions as well as the data be stored in the same memory. These ideas could not be worked into the ENIAC machine because of their late developement, but they were integrated into the EDVAC (Electronic Discrete Variable Automatic Computer), that was being worked on at the same time as the ENIAC. The EDVAC was not comploted until 1952, but it became the prototype of computers with stored-programs.

All of the computers discussed so far were one-of-a-kind ventures; experiments funded by various private and governmental agencies. They had been designed for specific purposes. It was not until 1951 that the first commercially available computer was installed at the U. S. Census Bureau. Called the UNIVAC 1, it was developed by the Mauchley-Ekert Company; the same guys responsible for the ENIAC. The UNIVAC I had several unique characteristics, but the most important was the fact that it could process alphabetic data as well as numeric data. Another important feature was the storage of programs and records on magnetic tape rather than the usual punched cards.

The one discovery that changed the shape and size of the computer was the transistor. The team at Bell Laboratories introduced the transistor in 1949. This device was many times smaller than the vacuum tubes used in ENIAC and could do more work. And, being so small meant it didn't require the enormous power consumption or produce so much heat. This began the revolution of smaller and faster computers.

Another discovery of the early 1950's was the "magnetic core memory." This consisted of rings of magnetic material that could be magnetized in either circular direction by passing a current through a wire. The two "states" designated either the 1 or the 0.

These new discoveries soon found their way into the new models of computers, the IBM 704 and 705 and the Sperry-Rand 1103A being examples of magnetic core computers. The available RAM (Random Access Memory) expanded from 18,000 to 64,000 bytes with access time measured in milliseconds.

In the early 60's the transistor companies discovered a way to put several components on the surface of a silicon chip thus creating the "integrated circuit." (Those little do-dads in your computer that looks like centipedes.) The process of photographic etching all

but revolutionized the production of these chips. The photographic etching eliminated the need for wiring and also produced the printed circuit boards.

In 1965, the first minicomputer arrived. It was the product of Digital Equipment Corporation called the PDP-8. This machine was the size of a two-drawer file cabinet and sold for "only" $18,000. However, that was quite a bargain in 1965. (I don't think you would have bought one for your home, though.)

Finally, in November 1971, the Intel Corporation produced the first microprocessor. The "computer-on-a-chip" had arrived! Applications for the microprocesor range from timing a microwave oven to controlling a traffic signal to the CPU in your very own TRS-80 Microcomputer! (Of course, the microprocesor alone is not a computer, but add some memory and you have one.)

The fast-paced developement of the computer industry has been quite unbelievable. What will we see in the future? Only time can tell. With the developement of microprocessors coming in only a decade and a half after the developement of the transistor, the future outlook will probably see staggering changes. The "Dick Tracy Wrist TV" may actually become a reality sooner than you think. The speed of handling data and communicationm will continue to increase making the world even smaller than it is already. And, just think, you and I will be here to witness it all. Won't it be a facinating experience?

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■

continued from page 30

since things like this happen regularly, there are manuals explaining how to do it.

The main reason why CP/M has not yet been implemented on the Model III is that it requires the computer to have RAM at the low addresses, where both the TRS-80 Model I and Model III have ROM. Lifeboat Associates is developing a modification for the Model III that will allow RAM to be switched in and out of low mamory, so that the user will be able to run either TRSDOS and TRSDOS-compatible systems or CP/M. Unfortunately, it appears that this modification will have to go inside the TRS-80 rather than attaching to the expansion port, which means that Radio Shack may not agree to service computers that are modified in this manner. If so, this will inhibit some users from employing it. Radio Shack would probably be doing itself a favor if it endorsed efforts like *this, which can* only make the Model III more attractive to professional customers. ■

PACK UP YOUR TROUBLES

Hugh David

I recently found a colleague swearing quietly over his desk. "I have just finished this job for those bloody people. They said they needed to store one of eight possible responses to each question, and as compactly as possible. I was actually handing over the program, and NOW they 'thought I understood' that they wanted to reserve zero to code 'No Response', making nine possible replies. I've written the complete program using four three-bit items per two-byte integer. Now I'll have to change to three four-bit items, or find some way of hauling in the sign bit. It's going to take a good week to get it straight. I wish I'd stuck to working for a living!"

Choking back any comments about making sure of your specifications—I like to stay friends with my colleagues, especially those with a Karate Black Belt—I looked through the program. Sure enough, powers of two were heavily represented. My suffering friend had wisely delegated the packing and unpacking to subroutines — a ray of hope.

"What's eight to the fourth?"

"Uh — 4096 — Why?"

"And nine to the fourth?"

"Just a minute. Where's my calculator? 6561. Why?"

"If you can store integers up to 32,767 in two bytes, without involving the sign, why can't you store values up to 6561? All you have to do is change your multiplying and dividing factors from eight to nine?"

"But how many bits is that?"

"Who cares — you aren't using assembler instructions. As far as the compiler is concerned the bit structure just doesn't matter. You can't test bits directly, but you don't need to anyway."

My friend had been suffering from a classic case of what, putting on my other hat as an ergonomist (Human Factors Engineer), I would call "set". An experienced IBM programmer, he had spent so long struggling with hexadecimal dumps that he could not think of breaking words down into anything other than bytes, nybbles and bits. But, in FORTRAN, BASIC or any other higher level language, there is no reason to suppose that powers of two have any advantage over any other values. There are many occasions where we need to store and retrieve large numbers of items which have a finite, small number of possible values—maps, inventories, monitor positions, questionnaire responses, subscriber characteristics and so on. The most economic form of storage is the integar array, which minimizes the storage required for variable names, and reserves only one bit for the sign.

The demonstration program below shows off a set of subroutines for packing and unpacking integers in TRS-80 Level II BASIC. When packing becomes necessary (and there is no point in using it unnecessarily), it is usually necessary to pack several different arrays in different ways, so these subroutines refer to an array of packing characteristics to control transfer of information between an integer M and a vector IV. It is up to the user to shunt his data into and out of M and IV as he sees fit.

The subroutine at 10 sets up an array containing the minimum value and range for each item to be stored in any integer—reading the minimum and maximum values from data. It presents a table of the minimum, maximum range and the largest code required. If the largest code required exceeds 32768, the system will generate an OV error — you are trying to get a quart into a pint pot. After tabulating the ranges of the items to be stored, the subroutine prints a "number of choices left". If this value is 1, then the packed word is now fully used. The subroutine will pause to allow the user to check the packing arrangement, then continue when any key is pressed. The subroutine at 20 is a stripped-down version, to be used when the packing arrangement is sufficiently well developed to need no further checking.

The subroutine at 30 unpacks a stored integer M into the vector IV,using the packing mode defined by IT. The subroutine at 35 ensures that the values of IV are within the ranges defined by IT, by truncating to the maximum or minimum. Attempting to store values out of range will disturb adjacent packed values, producing wrong results, and may lead to an OV error. (Truncation is not the only way of coping with this, as we shall see later.) The subroutine at 40 carries out the reverse operation, packing IV into M. The subroutine at 50 finds the Jth item in the integer M, using packing mode IT, and the subroutine at 60 replaces this by a different value. (These two subroutines take nearly as long to run as 30 and 40, which handle the complete word. They are best used only when one specific item has to be retrieved, or where the array IV is already prepared for another use).

Subroutines 20, 30, 40 and 50 are given as single statements for ease of relocation. Subroutines 10 and 60 are too long and contain logical branches requiring several statement numbers. The program in which these subroutines are embedded illustrates how they may be used. Line 0 is an example of deliberately induced "set"—cassette input is never used, but the "fix" is included in case it might be needed on another occasion: CLEAR must precede DEFINT; and DEFINT I-N is a tribute to seventeen years of FORTRAN

programming. Line 4 reads the maximum values for the packing mode, the number of items packed into an integer and the ship number. Line 5 contains the definitions of the arrays used to store these data. BASIC arrays are indexed from 0, and two values must be stored for the packing mode store. Line 6 calls subroutine 10 to store the packing control information given by line 8, then transfers control to line 90. Figure 1 shows the packing structure used.

At line 90 an array of ships is generated using random numbers. It is not necessary to construct and pack data if it can be generated or read in a pre-packed form.

From line 100 onwards, the ships are moved around the screen. In line 100 the course information is retrieved. In line 110 the course is changed in accordance with the amount of helm applied, correcting for passage through due North by adding or subtracting 360 degrees. In line 120 the course is stored, and in 130 the position information is retrieved. In 140 and 150 the position is updated accordingly. Note that 0.5 is added to each calculated value. The stored values are integers, but all calculations are carried out in "real" arithmetic. If this "fudge factor" is not added, then the distance increment must be at least one unit to produce any positive movement of the ship. On the other hand, any negative displacement at all will cause the ship to be displaced in the negative direction. The result is a series of cycloid-like loops moving gradually across the screen—spectacular but not what is required.

The bias can be removed by adding 0.5 before returning to the integer form, but the use of an integer implies that the minimum step will be one unit, and that left-over fractions will be lost. If a ship is moving slowly, say at one knot, it will move one unit on the horizontal axis only if the value of 0.6 Sin H (where H is the heading) is greater than 0.5 or less than -0.5. This requires that the absolute value of Sin H must exceed 5/6. Similar reasoning applies in the vertical plane, using Cos H in place of sine. Because sine and cosine cannot simultaneously exceed 5/6 (=0.83), the ship will appear to move in a square, the size of which will depend on the amount of helm applied. As the speed becomes greater, these effects become less important.

In lines 140 and 150, the revised position is also tested to see that it is within the defined screen position. When a ship leaves at any edge, the second order causes it to reappear at the opposite edge (wrap around). Alternative forms of order could cause the ship to mark time at the edge, bounce off, slide along the edge or disappear.

In line 160 the ship's position is updated (delete before re-set, to avoid losing any stationary vessels). In line 170 the revised position is returned to store, using subroutine 40. Line 180 allows an interrupt at the end

of any movement, by pressing any key. Lines 190 and 200 give the possibility of restarting the present run by pressing "#" or making up a new sample by pressing "*"

With the data given, this program will produce two ships, and move them in circles or straight lines. When you tire of admiring this, try deleting the RESET statement in line 160, increasing the number of ships by changing the third number of line 8, or suppressing the addition of 0.5 in lines 140 and 150.

This simple example of packing by no means exhausts the possibilities of packing systems. For example, the unassigned "type" code in the second word might be used to specify the type of UFO (Unidentified Floating Object). By using codes from 2 to 6, five type codes could be specified. Each of these could specify the maximum number of each type of weapon, or maximum endurance of the type, of which the actual values are packed into a third word for each ship. The same code could refer to an array of fixed characteristics, which do not vary with the circumstances of the individual ship—for example, the displacement or the armour. For example, in a simulation of convoy traffic in the first world war, the types given in Figure II might be used. Note that the maximum code is always less than 32768. Each variate starts from zero, so that for an escort the number of 4-inch guns available could be 0, 1, 2, 3 or 4—five possible alternatives. To produce a common code for the maximum of each characteristic would require a maximum code of 2x9x5x11x21x32001x16x3, which is 7,696,619,538,720 possible alternatives, needing at least three words to store. Note also that items which are not applicable to the type of object are given a zero maximum. Rocks, for example, have no armament, but their endurance is considerably greater than that of the average ship, and their functioning is not affected by bombardment, torpedoes or ramming.

The state code provided for submarines indicates whether the submarine is surfaced, charging batteries, or running submerged. This code is not needed for other types of vessel, since while they may become submerged they tend to lose interest in the subsequent proceedings.

So far, we have not discussed the sign bit of the integer. It is not usually economic to attempt to incorporate this in a higher-level packing system, because the gain in capacity (about 6%) is usually outweighted by the extra complexity in packing and unpacking. It can form a valuable "flag" that can easily be tested using the SGN function. Three integer stores provide three such flags. One might indicate which a ship is on. (Do not forget the zero case—a word containing entirely minimum values will be zero, and so could not be identified in this way. If the word we have just defined is used, this would represent a ship deprived of all supplies, weapons and fuel—practically neutral in any case).

It is sometimes possible to use different packing modes for packing and unpacking data for input and output. For example, a fifteen binary-choice questionnaire response might be loaded as a set of three five-digit decimal integers, each being unpacked into five nominally decimal digits, having always the values 0 or 1, and transferred into a fifteen-item array for packing as binary bits in a single integer.

Finally, it may be worth considering when to pack. Do not pack if you really need to use real values, or if you will need the data very often. Even this example can be irritatingly slow with more than ten ships. Do not pack if you have relatively few data. The minimal set of subroutines (20, 30 and 40) occupy some 200 bytes, so it is hardly worth packing data to save a hundred bytes.

As for my friend — he transformed his subroutines in a single hectic day, and took the revised version back to "those bloody people", who said:

"You did remember we wanted to code 'Don't Know' as 9, didn't you."

Fortunately for the structural integrity of the building, among other things, my friend had made a little calculation before hand and, finding that the fourth root of two to the fifteenth was about 13.45 he had set his routines to work with base 13 rather than 9.

However, the inter-divisional football match this year should be more than usually stimulating.

Figure I - Packing Structure for Demonstration Program

Packing Mode	Ø	1
Used on	MS(Ø,.)	MS(1,.)
Representing	Course	Position
Item Ø Range Representing	Ø - 359 Heading	Ø - 128 Horizontal Position
Item 1 Range Representing	Ø - 12 Speed	Ø - 47 Vertical Position
Item 2 Range Representing	-2 - +2 Helm	2 - 7 Type of Vessel

Figure II - Packing Structure for Types of Ships in a Convoy Simulation

Type No.	2	3	4	5	6
Name	Escort	Cruiser	Cargo	Submarine	Rock
Equipment					
12 Pounder	Ø	Ø	1	Ø	Ø
4 inch gun	4	8	Ø	1	Ø
8 inch gun	Ø	4	Ø	Ø	Ø
Torpedoes	1Ø	Ø	Ø	1Ø	Ø

Depth Charges	2Ø	1Ø	Ø	Ø	Ø
Endurance	25	6Ø	6Ø	3Ø	32ØØØ
Battery	Ø	Ø	Ø	15	Ø
State	Ø	Ø	Ø	2	Ø
Maximum Code	3ØØ29	3Ø194	294Ø1	32735	32ØØ1
Armour	1	5	1	Ø	32ØØØ
Maximum Speed	3Ø	25	12	12	Ø
Turn Rate	4	2	2	3	Ø
Displacment(log)	3	4	5	2.5	32ØØØ

```
Ø POKE 16553,255: CLEAR 5ØØ: DEFINT I-N: RANDOM: DR=Ø.Ø17453
1 'DEMONSTRATION OF PACKING SUBROUTINES
2 'HUGH DAVID, 15 AVENUE GABRIELLE D'ESTREES
3 '            9183Ø LE COUDRAY-MONTCEAUX, FRANCE
4 READ NT,NL,NS
5 DIM NP(NT*2+2,NL+1),IV(NL+1),MS(2,NS+1)
6 CLS: GOSUB 1Ø: CLS: GOTO 9Ø
7 'MAX MODE ITEM SHIPS  HEAD  SPEED   HELM    X     Y    TYPE
8 DATA  1,   2,    1,  Ø,359, Ø,12,   -2,2, Ø,127, Ø,47,  2,6
9 'SET UP ARRAY NP OF NL+1 ITEMS PER WORD I,IT,M,M1,M2,NR USED
1Ø FOR IT=Ø TO NT: M1=IT*2: M2=M1+1: PRINT " PACKING MODE",IT
11 M=Ø: PRINT "MIN", "MAX", "RANGE", "HIGHEST CODE"
12 FOR I=Ø TO NL: M=M+1: READ NP(M1,I),NP(M2,I)
13 NR=NP(M2,I)-NP(M1,I)+1.1: M=M*NR-1
14 PRINT NP(M1,I),NP(M2,I),NR,M: NP(M2,I)=NR: NEXT I
15 NR=32768/M: PRINT NR;" CHOICES LEFT"
16 IF INKEY$="" THEN 16
17 NEXT IT: RETURN
19 'STRIPPED VERSION OF PACKING  I,IT,M1,M2 USED
2Ø FOR I=Ø TO NT: M1=IT*2: M2=M1+1: FOR I=Ø TO NL: READ
NP(M1,I),NP(M2,I): NP(M2,I)=NP(M2,I)+1.1: NEXT I,IT: RETURN
29 'UNPACK M INTO IV MODE IT     I,M,M1,M2 USED
3Ø M1=IT*2: M2=M1+1: FOR I=NL TO Ø STEP -1: IV(I)=M:
M=INT(M/NP(M2,I))+.1: IV(I)=IV(I)-M*NP(M2,I)+NP(M1,I)+.1:
NEXT: RETURN
34 'CHECK IV IS WITHIN RANGE MODE IT
35 M1=2*IT: M2=M1+1: FOR I=Ø TO NL: IF IV(I)<NP(M1,I) THEN
IV(I)=NP(M1,I)
36 IF IV(I)>=NP(M1,I)+NP(M2,I) THEN IV(I)=NP(M1,I)+NP(M2,I)-Ø.9
37 NEXT I 'NO RETURN - PROCEED TO PACK AT 4Ø
39 'PACK IV INTO M MODE IT     I,M1,M2 USED
4Ø M=Ø: M1=IT*2: M2=M1+1: FOR I=Ø TO NL: M=IV(I)+M*NP(M2,I)-
NP(M1,I)+.1: NEXT I: RETURN
49 'FIND K=JTH ITEM IN M MODE IT     I,M1,M2 USED
5Ø M1=IT*2: M2=M1+1: FOR I=NL TO J STEP -1: K=M:
M=M/NP(M2,I)+.1: K=K-M*NP(M2,I)+NP(M1,I)+.1: NEXT: RETURN
59 'CHANGE JTH ITEM IN M TO K MODE IT     I,L,M1,M2,M3,M4 USED
6Ø M1=IT*2: M2=M1+1: M3=Ø: M4=1: FOR I=NL TO Ø STEP -1
61 L=M: M=M/NP(M2,I)+.1: L=L-M*NP(M2,I)+.1: IF I=J THEN
L=K-NP(M1,I)
64 M3=M3+M4*L: M4=M4*NP(M2,I)+.1: NEXT: M=M3: RETURN
89 'CREATE SOME DUMMY SHIPS
9Ø FOR K=Ø TO NS: MS(Ø,K)=RND(234ØØ)-1: MS(1,K)=RND(3Ø72Ø)-1:
NEXT K
99 'RUN THEM ABOUT A BIT
1ØØ FOR IS=Ø TO NS: M=MS(Ø,IS): IT=Ø: GOSUB 3Ø
11Ø K=IV(Ø)+IV(2)*2Ø: K=K-INT(K/36Ø)*36Ø: V=IV(1)*Ø.6 'NEW
COURSE
12Ø M=MS(Ø,IS): J=Ø: GOSUB 6Ø: MS(Ø,IS)=M 'STORE COURSE
13Ø M=MS(1,IS): IT=1: GOSUB 3Ø: IB=IV(Ø): JB=IV(1) ' OLD
POSITION
14Ø IA=IB+SIN(K*DR)*V+Ø.5: IA=IA-INT(IA/128)*128+.1
15Ø JA=JB+COS(K*DR)*V+Ø.5: JA=JA-INT(JA/48)*48+.1
16Ø RESET(IB,JB): SET(IA,JA)              'UPDATE POSITION
17Ø IV(Ø)=IA: IV(1)=JA: GOSUB 4Ø: MS(1,IS)=M 'STORE POSITION
18Ø IF INKEY$="" THEN 22Ø
19Ø IF INKEY$="*" THEN Ø
2ØØ IF INKEY$="#" THEN 22Ø
21Ø GOTO 19Ø
22Ø NEXT: GOTO 1ØØ
```

continued from page 24

```
35Ø IS#=Ø: RS#=Ø: K%=M%-2: SS#=Ø
36Ø FOR B=1 TO N%-1: K%=K%+1: IF K%=12 LET K%=Ø: GOSUB 15ØØ
37Ø RE#=SS#: IN#=R#*LO#: D#=1ØØ*IN#-INT(1ØØ*IN#): IF
D#>.5ØØØØØØ
THEN IN#=IN#-D#/1ØØ.ØØ+.Ø1ØØØØØØ ELSE IN#=IN#-D#/1ØØ.ØØØØØ
38Ø IS#=IS#+IN#:C=B: GOSUB 3ØØØ
39Ø NEXT
4ØØ GOTO 2ØØ
1ØØØ IF P$="C" THEN 1Ø4Ø
1Ø1Ø INPUT "TITLE, DATE (XX/XX/XX)";TT$,D$: LPRINT TT$,D$
1Ø2Ø LPRINT "LOAN= ";LO#,"APR= ";APR#,"PAYMENTS PER YEAR=
";PP%
1Ø3Ø LPRINT "YEARS= ",YEAR,"PERIOD PAYMENT= ";PAY#
1Ø35 LPRINT "PERIOD       INTEREST     REDUCTION
  LOAN          PAYMENT"
1Ø4Ø PRINT "LOAN= ";LO#,"APR= ";APR#,"PAYMENTS PER YEAR= ";PP%
1Ø5Ø PRINT "YEARS= ";YEAR,"PERIOD PAYMENT= ";PAY#
1Ø6Ø PRINT "PERIOD        INTEREST     REDUCTION      LOAN
    PAYMENT"
1Ø7Ø GOSUB 2ØØØ
1Ø8Ø RETURN
15ØØ C=Ø: IN#=IS#: IS#=Ø: RE#=RS#: RS#=Ø: GOSUB 3ØØØ
151Ø IF P$<>"P" GOSUB 2ØØØ
152Ø RETURN
2ØØØ INPUT "ENTER TO PAGE";DU$: RETURN
3ØØØ PRINT USING A$;C,IN#,RE#,LO#,IN#+RE#: IF P$<>"C" LPRINT
USING A$;C,IN#,RE#,LO#,IN#+RE#
3Ø1Ø RETURN
```

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VOL. 4 - DISASSEMBLED HANDBOOK FOR TRS-80

Robert M. Richardson

CHAPTER 9

110 BAUD ASCII RADIO TELETYPE RECEIVE PROGRAM

INTRODUCTION

There are as many different ways to write a 110 Baud ASCII radio teletype receive program as there are computer buffs who choose to write one. Since most readers are already familiar with the method used to create a software UART, universal-asynchronous-receiver-transmitter, (a mouthful meaning nothing more than a serial to parallel, or vice versa, converter) in Chapter 7's Baudot radio teletype receive program, we will stay with the same general approach.

This Chapter is a really small one—certainly the shortest in Volume 4.

WHY ? ? ? ARE YOU GETTING LAZY IN YOUR DOTAGE ? ? ?

I certainly hope not, Gridley. The reasons for this Chapter's brevity is two-fold:

1. Our TRS-80 is already completely "fluent" in ASCII, its native language. There is no need to teach it another language via voluminous pages of code conversion which were necessary when receiving Baudot radio teletype. All we need do is create a simple serial to parallel converter, and the program is off and running.

2. Chapter 5's and 8's rather extensive prepared messages for the transmit modes are not necessary for the receive mode. We can keep the "window trimming" overhead low, thereby sharing the cost reduction (time) with you.

WHAT TIME REDUCTION ARE YOU TALKING ABOUT ? ? ?

The time it takes you to enter the program and have it up and running, Gridley. There are only 118 lines of source code in this entire program. You should be able to enter and assemble them with Radio Shack's excellent EDTASM written by Mr. Harold Chamberlin et al, in about 30 minutes.

NOTHING YOU EVER WROTE EVER TOOK 30 30 MINUTES!!!

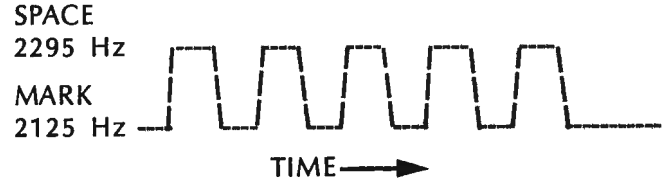
Come on now, Gridley . . . . stop that "gun-shy" foolishness and be serious for a moment. I will bet you a new package of Verbatim mini-disks you can do it in 30 minutes or less. There is NO NEED to enter the comments. Time yourself. You are on your honor.

OK. I'LL GOTO THE LIBRARY AND START RIGHT NOW.

Excellent, Gridley. Do not start timing yourself till you have loaded the EDTASM and are ready to GO. Distractions, like talking to pretty girls, do not count against the clock.

110 BAUD ASCII SIGNAL FORMAT WITH TWO STOP BITS

The ASCII signal format is somewhat similar to Baudot in that it includes a start bit followed by the data bits, and lastly the stop bit (or bits in the case of 110 Baud). The most significant difference between the two different codes is the number of data bits, Baudot having 5, and ASCII 8. The illustration below depicts a typical serial ASCII character, the letter "U" = 85 decimal and 01010101 binary. The least significant data bit is always transmitted first and the most significant data bit last. The start bit is always a Space and the stop bit (bits) always a Mark. Mark = 1 and Space = 0.



The most significant bit, bit 7, is NOT used by our receive program as most stations on the air today do not transmit any useful information in this bit and its use is "up for grabs." It may be always a Mark, always a Space, an even parity bit, or an odd parity bit. Quien sabe, tall masked man? Our program in the last Chapter always transmits a Space for bit 7, as does the American Radio Relay League station, W1AW.

ASCII pulse lengths for Baud rates up to 9600 are shown below: (All pulse lengths are milliseconds and WPM = words/minute figured at 5 letters per word plus a space).

BAUD RATE	START PULSE	DATA PULSE	STOP PULSE	WPM	CHARACTERS PER SECOND
110	9.091	9.091	18.182	100	10
110	9.091	9.091	9.091	110	11
150	6.667	6.667	6.667	150	15
300	3.333	3.333	3.333	300	30
600	1.667	1.667	1.667	600	60
1200	.8333	.8333	.8333	1200	120
1800	.5556	.5556	.5556	1800	180
2400	.4167	.4167	.4167	2400	240
4800	.2083	.2083	.2083	4800	480
9600	.1041	.1041	.1041	9600	960

display the received character by jumping around line 1070 to line 1080. Depending upon the type of operation you plan, you may wish to display the backspace = ASCII 8 on video. To do so add these 2 lines:

```
01015    CP    8        ;8 = BACKSPACE
01016    JP    Z,VID    ;JUMP AROUND <> TESTS
```

Lines 1050-1060: Test "A" for greater than 96 decimal with the "JP P,TIME" instruction and if plus, do not display the received character by jumping around line 1070 to line 1080, same as above. These 2 lines effectively filter out most all lower-case ASCII characters that are received. IF you have lower-case installed and wish to display them, simply delete these two lines.

Line 1070: Is our old friend, CALL 033H that displays the "A" register on video. IF you wish to output the received character to your line printer just add line 1075:

```
01075    LD    (37E8H),A    ;OUTPUT 'A' TO LINE PRINTER
```

Before adding the above line to the program, make sure that your line printer is fast enough to handle the incoming data or it will print out about every other character. Another alternative if you must have a printout and have a modestly slow line printer (like we do), is to is create a buffer in high MEM that will stash away the incoming bytes, forinstance 5 to 10 pages worth, and when the radio teletype contact is completed, allows you to leisurely printout the received data at a rate your line printer is able to handle. This is about ALL the sexy and high priced Baud rate converters one sees on the market today accomplish. If your line printer requires both a line feed AND carriage return, modify the program appropriately. You may have to add a characters per line counter to effect both a carriage return AND line feed, depending upon the convention used by the transmitting station. We believe that W1AW transmits BOTH a line feed and carriage return when transmitting the daily ARRL Bulletins in 110 Baud ASCII.

Lines 1080-1100: Create a 1 bit length time delay to ensure that the program is at least into the middle of the first stop bit before jumping off to START all over again. By doing so, this program should copy both 110 Baud conventions; i.e., those with only ONE stop bit whose stop pulse is 9.091 milliseconds long, and those (like W1AW) with two stop dits whose stop pulse is 18.182 milliseconds in length.

Lines 1250-1270: Set TIMEs 1, 2, & 3 for the Model I. Increase 15% for the Model III due to the slightly higher clock frequency.

Actually, the 15% increase for the values of TIMEs 1, 2, & 3 for the Model III just mentioned, are not absolutely necessary for good copy at this relatively low Baud rate.

MODIFYING THE PROGRAM FOR 300 BAUD ASCII

Is certainly an easy task, but REMEMBER that the Flesher TU-170 must also be modified as outlined in Appendix 7. For starters, let's try this formula:

$$\frac{\text{(110 Baud) } 9.091 \text{ ms}}{610} = \frac{\text{(300 Baud) } 3.3333 \text{ ms}}{\text{TIME1}}$$

Hence TIME1 = 224.

With TIME1 = 224, then TIME2 = 112, and TIME3 = 324. We DO NOT suggest that these constants are perfect, but only a good ballpark area to begin testing as we have not been able to find a 300 Baud signal using 170 Hz frequency shift keying to verify them. Considering that program execution time is a finite value, then an optimized value for TIME1 may very well turn out to be somewhat less than 224.

CONCLUSION OF CHAPTER 9

This ASCII radio teletype receive program is in actuality nothing more than a serial to parallel converter, a software UART if you will. It is a good illustration of the choices that system designers are faced with every day; i.e., whether to use software or hardware to accomplish a given task.

WHICH IS THE BEST CHOICE ? ? A HARDWARE OR SOFTWARE UART ? ?

Let me try to answer your question with a question, Gridley. Which is best, baseball or football?

HMMMMM ? ? ?

That was obviously a loaded question, Gridley. It all depends upon your own personal point of view. They BOTH have their strong points and it is entirely a matter of personal choice. There ks no right or wrong answer to the question.

The software versus hardware UART question is much the same. This program with its software UART requires approximately 118 lines of source code. You were able to enter the entire program in 29 minutes Grid, without comments. The hardware UART (RS-232C interface) for either the Model I or Model III TRS-80 sells for approximately $100. Let's ascribe 1/2 the cost to its parallel to serial transmit capability, and 1/2 of the cost to its serial to parallel receive capability. By using the hardware UART, this program could be reduced to about 25 lines of source code which means you could have entered the program in about 6 minutes = a time saving of 23 minutes. How much is 23 minutes of your time worth, Gridley?

SILENCE ! ! !

You have answered your question yourself, Grid old friend.

```
00100 ; - W4UCH ASCII TELETYPE RECEIVE PROGRAM -
00110 ;
00120 ; 110 BAUD (MAY BE MODIFIED FOR 300 BAUD)
00130 ;
00140 ; COPYRIGHT (C) 1981          ASCII 3 & 4
00150 ;
00160 W4UCH   EQU     32000          ;= 7D00H FOR YOU PURISTS
00170         ORG     W4UCH          ;LET'S START HERE
00180         EX      AF,AF'         ;SWAP ALTERNATE REGISTERS
00190         EXX                    ;SWAP ALTERNATE REGISTERS
00200         PUSH    IX             ;SAVE IN STACK
00210         PUSH    IY             ;SAVE IN STACK
00220         DI                     ;DISABLE INTERRUPTS
00230 MODE    LD      BC,33000       ;1/2 SECOND TIME DELAY -
00240         CALL    060H           ;TO AVOID DOUBLE JUMP
00250         CALL    CARRET         ;CARRIAGE RETURN
00260         LD      HL,RECV        ;RECEIVE MESSAGE ADDRESS
00270         CALL    28A7H          ;DISPLAY STRING ROUTINE
00280         CALL    CARRET         ;VIDEO CARRIAGE RETURN
00290 GO      LD      A,(14400)      ;CLEAR KEY MEM LOCATION
00300         CP      2              ;CLEAR KEY PRESSED ?
00310         JP      Z,MODE         ;GOTO XMIT-NEXT CHAPTER
00320         IN      A,(0)          ;127 = SPACE & 255 = MARK
00330         CP      127            ;SPACE SIGNAL PRESENT ?
00340         JP      Z,GO           ;IF SO, GO LOOK AGAIN
00350         LD      BC,(TIME3)     ;BIT LENGTH + 100 TO BC
00360         CALL    060H           ;ROM TIME DELAY ROUTINE
00370         IN      A,(0)          ;TEST PORT ZERO AGAIN
00380         CP      127            ;SPACE SIGNAL THERE ?
00390         JP      Z,GO           ;IF SO, GO LOOK AGAIN
00400 START   LD      A,(14400)      ;CLEAR KEY MEM LOCATION
00410         CP      2              ;CLEAR KEY PRESSED ?
00420         JP      Z,MODE         ;GOTO XMIT-NEXT CHAPTER
00430         IN      A,(0)          ;LOAD 'A' PORT ZERO
00440         CP      127            ;IS THE START BIT THERE ?
00450         JP      NZ,START       ;IF NOT, GO LOOK AGAIN
00460         LD      D,0            ;ZERO OUT CHAR COUNTER
00470         LD      BC,(TIME2)     ;1/2 BIT LENGTH VALUE
00480         CALL    060H           ;TIME DELAY SUBROUTINE
00490 BIT0    LD      BC,(TIME1)     ;FULL BIT LENGTH VALUE
00500         CALL    060H           ;TIME DELAY SUBROUTINE
00510         IN      A,(0)          ;LOAD 'A' PORT 2 VALUE
00520         CP      127            ;127 = SIGNAL PRESENT
00530         JP      NZ,SET0        ;IF NOT, GO SET BIT ZERO
00540         SET     0,A            ;EQUALIZING TIME -
00550         JP      BIT1           ;DELAY.
00560 BIT1    LD      BC,(TIME1)     ;FULL BIT LENGTH VALUE
00570         CALL    060H           ;TIME DELAY SUBROUTINE
00580         IN      A,(0)          ;LOAD 'A' PORT 2 VALUE
00590         CP      127            ;127 = SIGNAL PRESENT
00600         JP      NZ,SET1        ;IF NOT, GO SET BIT 1
00610         SET     0,A            ;EQUALIZING TIME -
00620         JP      BIT2           ;DELAY.
00630 BIT2    LD      BC,(TIME1)     ;FULL BIT LENGTH VAULE
00640         CALL    060H           ;TIME DELAY SUBROUTINE
00650         IN      A,(0)          ;LOAD 'A' PORT 2 VALUE
00660         CP      127            ;127 = SIGNAL PRESENT
00670         JP      NZ,SET2        ;IF NOT, GO SET BIT 2
00680         SET     0,A            ;EQUALIZING TIME -
00690         JP      BIT3           ;DELAY
00700 BIT3    LD      BC,(TIME1)     ;FULL BIT LENGTH VALUE
00710         CALL    060H           ;TIME DELAY SUBROUTINE
00720         IN      A,(0)          ;LOAD 'A' PORT 2 VALUE
00730         CP      127            ;127 = SIGNAL PRESENT
00740         JP      NZ,SET3        ;IF NOT, GO SET BIT 3
00750         SET     0,A            ;EQUALIZING TIME -
00760         JP      BIT4           ;DELAY
00770 BIT4    LD      BC,(TIME1)     ;FULL BIT LENGTH VALUE
00780         CALL    060H           ;TIME DELAY SUBROUTINE
00790         IN      A,(0)          ;LOAD 'A' PORT 2 VALUE
00800         CP      127            ;127 = SIGNAL PRESENT
00810         JP      NZ,SET4        ;IF NOT, GO SET BIT 4
00820         SET     0,A            ;EQUALIZING TIME -
00830         JP      BIT5           ;DELAY
00840 BIT5    LD      BC,(TIME1)     ;FULL BIT LENGTH VALUE
00850         CALL    060H           ;TIME DELAY SUBROUTINE
00860         IN      A,(0)          ;LOAD 'A' PORT 2 VALUE
00870         CP      127            ;127 = SIGNAL PRESENT
00880         JP      NZ,SET5        ;IF NOT, GO SET BIT 5
00890         SET     0,A            ;EQUALIZING TIME -
00900         JP      BIT6           ;DELAY
00910 BIT6    LD      BC,(TIME1)     ;FULL BIT LENGTH VALUE
00920         CALL    060H           ;TIME DELAY SUBROUTINE
00930         IN      A,(0)          ;LOAD 'A' PORT 2 VALUE
00940         CP      127            ;127 = SIGNAL PRESENT
00950         JP      NZ,SET6        ;IF NOT, GO SET BIT 6
00960         SET     0,A            ;EQUALIZING TIME -
00970         JP      SHOW           ;DELAY.
00980 SHOW    LD      BC,(TIME1)     ;SKIP BIT 7
00990         CALL    060H           ;TIME DELAY SUBROUTINE
01000         LD      A,D            ;MOVE 'D' TO 'A'
01010         CP      13             ;13 = CARRIAGE RETURN
01020         JP      Z,VID          ;JUMP AROUND < > TESTS
01030         CP      32             ;SUBTRACT 32 - SET FLAGS
01040         JP      M,TIME         ;IF < 32, THEN GOTO TIME
01050         CP      96             ;SUBTRACT 96 - SET FLAGS
01060         JP      P,TIME         ;IF > 96, THEN GOTO TIME
01070 VID     CALL    033H           ;DISPLAY 'A' ON VIDEO
01080 TIME    LD      BC,(TIME1)     ;DELAY INTO STOP BIT
01090         CALL    060H           ;TIME DELAY
01100         JP      START          ;START ALL OVER AGAIN
01110 SET0    SET     0,D            ;SET BIT ZERO TO ONE
01120         JP      BIT1           ;GOTO BIT 1
01130 SET1    SET     1,D            ;SET BIT ONE TO ONE
01140         JP      BIT2           ;GOTO BIT 2
01150 SET2    SET     2,D            ;SET BIT TWO TO ONE
01160         JP      BIT3           ;GOTO BIT 3
01170 SET3    SET     3,D            ;SET BIT THREE TO ONE
01180         JP      BIT4           ;GOTO BIT 4
01190 SET4    SET     4,D            ;SET BIT 4 TO ONE
01200         JP      BIT5           ;GOTO BIT 5
01210 SET5    SET     5,D            ;SET BIT FIVE TO ONE
01220         JP      BIT6           ;GOTO BIT 6
01230 SET6    SET     6,D            ;SET BIT SIX TO ONE
01240         JP      SHOW           ;GOTO SHOW
01250 TIME1   DEFW    610            ;110 BAUD = BIT LENGTH
01260 TIME2   DEFW    305            ;110 BAUD= 1/2 BIT LENGTH
01270 TIME3   DEFW    710            ;BIT LENGTH + 100
01280 RECV    DEFM    'RECEIVE MODE  -  110 BAUD'
01290         DEFB    0              ;MESSAGE DELIMITER
01300 CARRET  LD      A,13           ;ASCII 13 = CARRIAGE RET
01310         CALL    033H           ;DO IT ON VIDEO
01320         RET                    ;RETURN WHENCE U CAME + 1
01330         END     W4UCH          ;EL FIN = EL BEGUINE
```

■

The reasons for duplicating ALL the start, data, and stop pulse lengths are to illustrate that the ASCII pulse length ratios between the start or the data bit length and the stop bit length are always the same, = 1, except for the 2 stop bit lengths used by the first 110 Baud convention that we will be using. You will recall that most Baudot stop pulse lengths were 1½ times as long as the start and data pulse lengths.

All the stop bit lengths, both for Baudot and ASCII are the MINIMUM pulse lengths. The maximums may be anything you wish. Picture if you will, the "hunt and peck" typist at a 110 Baud machine/computer. Quite obviously, he/she will NOT be hitting those keys at any rate approaching 110 Baud's 100 words per minute capability. Therefore, most of the time you will be listening to a Space tone = 2125 Hz = stop bit awaiting the next input that will start with a Mark tone = 2295 Hz = Start bit, followed by data bits, etc.

MINIMUM COST ANCILLARY HARDWARE FOR USING THIS PROGRAM

Is rather well delineated by the Macrotronics M80 hardware that comes with their $149 Morse/Baudot package, although the program that comes with this system WILL NOT transmit or receive 110 Baud ASCII radio teletype. It is strictly Morse or Baudot, period. This is not a criticism, just an observation. For a more detailed review, see Chapter 10 of Volume 3 of "The Disassembled Handbook for TRS-80."

We have used NO phase-locked-loops, NO external discriminator, almost NOTHING except the bandpass characteristics of the TRS-80's CASSIN signal processing to copy both a Baudot and ASCII radio teletype signal via PORT 255 of the TRS-80.

WHY DON'T YOU TELL US ABOUT THIS WONDERFUL INVENTION?

You are back, Gridley. Seems like you just left. How long did it take you to load this Chapter's program with the EDTASM?

TWENTY FIVE MINUTES. YOU WIN COACH ! ! !

Well bless your heart, Gridley. You are indeed an honest man. Now, I'll tell WHY I would only be wasting your time to go into the details of copying Baudot or ASCII radio teletype via PORT 255 of the TRS-80 .... all by itself.

1. The bandpass characteristics of Z4, the four stage op amp in the Model I, and combo MC1741/dual MC1458, and LM339 op amps in the Model III, are certainly adequate for cassette program loading, BUT certainly NOT able to discriminate between either Baudot OR ASCII incoming signals with ONLY a 190 cycle frequency shift.

2. What you have to DO to make them WORK in this type of situation is to pass the incoming FSK, frequency shift keyed, signal from your receiver's speaker line through a VERY sharp, about 70 cycles wide, passive filter (88 mH torroids are used) and then feed the filters output to the CASSIN line.

Sure, it works, but it takes A LONG TIME to tune a signal properly, and once you've got it, any fading wipes it out. For all practical purposes it should only be considered a laboratory curiousity and relagated to the shelf full of goodies that, "you wished were practical, BUT ARE NOT."

VERY WELL, COACH. SO IT'S NOT PRACTICAL. WHAT IS THE MINIMUM PRACTICAL SYSTEM FOR RECEIVING 190 HZ FREQUENCY SHIFT ASCII RADIO TELETYPE ? ? ?

Gridley, old friend, I truly wish I could tell you that a cheapy port decoder and simple phase-locked-loop similar to that which comes with the $149 Macrotronics M80 package was adequate, BUT IT UNFORTUNATELY IS NOT ADEQUATE IN ANY WAY EXCEPT AS A TOY for the following reasons:

1. It operates only in the receive mode and NOT TRANSMIT.

2. In RECEIVE MODE it is just a simple phase-locked-loop that requires a CONSTANT amplitude signal for accurate decoding.

3. There are no limiter stages to "level out" received signal amplitude, nor "slicers" of any variety,

4. The phase-locked-loop is terribly voltage sensitive, even with modestly well regulated power supplies.

5. Most phase-locked-loop components in low-cost systems are exceptionally temperature sensitive.

6. Phase-locked-loops are notoriously "broad-band" devices, and as such MUST be tuned OFF CENTER to adequately decode a 190 cycle frequency-shifted signal (difficult to tune).

7. Phase-locked-loops (the inexpensive variety), are rarely used at Baud rates much higher than 60 or 66 equivalent speed. Even cheapy modems use the EXAR PLL variety rather than try to use the low cost 567 at 110 or 300 Baud.

STOP! STOP! STOP! I BELIEVE, I DO INDEED BELIEVE ! ! !

Very well, Gridley. We were just beginning to point out a few of the disadvantages of a minimum system. We will save the rest for another time. The Flesher TU-170 at $249 (factory built and aligned) is the best combination transmit & receive unit (TU) we have tested regarding its price/performance ratio. We have tested a number of systems costing more than THREE TIMES AS MUCH, that did NOT offer the all-around performance of the TU-170 both for Baudot & 110 Baud ASCII.

WOULD YOU CARE TO NAME THE LOSERS ? ? ?

Not really, Gridley. General Sarnoff, General Electric, and General Telegraph all were heroes in the last great war. It would be unpatriotic to name them individually, so I will NOT do so.

HOW ABOUT A QUICK RUN THROUGH THIS

MINI-PROGRAM, COACH ? ? ?

Well Gridley, I thought you would never ask that question. Let's have a brief look at this mini-program's logic and flow.

MODEL III COMPATIBILITY

To make the program as simple as possible to add on to, that is concatenate with, the ASCII TRANSMIT program in the next Chapter, we left out the CLS subroutine that makes the program compatible with the Model III. To do so, for this program on a stand alone basis, add the following lines:

```
00225        CALL      CLS          ;MODEL 3 COMPATIBILITY
- - -        - -       - -            - - - - - - - - - - -
01322 CLS    CALL        01C9H        ; "" "" ""
01323        LD          A,0          ; "" "" ""
01324        OUT         (224),A      ; "" "" ""
01325        LD          A,48         ; "" "" ""
01326        OUT         (236),A      ; "" "" ""
01327        RET                   ;RETURN WHENCE U CAME+1
```

Naturally, we do not wish to DUPLICATE these lines, so do not forget to remove them before adding the two programs together in the next Chapter. Line 1324 makes sure the Model III's internal clock interrupt is "turned off" after the CLS reactivates it, and line 1326 re-enables the Model III's I/O bus after the CLS deactivates it. We could have written our own CLS subroutine that would have only taken a few more lines, but why bother since the Model III's I/O bus must of necessity be activated anyhow.

EXPANDED COMMENTARY - ASCII RADIO TELETYPE RECEIVE PROGRAM

Lines 160-220: Start the program at 32000 decimal in MEM, swap alternate registers, save IX and IY in the stack, and disable interrupts. The object code of the combined programs in Chapter 10 requires only a bit more than 3000 bytes, so will easily fit into the top end of MEM in a 16K MEM system (though it will require at least a 32K MEM system to assemble the combined programs).

Lines 230-240: Insert about a 1/2 second time delay when switching from TRANSMIT to RECEIVE MODE. This is necessary to eliminate any DOUBLE jump (back to transmit) since the CLEAR KEY is used as the transmit/receive switch in BOTH modes.

Lines 250-280: Issue a carriage return on video and then display the message, "RECEIVE MODE - 110 BAUD" which is followed by another video carriage return.

Lines 290-390: Check the CLEAR key, and then search for a stop bit "that is more than" one data bit in length before falling through to START in line 400. This is certainly NOT a perfect nor ideal initialization routine, but it WORKS quite well, and most importantly requires only a few lines to do so.

Lines 400-480: Assume we have a "GO" for launch. The CLEAR key, is first tested in this start loop, and then the start bit searched for in lines 430-450. Until it arrives, the program keeps looping back to START searching for it. Once the start bit is found the program falls through line 450 and loads the "D" register with a zero. "D" register will in a sense be the received signal's character counter in that each bit that forms the ASCII byte being received is progressively stashed away in the appropriate bit of "D". Lines 470-480 delay for one-half of a data bit length which accurately places the program, with respect to time, "dead center" in the middle of the start bit.

Lines 490-550: First delay for a full bit length to place the program "dead center" with respect to time, in the middle of the first data bit, BIT zero. Lines 510-530 test this bit and if it is a Mark, then goto SET0 and set bit zero of "D" to a 1 before jumping back to BIT1. If it is a Space, the program falls through to lines 540 and 550 which DO NOTHING AT ALL except eat up exactly the same amount of time for a Space as a Mark. Four NOPs would have done ALMOST the same thing, but not EXACTLY. Since 110 Baud is relatively slow, they will work almost as well, but why not get into the habit of being EXACT so that when you begin writing programs for 300 Baud and up data rates, ALL the bit tests fall "dead center" rather than creeping ahead or behind of center as each bit is sequentially tested.

Lines 560-970: Are virtually identical to lines 490-550 except that bits 1 through 6 are tested and the "D" register set or not set, accordingly. All we have done so far is to create a software UART that quite simply transforms the serial data stream into a parallel byte in the "D" register. Did we HAVE TO do it exactly this way? Of course not, as this is only one approach to creating a receive mode software UART. We chose this method since it was a natural extension of the approach that was used in Chapter 6's Baudot radio teletype receive program.

WHAT HAPPENED TO BIT 7, THE MOST SIGNIFICANT BIT ? ? ?

You have a short memory, Gridley. Since there is no useful information in it (for our purposes) we are going to ignore it in this program. If you wish to receive graphics characters, by all means add it on to the program. Since the "D" register was initially set to zero in line 460, this program just leaves BIT 7 alone and it stays at zero.

Lines 980-1020: First delay the program into the middle of BIT 7 which is not decoded. "D" register with the received byte in it is moved into "A" and if a carriage return, jumped around the other tests to line 1070. The reason for doing so is to bypass the test in the next 2 lines that would reject it.

Lines 1030-1040: Test "A" for less than 32 decimal with the "JP M,TIME" instruction and if Minus, do not

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HARDWARE REVIEWS

GOLD PLUG 80

A Hardware Modification for the TRS-80 Model I

Joseph Rosenman

Have you ever had those days? Just finished "Penciling" in a 4000 word file, when the computer decides to re-boot. Must be those darn disk drives again, right? WRONG. Well, I heard that memory chips can go bad. NOT LIKELY. Bad transistor? DOUBTFUL. Friday the thirteenth? NO, it's Tuesday. WHAT IS IT? The dread specter of cheap contacts—OXIDE! (Gasps and groans of dismay from the audience, please.) Nothing left to do except kiss your file goodbye and clean the card edge contacts. My system, with heavy use, regularly required cleaning once every 6 weeks, or else. (Remember, you must carefully erase the card edges with a clean pencil eraser.) It makes you wish that you had backed up your file BEFORE the next paragraph. As much as I love my TRS-80, it's times like this when I think the name "TRASH-80" might just fit. Radio Shack chose to save pennies on critical connections. True, they produced a very inexpensive microcomputer. This benefit is seriously offset by the fact that it is often unreliable.

Not any more! There is an answer. E. A. P. Co. has produced a straightforward hardware modification called GOLD PLUG 80. GOLD PLUG 80 is a system of special adapters that fit over the edge connectors of both the keyboard section and the Expansion Interface of the TRS-80 Model I. They cost $9.95 each, $18.95 for the keyboard-Interface pair, or $54.95 for the entire set of six. Needless to say, installation will void your long expired 90 day warranties.

INSTALLATION

The installation of GOLD PLUG 80 requires the complete disassembly of your system. All that is required for installation is to solder the adapters onto the edge connectors. Ah, yes: this means 228 solders. No one said it would be quick. But don't worry, time flies when you're having fun. Just think of all those bomb-free computing hours waiting to be.

NOTE: If you can't solder and can't find someone who can, this kit isn't for you. Mistakes might cost you your computer. On the other hand, if you CAN solder, this mod is a blessing. The instructions included are clear and adequate.

PROBLEMS: Yes, just a few. When you are ready to install the kit, you will probably need to bend the pins in to provide a tighter fit and to insure properly soldered connections. This is mentioned in the instructions, but I feel it needs to be stressed. The connecter hoods will no longer fit over the plugs (also mentioned). This is unfortunate, but you should have a dust cover anyway. In the end, I think that it is a very small price to pay for the dramatic increase in system reliability.

STRANGE PROBLEMS: My system has an Electric Pencil Control Key and a special RS-232 brace installed. The RS-232 brace needed to be removed entirely, and it took 45 minutes to re-adjust after the installation. The control key and lower case mod requires wires interconnnecting the keyboard computer with both halves of its housing shell. These facts made my installation of the GOLD PLUG 80 a bit more difficult. If you have similar modifications to your TRS-80, be aware that they will impact your installation of the GOLD PLUG 80. (For that matter, they could affect many other possible mods. That is the danger of using non-standard mods.)

SO WHAT DOES IT MEAN? If you want my advice, I would learn to solder, or grab a competent solderer off the streets, and install this mod. It works, the price is reasonable, and they really ARE gold contacts. Gold is the metal of choice in electronic contacts because of its resistance to any oxidation and its superior conductive qualities. The fact that your TRS-80 becomes reliable is more than enough reason to investigate this hardware enhancement. GOLD PLUG 80 can be ordered from:

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If you are not ordering the entire set, specify which card edge you want connectors for. The company accepts check, Master Charge, or Visa. All orders except COD are sent first class post paid. (I don't know about foreign orders.)

P.S. Back up your files anyway. It still could be Friday the thirteenth.

Joseph Rosenman
35-91 161 Street
Flushing, New York 11358 ■

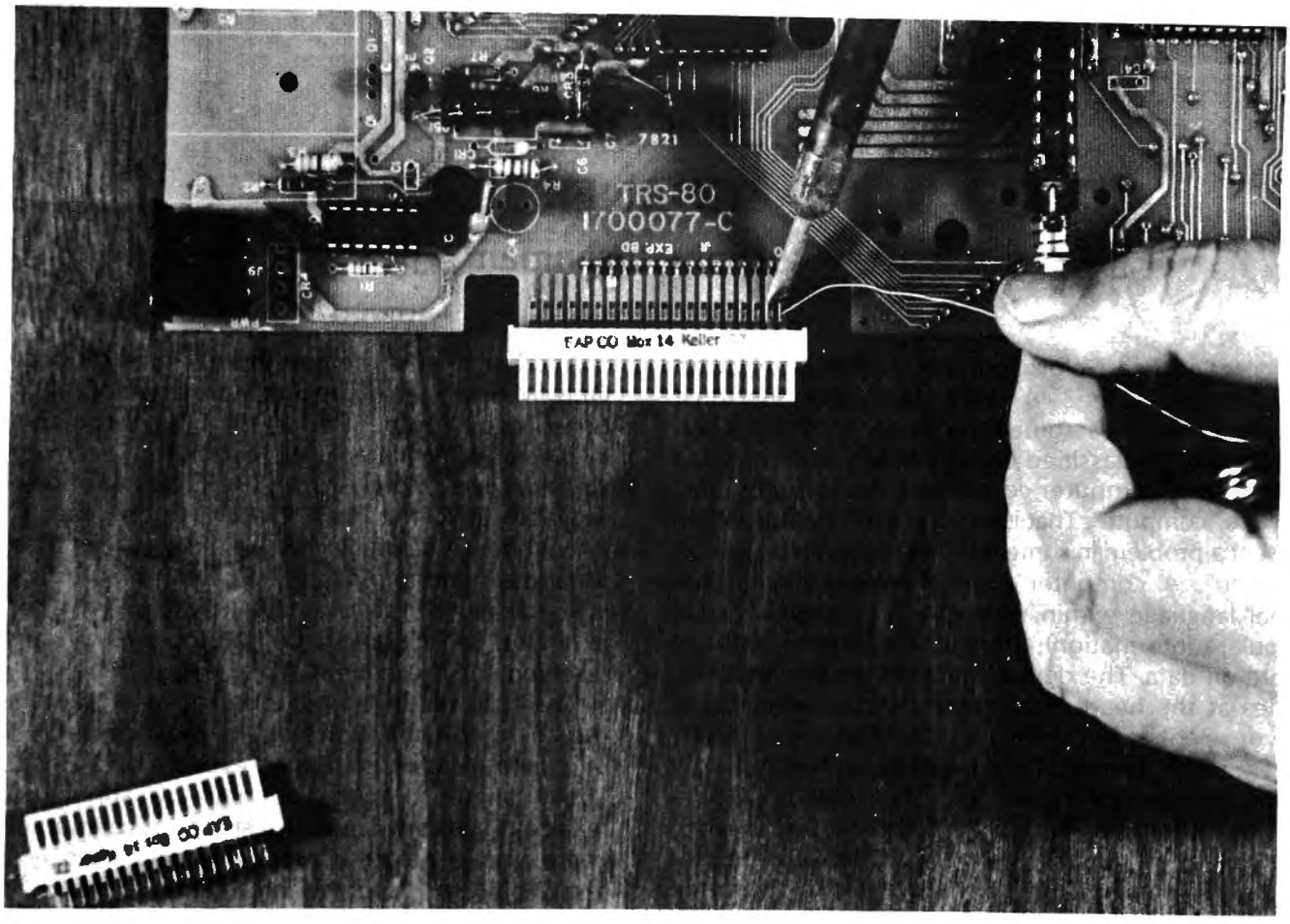

Photo 1: Installing the E.A.P. Co. Gold Plug-80 Kit

COLOR COMPUTER CORNER

Joseph Rosenman

What good is a Color Computer? Is it a toy or an electronic TV game? A fully functional personal computer? Well, it's something of all of these. Then again, it can't be classified entirely in any one catagory. What makes a computer computer? A computer must be able to "compute". That is to say, it must be possible to represent a problem in some form where it can be logically "solved". A computer must therefore have some internal language within which to solve problems (or manipulate information), and some device(s) that can operate on data. The device that performs these tasks, and lies at the heart of all computing systems, is the CPU or Central Processing Unit. There are many different CPUs around. They differ in both complexity and power. Several types are: The Intel 8080 and 8088, the Zilog Z80 and Z8000, the Motorola 6809, the DEC PDP-11, and the IBM 3033. The CPU defines the potential power and versatility of the computer. The CPU also understands only one "language". This language is always the machine language of the computer. What's more, this language is almost always unique to the particular computer. This means that some other special language, or a "higher level" language, must translate your instructions or commands into an unambiguous machine language statements (the other choice is to write directly in the CPU's native machine language). The Color Computer is a 6809 based microprocessor, and so only understands 6809 machine language. Computers also differ in the "size" of the information they can handle. Many large computers (such as an IBM 3033) use values of four bytes or 32 bits as their basic unit. Minicomputers often use a 16 bit value. The common unit used in microcomputers (including the Z80 and 6809 used in the TRS-80 computers) is the byte, an 8 bit value.

Another part of every computing system is the ability to "remember" data and programs. The part of computer systems that perform this function is known as memory or RAM (Random Access Memory). Computer systems differ in the amount of memory they contain. Memory is usually measured in units known as Bytes (a byte is a number comprised of eight binary digits or bits, and can represent a value anywhere between 0 and 255, or -128 to +127). I've known of computer systems containing as little as 256 bytes. Today, it is not uncommon for large computer systems to contain as many as 8 MEGABYTES (yes, "megabyte" means million bytes). The typical microcomputer contains 64K bytes (65534 bytes).

Another type of memory is known as ROM or Read Only Memory. If a program (a sequence of instructions) is going to be used all the time, it can be placed in special ROM chips in the computer system. If ROM chips are used, they usually use up some of the space available in RAM. The TRS-80 Model I uses 48K of RAM, and (essentially) 16K of ROM. This totals the usual maximum of 64K. The Color Computer is similar in its design. There is a 16K ROM (only 8K for non-extended BASIC), and upto 32K RAM. The final 16K is reserved for the plug-in ROM packs.

The final feature a computer system must have is the ability to communicate. The most common means of communication is via the keyboard and CRT screen. Today, some computer systems are adding esoteric features such as voice synthesis and recognition. Many computers generate a monochromatic display (Black and White), or send the information destined for the video screen serially (usually via a RS-232C interface). The Color Computer is (obviously) a multi-colored display. Specifically, it can generate up to a maximum of 8 colors (plus black). Some more sophisticated (and very expensive) color computer systems can generate virtually any color at extremely fine resolution. These expensive computers can literally "paint a picture" with the detail and quality of a photograph.

While not essential to fulfill the minimal requirements of a computer system, most computers also have the ability to print information, and to store programs and data in some permanent form (RAM is scrambled whenever the computer is turned off). Most microcomputers have the ability to store information on cassette tape. More sophisticated systems include a floppy disk. The largest systems usually include high density hard disk and tape storage. The Color Computer has the capacity to use cassette storage, and can be upgraded to include floppy disk.

Included with the Color Computer is a ROM containing a high level language, BASIC. This BASIC was written in 6809 machine language, and translates your BASIC commands into a form the 6809 CPU can understand. The BASIC was written by a company called Microsoft. Microsoft also happened to write the BASIC Interpreter contained in the TRS-80 Models I, II, and III. While the languages are not identical, they are very similar. Many programs that exist for the Models I and III will likely work (with a few changes) in the Color Computer. Over the course of the next few issues, I plan to explore the differences between Color

Computer BASIC and the "other" BASICs, with an eye towards translating programs written for other microcomputers into Color Computer BASIC.

To begin with, if the program relies on PEEKs or POKEs, it is probably a lost cause. Programs that use these functions are usually either accessing values stored in the Operating System tables, or special machine language subroutine(s) that are used by the program in BASIC. Since most computers use different Operating Systems, and are written for different CPUs (and therefore for different machine languages), the POKEs/PEEKs will be accessing meaningless information. The notable exception is when the POKE/PEEK is into Video RAM. In these cases, (and where the computer uses Directly Addressed Video Memory), it is sometimes possible to "offset" the addresses for the new microcomputer system.

Software Reviews: SECS—Screen Edit Control System by Datasoft Inc.

SECS is a machine language program that acts like a special "enhanced" BASIC. Let me start off by sharing my general conclusions. If you own a non-extended version of the Color Computer, the SECS program is a terrific piece of software to acquire. If you do own the Extended BASIC, the SECS program offers several interesting features that might be worth your while. The SECS program includes several powerful subroutines for graphic displays. While many of the routines are similar to Extended BASIC routines, several are unique to the program. It is very unfortunate that the SECS program disables the Extended portion of Extended BASIC (of course, only temporarily).

One special feature of the SECS program is the ability to re-map the structure of the characters. In other words, it is possible to re-form the appearance of all the displayable characters any way you want to by adding or deleting the dots that comprise that character. Of course, when you change a character into another type, the original is no longer available. If you are into hieroglyphics, you should gain endless hours of fascination with this feature. Fortunately, it is also possible to save the new character set just created (on cassette tape).

In addition to the editor functions, SECS features a greatly enhanced SET command. This command has a multi-variable field to permit complex line formation. It is possible to specify the exact position, color, and character. The SECS program comes with a short demonstration program that generates a dazzling display. The SECS program is available on cassette tape, and comes with a short descriptive booklet.

Joseph Rosenman
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Flushing, New York 11358

■

SOFTWARE REVIEWS

The System Diagnostic Program

Elliott Forman

"System Diagnostic" is program that completely tests the TRS-80 microcomputer. It comes in two versions, for the Model I or Model III. The version I am testing is for the Model I, but I understand that the Model III version is essentially the same. The System Diagnostic program was written by Hubert S. Howe, Jr. and is distributed by Howe Software. The program is supplied on cassette and costs $99.95. Included with the program is extensive documentation, and thorough explanations for use with the program. One of the outstanding features of this package is the detailed explanations that are included with the tests. Useful hints and some technical information are included to assist the user in understanding the TRS-80 and the problems that could occur with it.

The program exercises every aspect of the TRS-80, in order to discover any hidden or obvious defects. The program can be run with individual tests, or in a continuous test mode. Since several of the tests require operator assistance, the individual test mode is the only way to completely test the system.

Description of Tests

When the program first begins, it requests a "system inventory". The system parameters it requests are:

(1) RAM SIZE (16K, 32K, or 48K)?
(2) CASSETTE RECORDER (Y/N)?
(3) LINE PRINTER (Y/N)?
(4) UPPER/LOWER CASE (Y/N)?
(5) RS232C INTERFACE (Y/N)?
(6) DISK DRIVES (Y/N)?
(7) HOW MANY DRIVES (1-4)?
(8) OUTPUT TO PRINTER (Y/N)?

The final question will allow any error messages to be line printed as well as displayed on the video. Any peripherals excluded from the list will not be tested. It is possible, however, to re-specify the inventory.

Some of the tests have multiple options. When you select the individual test mode, you are offered a selection of 8 tests, or the option of returning to the main menu (to exit, respecify system inventory, or select continuous testing). The Individual tests include:

(1) ROM
(2) RAM
(3) Video Display
(4) Keyboard
(5) Line Printer
(6) Cassette Recorder
(7) Disk Drives
(8) RS-232C Interface

The ROM Test

This test checks to see if the ROM (Read Only Memory) in the Keyboard section is correct. It does this by calculating a "checksum". Each 4K ROM segment is tested separately. Radio Shack has produced several different ROM versions, and each yields a different result. While the documentation doesn't say so, I assume the program compares the checksum test results against the various known correct answers.

The RAM Tests

These tests provide an indication of whether the RAM (Random Access Memory) is operational. There are four different tests:

(1) Non-Destructive
(2) Complete
(3) Glitch
(4) Refresh

The Non-Destructive test is a rapid test upon each memory location. The contents of the location are saved, the byte is tested, and the contents are restored. If any byte is consistently bad, this test will identify it.

The Complete test takes much longer. It tests memory from the end of the program to the end of memory. All the memory tested is "destroyed". This means that any information stored there has be erased. This test works by filling memory with every possible number (from 0 to 255), then checking that memory is indeed filled with the correct number.

The Glitch test is one of the more inventive. It calculates a RAM checksum, then simulates the starting and stopping of all the peripherals. What you hear is a steady click from the expansion interface. Suddenly, all your disk drives turn on. The RAM checksum is recalculated. If the two results compare, your system passes the Glitch test.

The Refresh Test is one of the more important tests. In order for memory to work correctly, it needs to be periodically "refreshed" by the CPU. This is because the TRS-80 uses "dynamic" memory instead of "static" memory. If memory is not being refreshed properly, it will be unable to store information reliably.

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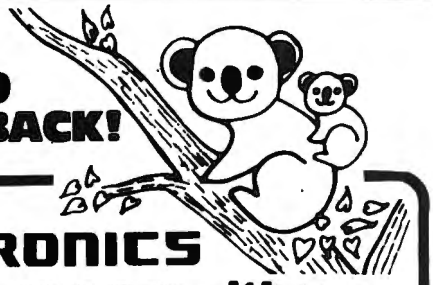

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The Video Tests

The Video tests (there are three of them) examine specific aspects of the CRT display. Two of these tests require that the you examine the display in order to verify the correct appearance of the tests.

(1) Character Generator Test: This test will display every character that can be generated. If any of the characters appear mal-formed, it probably means the character generator chip needs replacement.

(2) Video RAM Test: This test will fill the video RAM with every possible displayable character, then verify the results. Video RAM is located away from normal RAM, so must be tested separately. While the test is running, you will see the display fill with all the different characters.

(3) Video Signal Test: This test fills the screen with a "centering box". If the box isn't centered or the lines aren't straight, your TRS-80 might require some adjustment.

The Keyboard Test

This test verifies that each key is connected in the proper location, and that there are no intermittent short circuits. This test works by having you press the correct key when the program instructs you to. The program will examine every key on the keyboard.

The Line Printer Test

This test will print a line of each character. You must then examine the line to make sure the characters were printed correctly.

The Cassette Test

This includes a pair of tests: Read and Write. The Write test will write out 16 blocks of data (each including every possible byte), along with sync and leader. The Read test will read back the results of the Write test, and verify the data.

The Disk Drive Tests

This series of tests is very extensive, and they throughly exercise the disk system. Along with tests, there is a large section in the documentation to explain the working of the disks. The individual tests include:

(1) Drive Select and disk controller functions
(2) Track seek and verify read
(3) Formatting
(4) Read/Write/Verify all tracks and sectors
(5) Read/Write/Verify without erasing
(6) Disk Drive Timer
(7) Disk Head Cleaner

In order to test a drive, you must select:

(1)	Drive number	(0-3)
(2)	Track Count	(35 or 40)
(3)	Stepping Rate	(12, 20, or 40 ms)

Individual Disk Tests

(1) Drive Select and Disk Controller Functions: This test determines whether the drive logic is at all functional. If this test fails, it is likely that the drive is not communicating with the computer, or the circuit board is defective.

(2) Track Seek and Verify Read: This command will read every track sector by sector, verify the track can be read, and display the contents. The tracks are read in the order 0, 34, 1, 33, 2, 32, etc. (on a 35 track diskette).

(3) Formatting: This test doesn't test the drive, but the characteristics of the diskette. Specifically, the format and ID information is displayed for each sector.

(4) Read/Write/Verify all Sectors: This test will write a test pattern to every sector of a diskette, then read it back again.

(5) Read/Write/Verify without erasing: This test performs in the same fashion as test 4, except the contents of each sector are first saved, then restored after the test.

(6) Disk Drive Timer: This test determines the speed of the drive. The speed is displayed both as a number (in RPM) and graphically. The test will continue until you terminate it.

(7) Disk Head Cleaner: This isn't really a test, but an assist in drive maintenance. This will simply cause the drive to spin while a disk head cleaner is inserted.

The RS-232-C Tests

The RS-232-C Interface is the Serial communication device that may be installed in the Expansion Interface. It is usually connected either to a modem or to a serial printer. There are five test included:

(1) Connector Test
(2) Transmit Data Test
(3) Framing Test
(4) Data Loop Test
(5) Baud Rate Generator Test

(1) Connector Test: This tests whether or not a good connection between the RS-232-C board and the Expansion Interface exists. The connection often is faulty, and this test quickly determines whether or not the contacts are good.

(2) Transmit Data Test: This test attempts to transmit information through the special communications chip in the RS-232-C, the UART (Universal Asychronous Receiver/Transmitter).

(3) Framing Test. This test determines whether or not the "communications protocol bits (start/stop)" are in the proper relationship with the data bits. (All serial communication occurs via bits, not bytes.)

(4) Data Loop Test. This test transmits a 64 byte sequence via the RS-232C. The data stream should be echoed back to the video screen from the modem. A visual inspection of the sequence will reveal any errors.

(5) Baud Rate Generator Test. This test will verify that the different baud rate settings are operational.

Continuous Tests

The continuous test mode includes:

(1) Rom Checksum Test
(2) RAM Tests:
  Non-Destructive Test
  Complete Test
  Glitch Test
  Refresh Test
(3) Video Ram Test
(4) Disk Drive Tests:
  Drive Select and Disk Controller
  Track Seek and Verify Read
  Formatting
  Read/Write/Verify without erasing
(5) RS-232C Tests:
  Connector Test
  Transmit Data Test
  Framing Test

The continuous tests will repeat—continuously. Only one disk drive can be tested at a time.

Evaluation

The System Diagnostic Program is a thorough test of the TRS-80 system. While no test could possibly cover EVERYTHING, this one comes close. The different tests are arranged in a logical fashion and are easy to use. The documentation is virtually a small book, containing a fund of useful information about the TRS-80 peripherals. Every TRS-80 system could use a reliable indication as to whether or not it is fully operational. I strongly recommend this program to other TRS-80 users. ■

THREE BASIC PROGRAMS

Gordon Speer

SPELLOUT

If you like special effects, here is another one. It spells out a message by bringing the letters in from any of the four directions as if they were anagram (or scrabble) letters being physically moved. If you haven't done this yet, try it. You don't have to do all four directions. Any one will give you the idea. Notice that to bring the letters in from the left side, you must spell the message out backwards.

```
100 '   SPELLOUT
110 CLEAR 1000                  'STRING SPACE
120 LET M$="H & e COMPUTRONICS"
130 LET L=LEN(M$)               'LENGTH OF THE MESSAGE
140 CLS
150 REM  FROM THE TOP
160 FOR N=1 TO L                'CHARACTER NUMBER IN MESSAGE
170 FOR V=0 TO 8                'LINE NUMBER
180 IF V=0 THEN 200
190 PRINT @ (V-1)*64+32-L/2+N," ";
200 PRINT @ V*64+32-L/2+N,MID$(M$,N,1);
210 NEXT V,N
220 FOR DELAY=1 TO 1000:NEXT
230 CLS
240 REM  FROM THE RIGHT
250 FOR N=1 TO L
260 FOR X=63 TO 32-L/2+N STEP -1
270 PRINT @ 512+X,MID$(M$,N,1)+" ";
280 NEXT X,N
290 FOR DELAY=1 TO 1000:NEXT
300 CLS
310 REM  FROM THE BOTTOM
320 FOR N=1 TO L
330 FOR V=15 TO 8 STEP -1
340 IF V=15 THEN 360
350 PRINT @ (V+1)*64+32-L/2+N," ";
360 PRINT @ V*64+32-L/2+N,MID$(M$,N,1);
370 NEXT V,N
380 FOR DELAY=1 TO 1000:NEXT
390 CLS
400 REM  FROM THE LEFT
410 FOR N=L TO 1 STEP -1
420 FOR X=0 TO 32-L/2+N
430 PRINT @ 511+X," "+MID$(M$,N,1);
440 NEXT X,N
450 FOR DELAY=1 TO 1000:NEXT
460 CLS
470 GOTO 140
```

CURRENCY

If you have occasion to travel in a foreign country, or work for a bank where foreign money is exchanged, or for a company doing business beyond your national borders, you might like a handy-dandy money converter to figure how much something is in "real" money. (That is what we call our greenbacks when we are out of the country!)

This program converts any amount in one country's currency to an equivalent amount in any other country. In case you are a novice at this sort of thing, let me remind you that all the rates of exchange change daily or oftener. Those given in the program are from July 1981, when this program was written. The rate for each country listed in the data statements is the value of one unit of foreign money in U S Dollars.

```
100 'CURRENCY
110 CLS
120 CLEAR 1000
130 DEFSTR C                    'ALL C'S ARE STRING VARIABLES
140 DIM C(15),CU(15),R(15)      'COUNTRY,CURRENCY,RATE ($/UNIT)
150 LET N=N+1
160 READ C$(N),CU$(N),R(N)
170 IF C$(N)="OUT" THEN 250
180 GOTO 150
190 DATA AUSTRIA,SCHILLING,.0712,BELGIUM,FRANK,.0305
200 DATA CANADA,CANADIAN DOLLAR,.81,ENGLAND,POUND,2.1
210 DATA FRANCE,FRENCH FRANC,.196,GERMANY (WEST),MARK,.49
220 DATA HOLLAND,GULDEN,.452,ITALY,LIRE,.00105
230 DATA SWITZERLAND,SWISS FRANC,.54,UNITED STATES,DOLLAR,1
240 DATA OUT,OF,0
250 LET N=N-1                   'NUMBER OF COUNTRIES
260 PRINT "       C U R R E N C Y     C O N V E R T E R"
270 PRINT "        CHOOSE ANY TWO COUNTRIES, BY NUMBER"
280 PRINT
290 FOR I=1 TO N/2
300 PRINT I;C(I);TAB(32)N/2+I;C(N/2+I)
310 NEXT
320 PRINT
330 INPUT "FROM,TO";A,B
340 IF A > N OR B > N THEN 330
350 PRINT @ 768,STRING$(32,32);
360 PRINT @ 768,;
370 INPUT "AMOUNT";X
380 IF X > 1 THEN LET CS(A)="S" ELSE CS(A)=""  'PLURAL
390 IF X*R(A)/R(B) > 1 THEN LET CS(B)="S" ELSE CS(B)=""
400 LET CS(8)=""                'PLURAL OF LIRE IS LIRE
410 PRINT C(A),,C(B)
420 PRINT X;CU(A);CS(A);"     EQUALS ";
430 PRINT USING"########.##";X*R(A)/R(B);
440 PRINT " ";CU(B);CS(B)
450 GOTO 350
```

DENSITY

One of the favorite exercises in the teaching of metric system units in science classes is a determination of the density of a small metal object, such as a short piece of wire, or a ball bearing, or a rectangular block. The student can then check his/her answer

against a table of known values to see how close it is. I like to give students an opportunity to use a computer when its power, speed, and accuracy can really be impressive, and this is as good a time as any. The program not only does their calculation for them, it presents their answer on a scale next to the known densities for the materials they are using so they can see how close they came.

```
100 'DENSITY
110 CLS
120 CLEAR 1000
130 LET PI=3.14159
140 LET D$="ENTER DIMENSIONS IN CENTIMETERS"
150 PRINT:PRINT:INPUT"BLOCK, CYLINDER OR SPHERE (B/C/S)";Q$
160 IF Q$="B" THEN 240
170 IF Q$="C" THEN 290
180 IF Q$ <> "S" THEN 110
190 'SPHERE
200 PRINT D$
210 INPUT "DIAMETER OF THE SPHERE";D
220 LET V=4/3*PI*(D/2)¢3        'VOLUME
230 GOTO 330
240 'BLOCK
250 PRINT D$
260 INPUT "LENGTH, WIDTH, HEIGHT OF THE BLOCK";L,W,H
270 LET V=L*W*H
280 GOTO 330
290 'CYLINDER
300 PRINT D$
310 INPUT "DIAMETER, HEIGHT OF THE CYLINDER";D,H
320 LET V=PI*(D/2)¢2*H
330 INPUT "MASS (IN GRAMS)";M
340 CLS
350 PRINT @ 200,"THE DENSITY OF THE OBJECT IS "M/V
360 IF M/V < .5 OR M/V > 13 THEN END
370 PRINT
380 FOR N=1 TO 13
390 PRINT USING"###";N;
400 PRINT"  ";
410 NEXT N
420 LET Y=18                    'VERTICAL POSITION
430 FOR X=5 TO 125 STEP 10
440 SET(X,Y)                    'DRAW THE SCALE
450 NEXT X
460 DATA WATER,1,512,ALUMINUM,2.7,521,IRON,7.8,545
470 DATA BRASS,8.6,552,LEAD,11.2,564
480 DATA QUIT,0,0
490 READ S$,D,P                 'SUBSTANCE, DENSITY, POSITION
500 IF S$="QUIT" THEN 540
510 SET(D*10-5,22)              'PLOT DENSITY OF SUBSTANCE
520 PRINT @ Pk*
```

Gordon Speer
3304 Woodlawn Road
Sterling, IL 61081

■

QUESTIONS AND ANSWERS

Conducted by Hubert S. Howe, Jr.

QUESTION

from M. I. Stewart, 1171 Carey Road, Oakville, Ontario, Canada L6J 2E3: Although I have had a Model I, Level II, 32K one-disk system for some time, there are a number of queries that I have:

1. How do you eliminate the superfluous protected programs from the TRSDOS 2.3, once these are transferred to a disk on which you wish to save programs. Specifically, BACKUP, FORMAT, and BASICR?

2. How do you transfer machine language programs from disk to tape?

3. How do you protect two or more areas of high memory for different routines?

4. How do you determine the address of a tape-based SYSTEM tape, to enable it to be transferred to disk by TAPEDISK?

5. How do you transfer from tape to disk programs which have automatic loaders, such as SARGON II?

I feel I know my system very well and have studied the manual. I just do not seem to find the answers to these questions. They seem natural questions, and I am sure they are somewhere in the manual.

ANSWER

These are all good questions, but I don't think you'll find the answers in the manual.

1. To eliminate these superfluous system programs, you need to know the passwords. Here, happily, the passwords are easy: they are simply the names of the programs! (The password for BASICR is "BASIC".)

If this doesn't work, the easiest solution is to get a disk operating system like NEWDOS or NEWDOS/80 which can read or kill programs without checking the passwords. NEWDOS also provides various utilities like SUPERZAP, which allow you to patch the disk to change the passwords of unknown programs into known values, so they can be eliminated.

2. Transferring programs from disk to tape requires a machine-language program that can write SYSTEM tapes. I always use MON-3 or MON-4 for these purposes, since I wrote them, but TBUG also has such a command. You will still have to know the starting, ending, and entry addresses, and again these can be discovered using the NEWDOS utility LMOFFSET.

3. There is no way to protect two or more high memory areas. This means that all your high-memory subroutines must go into a single protected area. If two or more programs have to fit into the same area, they will either have to be loaded each time you want to use them or rewritten so that they do not overlap.

4. Determining the addresses of a tape-based SYSTEM tape requires a utility that reads these values. Again, these exist either in MON-3 or MON-4 or in NEWDOS's LMOFFSET.

5. You can't transfer tape programs to disk if they have an automatic loader, and in fact that is the whole point of the automatic loader. Companies that market products like this want you to buy another version for disk. Defeating this requires writing your own program to read the cassette, then figuring out what they have done to confuse you and putting the program into understandable form. It can be done, but it is much more time and effort than simply buying the disk version. ■

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From the January 1981 issue of the CSRA Computer Club newsletter:

There was some amusement at the November meeting when the Radio Shack representatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical informations on the TRS-80 color computer™. Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

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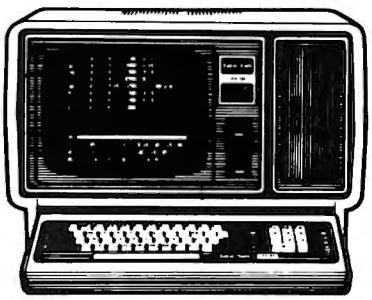

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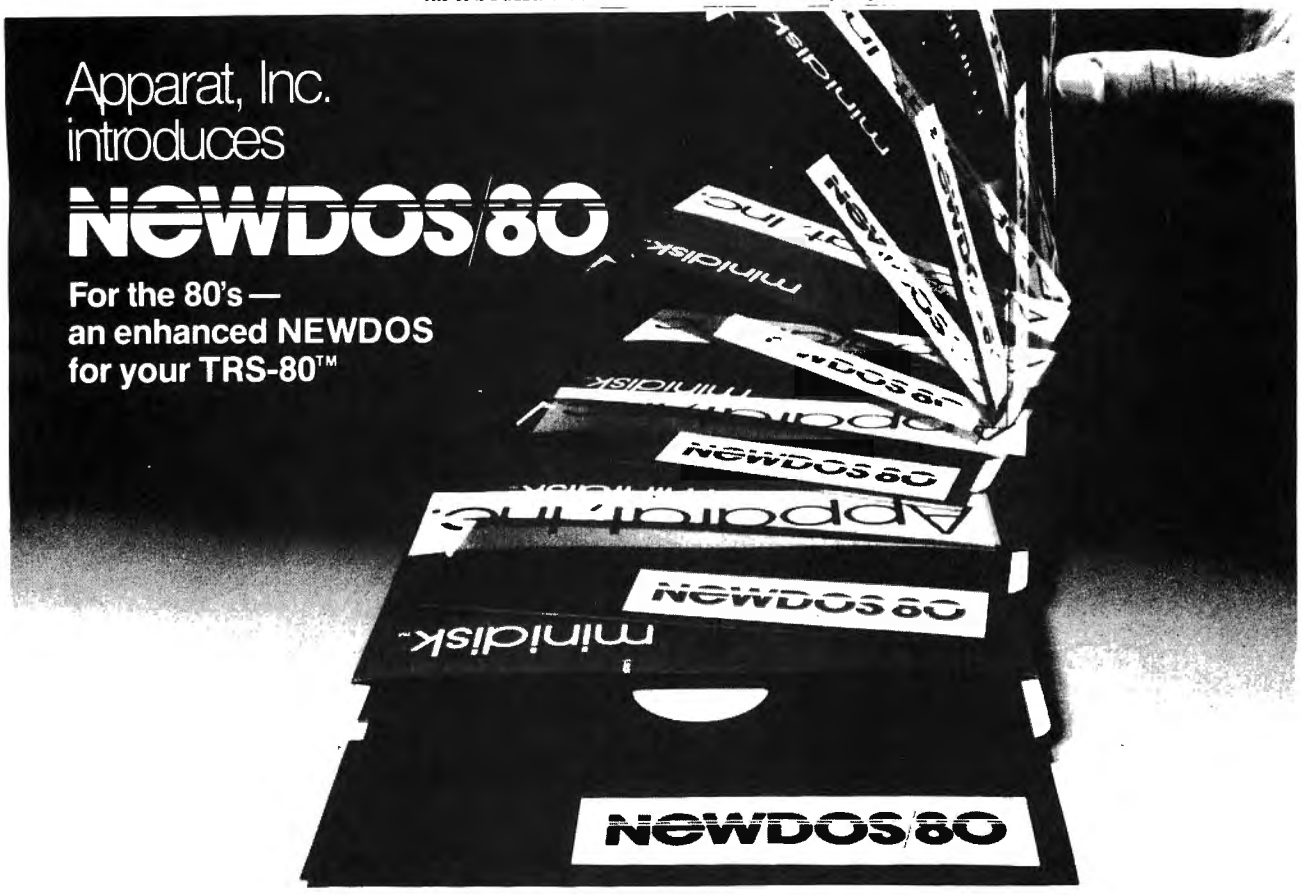

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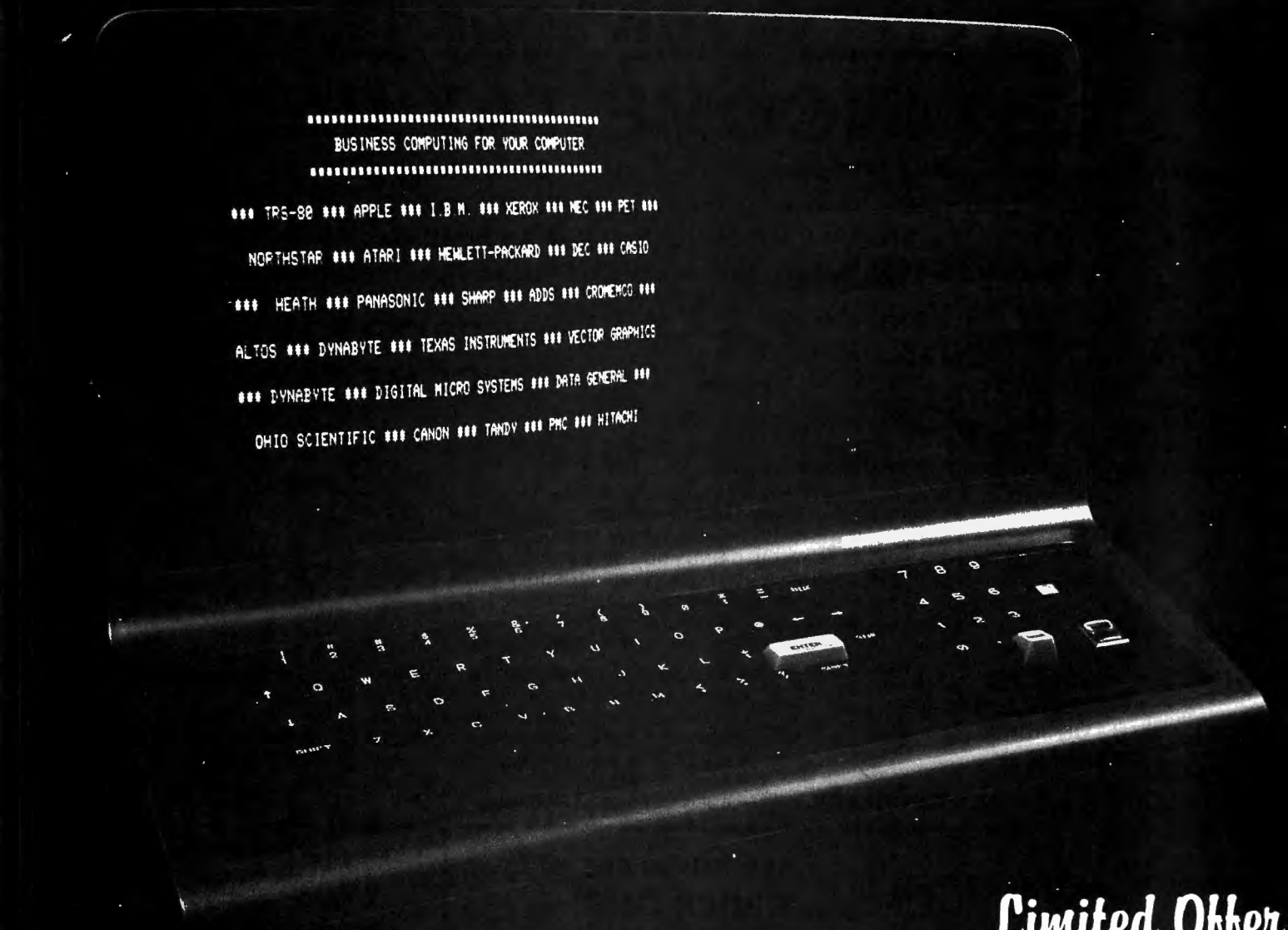

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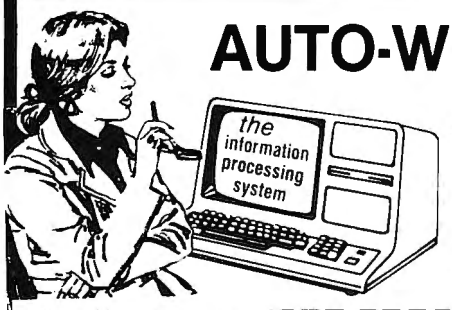

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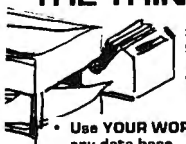

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Your screen will look like this;

```
)-)-)-)-)          D A N D Y   D I S K          (-(-(-(-(
.....                                           .....
  A (Word processing program.)    K .....
  B  Time billing program.        L .....
  C  System monitor.              M .....
  D  Time data gen. pgm.          N .....
  E  .....                        O .....
  F (General calculating pgm.)    P .....
  G  Data management sys.         Q .....
  H   (use data disk in :1)       R  Jump to BASIC Ready )
  I  .....                        S  :0 BACKUP - Single drive
  J  .....                        T  :1 BACKUP - Twin drives
          'X' - M O D I F Y   D A N D Y   D I S K
* (4.)  Access any program that YOU have installed
        'with a single keystroke.'
* (5.)  OR - Make a backup of DANDY DISK master
        'with a single keystroke.'
* (6.)  OR - ADD or DELETE a program listing.
```

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