creative computing

Jan-Feb 1977
Vol 3, No 1

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Julie Christie Meets Proteus IV

Equipment Profiles:
- IMSAI 8080
- SWTPC 6800
- Teletype KSR 43

Catastrophe Theory

Computational Unsolvability

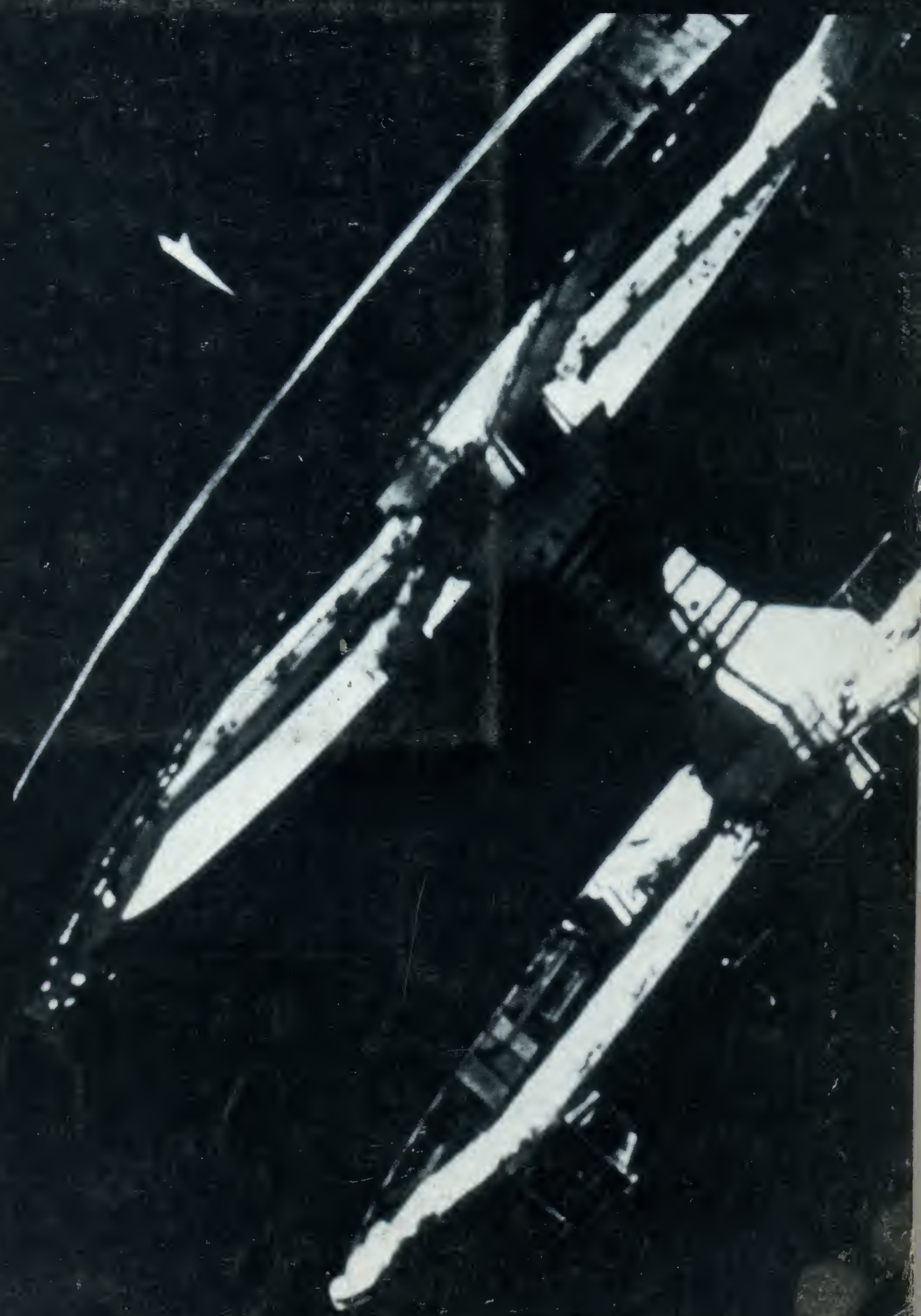
Gruenberger: Learning by Doing

Computer Games:
- Masterbagels
- Strike 9
- Drag
- Daytona 500

Computing in France

Puzzles and Recreations

Man/Machine Interface



SWTPc 6800-SOFTWARE

WARNING — It has been determined that reading this ad may be hazardous to your health, if you own another type computer system. We will not be responsible for ulcers, heartburn, or other complications if you persist in reading this material.

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* Full floating point math
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* User programs may be saved and loaded
* Direct mode provided for most statements
* Will run most programs in 8K bytes of memory (4K Version)
  or 12K bytes of memory (8K Version)
* USER function provided to call machine language programs
* String variables and trig functions—8K BASIC only

COMMANDS	STATEMENTS			FUNCTIONS
LIST	REM	END	NEXT	ABS
RUN	DIM	GOTO*	STOP	INT
NEW	DATA	ON. . .GOTO*	GOSUB*	RND
SAVE	READ	ON. . .GOSUB*	PATCH*	SGN
LOAD	RESTORE	IF. . .THEN*	RETURN	CHR
PATCH	LET*	INPUT		USER
	FOR	PRINT*		TAB

* *Direct mode statements*

MATH OPERATORS

- (unary) Negate
* Multiplication
/ Division
\+ Addition
– Subtraction

RELATIONAL OPERATORS

= Equal
<> Not Equal
< Less Than
> Greater Than
<= Less Than or Equal
>= Greater Than or Equal

You guys are out of your minds, but who am I to complain. Send —

☐ **4K BASIC $4.95**
☐ **8K BASIC $9.95**
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Box 32040, San Antonio, Texas 78284

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4 K BASIC© 8 K BASIC©

* Full floating point
* 1.0E-99 to 9.99999
* User programs may
* Direct mode provid
* Will run most progr

* USER function pro
* String variables and

COMMANDS
- LIST
- RUN
- NEW
- SAVE
- LOAD
- PATCH

* *Direct mode statem*

MAT
- (u
* M
/ D
+ A

– Subtraction

< = Less Than or Equal

> = Greater Than or Equal

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Southwest Technical Products Corp.
Box 32040
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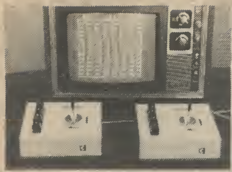
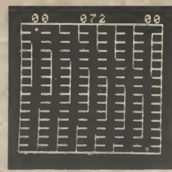

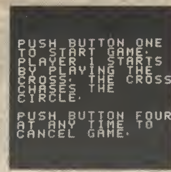

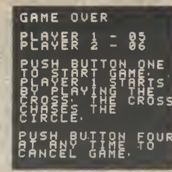


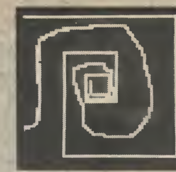

You get more games, more fun, more computer uses with this new joystick

ORDERS AND INFORMATION

Dear People:

Please send me the following—

- ☐ 4K BASIC CASSETTE $4.95
- ☐ 8K BASIC CASSETTE $9.95
- ☐ MP-68 COMPUTER KIT — with serial interface, 2k of memory and ROM monitor $395.
- ☐ GT-61 GRAPHICS TERMINAL KIT $98.50
- ☐ AC-30 AUDIO CASSETTE CONTROL KIT $79.50
- ☐ PR-40 ALPHANUMERIC PRINTER KIT $250.00
- ☐ INFORMATION ON ALL SWTPC PRODUCTS free

☐ Payment Enclosed

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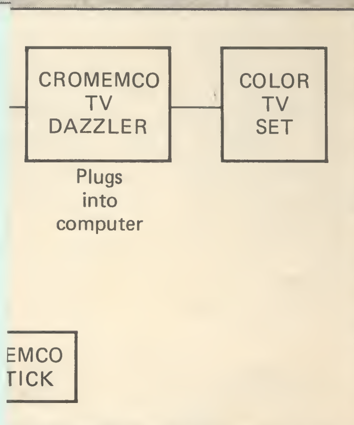

sound, too

have your computer talk to you.

A third feature you get is *four pushbutton switches*. These give you even more possible uses such as selecting various colors on a color graphics terminal.

Four pushbuttons

1
2
3
4

EASY TO COUPLE

To couple the new joystick to your computer, just use our D+7A™ I/O board. It will couple not only one but *two* consoles to your Altair™

Here's some new Cromemco software for the joystick (to display, use DAZZLER interface):

SPACEWAR (2 players, 2 joysticks): this famous game is available for the first time for a microcomputer.

CHASE! (2 persons, 2 joysticks): the cross chases the circle.

TRACK (1 person, 1 joystick): move the dot to the center of the spiral without touching the spiral's arms.

DAZZLE DOODLE (1 person, 1 joystick): lets you draw pictures in 4 colors on your color TV terminal using the joystick.

STORE/MAIL

romemco wishes you more fun, use from your computer. Get iew joystick console and other iemco peripherals at your com- store or order from the factory.

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ck console assembled
odel JS-1W) .... $ 95
A I/O kit (Model D+7A-K) .. $145
A I/O assembled
odel D+7A-W) $245
TV DAZZLER kit (Model CGI-K) ... $215
TV DAZZLER assembled
(Model CGI-W) $350

SOFTWARE

(Punched paper tape with documentation)

SPACEWAR $15
CHASE! $15
TRACK $15
DAZZLE DOODLE $15

PROMPT SHIPMENT

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Mail orders shipped prepaid if fully paid with order. Purchase orders accepted subject to credit approval.

California users add 6% sales tax.

Cromemco

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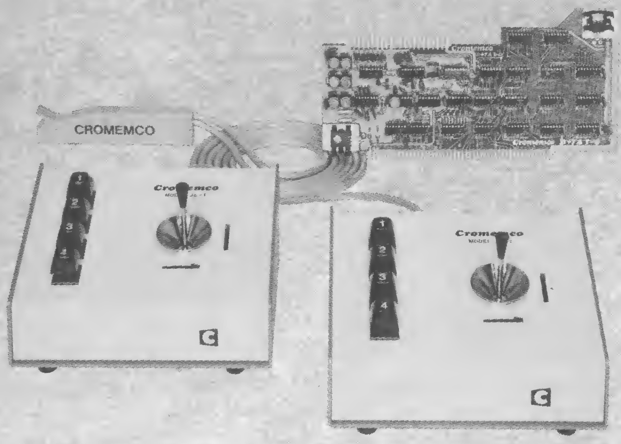
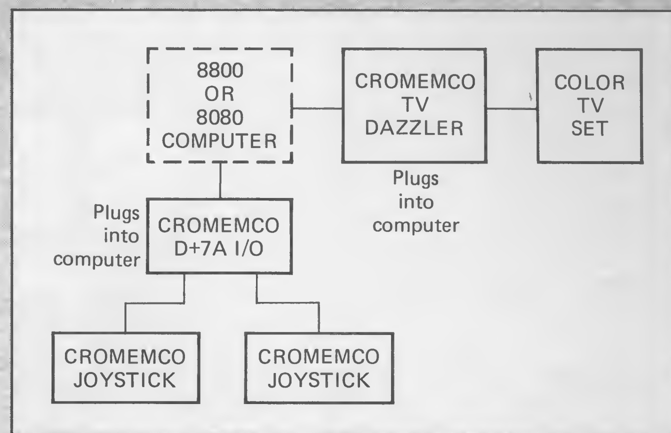
2432 CHARLESTON RD., MOUNTAIN VIEW, CA 94043 • (415) 964-7400

You get more games, more fun, more computer uses with this new joystick





AND THERE'S AN EASY WAY TO INPUT IT TO YOUR COMPUTER

You'll get a lot more fun out of your computer with this new joystick.

But note that it is not just an ordinary joystick — it is a *console*. It has a 2-axis joystick *and* contains a *speaker* and *speaker amplifier*. You can have *sound* with your games or, say, warning sounds in other applications. Or have your computer talk to you.

Gives you sound, too

A third feature you get is *four pushbutton switches*. These give you even more possible uses such as selecting various colors on a color graphics terminal.

Four pushbuttons

1
2
3
4

EASY TO COUPLE

To couple the new joystick to your computer, just use our D+7A™ I/O board. It will couple not only one but *two* consoles to your Altair™ 8800 or IMSAI 8080. And you'll still have several analog channels left over (and one 8-bit output port).

The D+7A plugs into the Standard 100 (S-100) bus of your Altair or IMSAI computer.

EASY TO DISPLAY

Displaying the joystick outputs with the software below is also easy. Just use our TV DAZZLER™ board. It also plugs into the S-100 bus.

NEW SOFTWARE

Here's some new Cromemco software for the joystick (to display, use DAZZLER interface):

SPACEWAR (2 players, 2 joysticks): this famous game is available for the first time for a microcomputer.

CHASE! (2 persons, 2 joysticks): the cross chases the circle.

TRACK (1 person, 1 joystick): move the dot to the center of the spiral without touching the spiral's arms.

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STORE/MAIL

Cromemco wishes you more fun, more use from your computer. Get this new joystick console and other Cromemco peripherals at your computer store or order from the factory.

Joystick console kit (Model JS-1K)	$ 65
Joystick console assembled (Model JS-1W)	$ 95
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PROMPT SHIPMENT

Mastercharge and BankAmericard accepted with signed order. Please show complete card number and expiration date.

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California users add 6% sales tax.

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SCELBI'S "6800" SOFTWARE GOURMET GUIDE & COOK BOOK

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Now you can cook up delectable programs with this mouthwatering gourmet's delight of all new "6800" software. Over 200 pages. Action-packed, information-crammed, practical "how to" facts. Using the original manufacturer's recommended mnemonics and assembly formats, with hexadecimal notations, you get the description of the "6800" instruction set. General purpose routines for multiple precision operation. Programming time delays for real time applications. Random number generators. Completely assembled relocatable floating point arithmetic program, with 23 bit signed mantissa and 7 bit signed exponent. Input/output processing for basic I/O programming. Interrupt processing. Code, numeric conversion routines. Real-time programming. Search and sort routines. And too many more finger-lickin' goodies to mention here. All for only $9.95 ppd. Order today!

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Captain your own crusading starship against the logic of your "6800". Your mission: search-and-destroy a random number of alien ships. But, don't run out of time, out of fuel, out of ammunition or out of the galaxy. Your galaxy consists of 64 quadrants, subdivided into 64 sectors. Plan your mission to destroy all aliens. But, every time you move you lose a stardate and precious fuel. Don't run into a roaming star that could damage your ship! And, don't forget how much fuel your warp factor uses! Suddenly, *Condition RED! Alien in sight!* How big is he? Fire a phasor or torpedo? He's damaged or destroyed. But, you've used up valuable fuel! Does he fire back? How much fuel was used for protective shields? Be careful. You're running out of time and fuel. You get the idea. You must maneuver logically, strategically, carefully . . . to complete your mission. Here's the multidimensional computer game you've asked for. Using the original manufacturer's recommended mnemonics and assembly format, with hexadecimal notations, you've got a total book form program in machine language, for 4K memory, with flow charts, illustrations and more. All this for $14.95 ppd. Order today!

BOTH BOOKS ARE AVAILABLE NOW! ORDER YOUR COPIES TODAY!

SCELBI COMPUTER CONSULTING INC.

1322 Rear Boston Post Road, Milford, CT 06460 • Telephone: 203/874-1573

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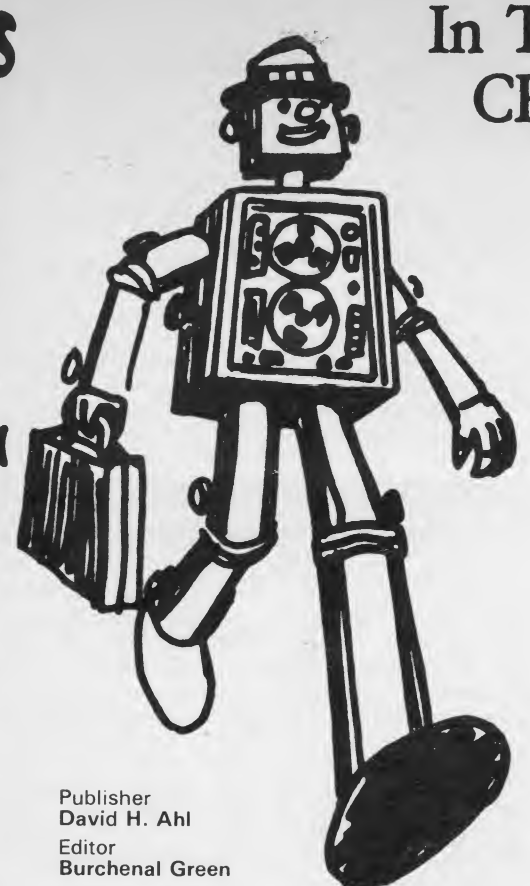
Creative Computing



In This Issue of CREATIVE COMPUTING

ARTICLES

FICTION AND FOOLISHNESS

REVIEWS AND RESOURCES

THINGS TO DO, COMPUTER GAMES

DEPARTMENTS

Jan-Feb 1977
Volume 3, Number 1
Consecutive Issue No. 13

Creative Computing magazine is published bi-monthly by Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. (Editorial office: 20 Lynnfield Drive, Morristown, NJ 07960)

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Second class postage paid at Morristown, New Jersey and at additional mailing offices.

THE COVER

Photo of the space station from *2001: A Space Odyssey*. See article "Computer Sex? What Next?" on page 39 for a discussion of how Hollywood portrayed computers in *2001* and several other recent movies.

THE FIRST WEST COAST COMPUTER FAIRE

From Friday evening April 15th, until Sunday Evening April 17th, the Civic Auditorium in San Francisco will be alive with the activity and excitement of this major conference and exhibition exclusively concerned with personal, home, and educational computing.

It is being sponsored by a number of local and regional hobbyist clubs, educational organizations, and professional groups. These include:

- The Homebrew Computer Club
- ACM Peninsula Chapter
- Stanford University's EE Department
- The Community Computer Center
- People's Computer Company
- The Amateur Research Center

? It is expected that the Faire will draw 7,000 to 10,000 people, will have 50 to 100 conference sessions, and will include over 200 commercial exhibitors.

There will be two banquets and a luncheon, formal papers, informal, off-the-cuff talks, panel sessions, seminars, presentations of home brewed systems and projects, prizes and awards.

Sections of note include:

- Personal Computers For Education — in the home, elementary and secondary school, and one-on-one computers for college and university students.
- Microprogrammable Microprocessors for Hobbyists
- Computer Music

Presentations and *participation* are actively encouraged. If you have suggestions, projects, would lead a seminar or give a paper, or whatever participation you can offer, contact:

Jim Warren, General Chairperson
(Editor, *Dr. Dobbs Journal)*
P.O. Box 310
Menlo Park, CA 94025
(415) 323-3111, 851-7664

OR

Bob Reiling, Operations Chairperson
(Editor, *Homebrew Computer Club Newsletter)*
193 Thompson Square
Mountain View, CA 94043
(415) 967-6754

HOBBYIST COMPUTING SHOW

Western Personal Computing Show, International Hyatt House, Los Angeles, California. Saturday and Sunday, Mar. 19-20, 1977. Pre-registration rate $7.50 for 2 days, $4.00 for 1 day.

Personal Computing, Conference & Exposition Management Co., Box 844, Greenwich, Ct. 06830.

MPU TECHNOLOGY COURSE

A Microcomputer Data Processing course is offered periodically by Thames Valley State Technical College, Norwich, Connecticut. The course covers the MOS Technology 6502 in detail but general principles will be emphasized. Students receive a KIM-1 microcomputer power supply, and manual set as part of the course fee of $325.

For further information, call Frank Rybicki (203) 886-0177 or write TVSTC-Extension Program, 574 New London Turnpike, Norwich, CT 06360.

COMPUTER SIMULATION GAMES WORKSHOP

Here's your opportunity to discuss philosophies and objectives, problem-solving and exploration in educational gaming with designers and users of computer simulation games. Workshop is at UNH, Durham and runs from 3 pm, Friday, Jan. 14 to 4:30 pm Saturday. $25.00 registration includes Friday dinner and Saturday luncheon.

Contact: Anne Knight, University of New Hampshire, Computer Services, Kingsbury Hall, Durham, NJ 03824. (603) 862-2323.

(Sorry this notice is so late appearing but we just got it. We'll try to reprint some of the significant sessions. — DHA)

CALL FOR PAPERS

1977 CONFERENCE ON COMPUTERS IN THE UNDERGRADUATE CURRICULA

to be held June 19-22, 1977, at Michigan State University at East Lansing, Michigan seeks papers describing actual experience with computer use in a specific course or sequence of courses that report concrete results, or survey papers that summarize national progress if they include a thorough evaluation. Because conference emphasizes applications of computers in many disciplines, Computer Science is excluded.

The format authors should submit is an original manuscript and four copies. Papers should be typed, double spaced, and should not exceed fifteen pages. Pictorial material should be 8"x10" — glossy, black and white photographs or other illustrations suitable for photo-reduction. The title page of each manuscript must contain the author's names, complete mailing address, and telephone numbers. Each page should have the principal author's name on it. If there are multiple authors, the title page should indicate which one handles correspondence and delivers the talk.

A limited number of partial travel and subsistence grants may be available to speakers and attendees from minority institutions and small colleges. To obtain further information and an application write to: CCUC/8 Travel Grant Committee, Eppley Center, Michigan State University, East Lansing, Mich. 48824.

DEADLINE — JANUARY 15, 1977

Send papers to: Gerald L. Engel, Virginia Institute of Marine Science, Gloucester Point, Virginia 23062.

CALL FOR PAPERS

THE THIRD INTERNATIONAL CONFERENCE ON COMPUTERS IN THE HUMANITIES co-sponsored by Universite de Montreal and University of Waterloo will be August 2-5, 1977 at University of Waterloo, Waterloo, Ontario, Canada.

Send abstracts or papers on any topic regarding computers and their relation to the humanities to: Professor Paul Bratley, Department d'informatique, Universite de Montreal, Montreal, Quebec, H3T 1J4, CANADA.

Deadline for abstracts or papers: January 15, 1977.

FREE GAME TIME

Computer Recreations proudly announces the opening of its multi-user BASIC programming and entertainment system. The system can becalled on 609-448-7900 and accessed with any 30 CPS, full-duplex ASCII terminal. There is *no charge* for using the system as yet. The company is engaged in a wide ranging study of the question "How can computers be used for recreation and entertainment." Current projects include a variety of communication facilities, multi-player computer games, and central support of personal computers.

Computer Recreations can also be reached c/o Scott Guthery, P.O. Box F, Cliffwood, NJ 07721.

creative computing
BACK ISSUES

Mar/Apr 1976 — Vol. 2, No. 2
We recently discovered a hidden cache of some 400 Mar/Apr 1976 issues. It covers artificial intelligence (4 articles including a primer on AI); the future of computers (9 articles including one on the state of the art of microcomputers and 3 on videodiscs); extraterrestrial intelligence (3 articles including ones by Martin Harwit and Isaac Asimov); some general interest material; 3 stories; 14 pages of computer games, puzzles and other things to do; and, of course, reviews, foolishness, and all the rest. First come, first serve, $1.50.

Sep/Oct 1976 — Vol. 2, No. 5
Covers the 1976 Nat'l Computer Conference and Student Fair; computer-generated poetry (6 articles or activities), amateur computing including a hobbyist club directory; computers in elections and polls; "The Art of Education" by Tom Dwyer; 2 stories; 13 pages of games and things to do; gobs of resource information including a Star Trek information exchange; and lots more. Limited quantities available. (A classic of sorts — this was our last issue on newsprint.) $1.50.

Nov/Dec 1976 — Vol. 2, No. 6
Covers a wide range of topics. Equipment reviews of Tektronix 4051, HP 25, Odyssey Game; "Using the Altair 8800"; a tutorial "Beyond BASIC"; Computer stores directory; cover features "Computers and Beauty"; a new story by Frederik Pohl "Pulling the Plug"; a comparison of sorting techniques, 5 pages of catalogue entries; 23 pages of games, puzzles, and things to do; and, of course, reviews, stories, humor, opinion, etc. Ample quantities available. $1.50.

Volume 1
All the individual issues of Volume 1 (1975) are sold out and will not be reprinted. However, the vast majority of their content has been reprinted in the book *The Best of Creative Computing — Volume 1.* This 328-page blockbuster of a book contains a staggering diversity of articles and fiction (Isaac Asimov, etc.), computer games (18 new ones with complete listings), 15 pages of foolishness, loads of things to do with your computer, and comprehensive reviews of over 100 books. $8.95.

Order books & back issues here!!

ARTIST AND COMPUTER is a unique new art book that covers a multitude of computer uses and the very latest techniques. In its pages, 35 artists who work with computers explain how the computer can be programmed either to actualize the artist's concept (such as the visualization of fabric before it is woven) or to produce finished pieces. Illustrated with more than 160 examples of computer art, 9 of them in full color, ARTIST AND COMPUTER will fascinate and inspire anyone who is interested in art or computer technology. Size 8½" x 11".

ARTIST AND COMPUTER

Edited by RUTH LEAVITT

Paper $4.95, cloth $10; now at selected bookstores, or send payment plus 75¢ handling to Creative Computing, P.O. Box 789-M, Morristown, N.J. 07960. N.J. residents add 5% sales tax.

NATIONAL ACM STUDENT PROGRAMMING CONTEST

The first annual National ACM Student Programming Championship Contest will be held in connection with the Computer Science Conference on January 31 through February 3 in Atlanta, Georgia. This contest is to be patterned after the existing Regional Programming Contests that have been held in the South Central Region, North Central Region, East Central Region, and the North East Region. This contest is sponsored jointly by the ACM Committee on Student Chapters and Student Memberships, and Upsilon Pi Epsilon (National Computer Science Honor Society).

The contest will be designed to accommodate up to 24 teams consisting of four student programmers. It will take place over an eight-hour period where each teams' programs will be judged strictly on the criteria of completion time and number of runs required to devise a correct solution. The winners from the Regional Programming Contest will become the seeded entries in the National tournament. Additional entries will be accepted from all regions and a lottery selection will be used until the tournament is full. Winners will be presented a trophy and recognized as the National Programming Champions.

For further information concerning regional playoffs or concerning the National Contest, contact either of the people listed below.

Barry L. Bateman, Ph.D.
Executive Director
for Computing Affairs
Anthony Hall, Room 213
Southern Illinois University
Carbondale, IL 62901
(618) 536-6657

J. Richard Newman, Ph.D.
Director, Academic Computing
Faner Hall, Room 2032
Southern Illinois University
Carbondale, IL 62901
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Book orders from individuals must be prepaid.

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Input/Output

More on Structured Programming

Dear Editor:
I noticed that in Vol. 1, No. 6, there was a discussion of structured programming. I've been interested in structured programming and design for a number of years, and have found that the approach allows a marked improvement in program correctness, comprehensibility and maintainability. I have not had any great difficulty applying it in using any of several languages for implementation — FORTRAN, Basic APL, ALGOL, BAL, COBOL, PL360 (designed for it) and PL/I. But one is able to enjoy the fruits of structured design much better when using a language such as PL/I, ALGOL or PL360 which have appropriate control structures than in FORTRAN, BAL or COBOL which do not. The difficulty is that when using a small machine (MICRO or MINI) and in many larger machine environments the languages with better control structures are either not available, are poorly supported, or expensive to use.

FORTRAN is almost universally available and generally both well supported and reasonably efficient. Its greatest deficiency lies in its truly archaic set of control structures, which leave even well structured FORTRAN programs difficult to follow unless extensively commented. I think most experienced programmers are aware of the difficulty of getting extensive comments and keeping them up to date.

Recently I became aware of a FORTRAN preprocessor named FLECS (*F*ortran *L*anguage with *E*xtended *C*ontrol *S*tructures) developed by Terry Beyer at the University of Oregon in Eugene, Oregon. I've attached a FLECS Summary Sheet from the User's Manual which depicts the syntax and flow charts for each of the extensions. (Note that the "TO" construct is an internal procedure call!) This preprocessor has several advantages: the extensions can be freely mixed with standard FORTRAN code, the extensions are "in the flavor of" FORTRAN; it is written entirely in FORTRAN (though it will run much faster if a few routines are rewritten in the local assembler language) and the current one-time charge for a mag tape of the source tailored to one's own machine (including indefinite maintenance) is $100. The program is currently available in versions for CDC, Honeywell, IBM, DEC, UNIVAC and XDS machines and I will be installing it shortly on a PRIME mini. It should fit on most larger Mini's (24K 16 bit words), especially those with virtual memory, and can be obtained in several tape formats or on punched cards or papertape (extra charge). I highly recommend that anyone interested in structured programming, with access to FORTRAN inquire with Mr. Beyer for detailed information: Terry Beyer, Computing Center, University of Oregon, Eugene, Oregon 97403 — (503) 686-4416

A second item I wanted to mention relates to program design and documentation. I was never satisfied with standard flowcharting techniques. I found them difficult to do, understand or use, especially during the design phase. For the past couple of years I have been using a structured flowcharting technique which I first saw described by Norris and Schneiderman in Vol. 8, No. 8 (Aug. 1973) of SIGPLAN Notices, but also described in a more limited way by Ned Chapin in Datamation a little later. Their technique allows one to actually see the structure of one's program, provides constructs for If-then-Else, Do While, Do Until, Interations, and Case statements and lends itself well to hierarchical structuring. I have found this technique to prove extremely useful in correctly designing programs and in later maintenance. Given a language with appropriate constructs one can convert the chart directly into code with minimal effort.

A copy of the SIGPLAN paper "Flowchart Techniques for Structured Programming" can probably be obtained from the authors, I. Nassi or B. Schneiderman, Dept. of Computer Science, SUNY, Stony Brook, N.Y. 11790.

Ed Paulette
Washtenaw Co. Community
Mental Health Center
2929 Plymouth Road
Ann Arbor, MI 48105

Navy Gumball Machines

Dear Editor:
I was very surprised at David Ahl's editorial on the lack of computer facilities in secondary schools. The IBM 1130 he describes so disparagingly could, I'm sure, compete favorably with our present system, which is used for all our shipboard data processing: the AN/UYK-5 Military Computer System (which consists of a 450 line per minute "high speed printer" on-line with a modified gum-ball machine).

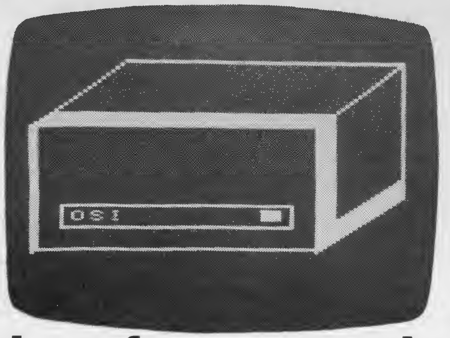
DP2 Eric Evans
S-7 Div. USS Saratoga
FPO, New York, N.Y. 09501

Hamburger Pyramids

Dear Editor:
Your cute quotation "under 1,000,000 circulation" was obviously inspired by the McDonald's slogan. Once, I went past a McDonald's billing "over 8 billion sold." Then, a few blocks later, I saw another McDonald's sign saying "over 7 billion sold." For a moment I thought someone had misplaced a billion Big Macs when I realized that both could be correct. And that it was just a billion hamburger lag taking its time travelling two blocks. But imagine, what would it be like to discover 1 billion lost hamburgers? That would be a pyramid measuring 409 feet on a base! Now that's a steaming heap! Someday, someone will be reading back issues, see this letter and exclaim: "Only 8 billion? They're in the trillions now!".

Whimsically,
John Miller
1895 Buck
West Linn, Oregon 97068

Meet the Challenger.™



The Challenger Self Portrait

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The OSI Challenger 65-1K. Fully assembled. Features 6502A CPU, serial interface, 1,024 words of memory. **$439.**
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SPECIAL! ADDITIONAL 4K MEMORY BOARDS. Ordered with your Challenger, limit 3 more at this special Low Price, (total 16K, including 4K already on-board in mainframe). **$139**
Buy 12K or larger Challenger 65 system and we include Extended BASIC FREE!

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Dept.CC 11679 HAYDEN STREET, HIRAM, OH 44234 (216) 569-7945

Programming Contest Improvements

Dear Editor:

John Lee's article, "The Madness Known As Programming Contests," (Vol. 2, No. 5) has been a very inspiring one for me. Because of it I have tried to think of ways of designing programming contests which would more closely mimic the situations practical programmers face once outside the academic environment.

I suggest the following scheme as a beginning:

First, give each group of four or five programmers one or two rather involved problems rather than four or so smaller problems. My intention here is to force each group to work on the problems *as a group* rather than individually. (The lone programmer is an increasing rarity outside the school!)

Second, assign extra points to the group which completes the problems with the smallest staff. It is, of course, important to provide some alternate contest for the "rejects" from each group. They could perhaps be formed into another competing group to attempt the contest problems.

Third, deduct points for the amount of computer time used to debug the problems.

Fourth, add points for finishing problems early or on time. Maybe add a little for minimum memory, etc.

Fifth, and this is the important change: After the teams have been working on the problems for an hour or so, *change the problem definition.* Then again, about an hour or so later — *change it again.* This automatically gives points to the groups who design the most comprehendible and modular programs.

Sixth, if time permits, have each group add a modification to its program — perhaps the next day or the next weekend. Again points to those to do the job quickest.

Finally, I don't think that one standard language has to be used. After all, what counts is that a given input produces a given output. No one except the programmers themselves ever need examine the contest programs. In fact, part of the contest could involve choosing the appropriate language from among several — given the contest constraints.

It is also my strong feeling that COBOL should be included among the languages used in the contest. Remember that outside schools 60% of all programs are written in COBOL. Probably a little incentive to learn this popular language would not be in vain.

W. Michael Denny
Computer Science Dept.
Santa Barbara City College
721 Cliff Drive
Santa Barbara, CA 93109

P.S.
If anyone in the Southern California area would like to have a contest along lines something like this *and is willing to help*, please get in touch with me.

6800-Based Computers — One User Speaks Out

Dear Editor:

I was pleased to see *Creative Computing* was interested in articles on computer kit building. I'd like to share my experiences with two of the larger suppliers of computer kits. All the information is true to the best of my knowledge with opinions clearly presented as such.

In October of 1975, I read with great interest an article in Popular Electronics about a small computer by MITS using the Motorala 6800 processor. The Altair 680 seemed to be just what was needed for a musical synthesizer project I am working on. The application used the microcomputer to sequence the synthesizer through music that the operator has stored in memory. Within a few days the decision was made to order the Altair 680 from MITS by phone using Master Charge.

The first surprise from MITS came when I was told the delivery was six weeks. Since the Altair 680 is a small machine with little internal I/O space I started a card cage to house my I/O system to use up the month and one half until the expected delivery of the computer. As it turned out I had time to work on MANY projects while waiting for MITS to deliver the machine. Over the next eight months I was given all sorts of reasons for the delay in shipments for the Altair 680.

In April 1976 I called Southwest Technical Products to see what they had to offer. I was pleased to hear that they had been shipping their SWTP 6800 computer since November. I was also pleased that they would ship within four weeks. I decided to put in a simultaneous order with SWTP to see if they could deliver before MITS who now had a seven month head start. I guessed correctly that there was no way I could get two computers since whichever company attempted to ship last would exceed my Master Charge credit limit. The race was on!

Twenty-four days later the SWTP 6800 arrived. Some time after that I received notice from MITS that my Master Charge Balance had been exceeded. I had already notified them that I was canceling my order. The delivery for the Altair would have been eight months.

So much for the ordering part of my letter. The construction of the kit went smoothly. The instructions for the kit are intended for someone with experience in kit building. SWTP doesn't break down the assembly to one resistor at a time since anyone who attempts a computer kit should be able to follow a board layout and install all resistors in one construction step. The manual describes how to check out each board as you go. I built the computer in two days working rather late each evening. I used sockets throughout for the IC's. Initial troubleshooting took another day and true to the advice in the manual the problems were in soldering and interfacing the teletype. Once I got my own problems straightened out the SWTP 6800 performed flawlessly. In five months of operation the microcomputer has had only one component failure — a small capacitor shorted. Considering I now have 8K RAM, 2K ROM, and 7 I/O cards I'm amazed that the equivalent of several hundred thousand transistors can work so dependably. I find programming with the MIKBUG microassembler rather tedious. MIKBUG is somewhat unforgiving when used as an assembler. If you forget to type a space before your new opcode you must type eight more characters to get back to where you were when you slipped. Of course, having a built-in loader and assembler beats toggling programs in with front panel switches. I soon ordered an assembler from SWTP at their very low software prices. MIKBUG was used for four months to get started and to assemble a replacement for MIKBUG. My one criticism of SWTP is they do not sell a PROM board for the SWTP 6800. Since I'm in the minority group of microcomputer owners I couldn't find other suppliers who made SWTP compatible PROM boards. So I designed my own using bipolar PROMS that are working well holding my MIKBUG replacement. I was unable to use the industry standard 1702A PROM due to the speed of the SWTP 6800.

I enjoy personal computing and hope not too many people have been discouraged by getting off to as bad a start as I have.

Leo Taylor
18 Ridge Court West, Apt. 21C
West Haven, Conn. 06516

Ed. Note: See the article "Building the SWTPC 6800" by Bryan Loofbourrow for further discussion of this machine.

About the 680 delivery problems, MITS had this to say:

MITS, Inc. has expressed many times its apologies to customers who had to wait an inordinate length of time to receive their Altair 680 computers. This incident occurred over a year ago when MITS was experiencing an extremely fast growth rate as the result of sales of the Altair 8800. It in no way reflects the current delivery time on the Altair 680b computers, which is less than 60 days. Those people who ordered the original Altair 680 were given the opportunity to cancel their orders and receive refunds and, for those who wished to retain their orders, discounts on later purchases from MITS were offered.

The Altair 680b is an extremely reliable unit and MITS feels the design changes which caused the delay were necessary in order to provide the highest quality possible to their customers.

"Reason can answer questions, but imagination has to ask them!"

Ralph W. Gerard

Creative on Microfiche

Dear Editor:

I am writing to you to get your interest and cooperation to extend the microfilming of *Creative Computing* to microfiche at University Microfilms (UM). As you know it is currently available from UM on 35 and 16 mm roll film by contract with you.

I am an amateur microfilm user of microfiche. I do not have a roll film viewer. But for a number of years now I have had a microfiche viewer, a Realist 320 (a fairly good one for serious reading!). I believe microfiche is the microfilm of the common man. The readers are generally cheaper and fiche cards are easier to handle. For instance, I am on a regular subscription for *Scientific American* from Bell and Howell on microfiche only.

I would like your help. I have committed with UM to obtain *Creative Computing* on microfiche. UM, since it already films *Creative Computing* under contract needs only *3 firm* requests to start filming on fiche.

So I need 2 more. Anyone interested request an order on microfiche from:

Ms. Candace Gillen
Publisher Relations Dept.
University Microfilms
Xerox Corp.
300 Zeeb Road
Ann Arbor, MI 48206

A "firm order" means produce the microfiche, mail it, and bill "me."

Neil Karl
2145 Duns Scotus
Southfield, MI 48075

Guiding the Future — It's Up to You

Dear Editor:

The September-October issue of Creative Computing was the one where everything finally clicked, came together, and headed out in a definite direction. It is at this point that I take CC seriously. From the earlier issues, which tended to be collections of more or less interesting games and computer trivia, you've moved to the forefront of the philosophy of computing. I think this is an important direction, one which is not considered in other journals. Hardware is ably served by BYTE and Interface, but their necessarily narrow scope precludes their considering the wider aspects of the field.

CC is therefore in a unique position to provide a forum for people who want to talk about computing as well as computers, about the future of computers (for example, where should we go? Where should we *not* go?). In short, my feeling is that you can take the list on Pg. 4 of that issue (ATTENTION READERS), expand it severalfold, then move "computer kits" to the bottom of the list.

I was pleased that you ran the reviews of *Computer Power and Human Reason.* I hope that everyone who read the reviews was moved to read the book. (More reviews can be found in the past few issues of Datamation.)

The last batch of letters was exceptional, especially Fr. Chase's. (I agree with his stand on birds; disagree about flowcharts.)

I'd like to propose that our readers get more involved in forecasting the future of computing, as it affects society in general and individuals in particular. The future is ours to determine, and that determination is too important to be left to a few experts in a few specialities. One of the current techniques of forecasting is to draw on the collective intuition of large numbers of people. From the responses of thousands of people, you have a cross section of a large number of possibilities. For example, let me pose this question:

> Small-scale computing systems (micros and minis) have been readily available to the general public for 10 years now (let's say this is around 1986). What kinds of changes have taken place in society (and in the arts, in science ...) as a result of this wide spread computing power?

Perhaps commercial television has become a thing of the past (because everybody's TV set is hooked into their system, and they're all playing Space War). Perhaps an Amdahl Mark 8 has just won the Nobel Prize for literature. Perhaps each of you can come up with a few forecasts.

One man thinking, however long (given current mortality), isn't likely to come up with all the possibilities. There's a synergetic effect in combining the thinking of thousands of people (and consider the expansion possible if we had a widely-distributed network, with a central computer to do the collating, counting, and distribution of the results). There's not likely to be any possibility overlooked somewhere in the list. So now we have all the alternative outcomes, some good, some bad, some impossible, and some from out in left field. Then we can go through the list, pick out the desirable outcomes and the undesirable ones, and decide how to increase the chances of the first and decrease the chances of the second.

Of course, that gets us involved in the question of where we should and should not go, and who decides (which is what Weizenbaum's book asks). Well, the future is going to arrive, and it will be as a result of somebody's decision, and it might just as well be us as them.

To conclude, I hope you keep emphasizing the human use of the computer.

Ask not what you can do for your computer, ask what your computer can do for you.

Michael D. Zorn
1833 S. Peck Rd. #4
Monrovia, CA 91016

Software Exchange

Dear Editor:

I am sponsoring a SOFTWARE EXCHANGE devoted to the free exchange of programming material for the computer hobbyist. Anyone interested in receiving software and participating in my SOFTWARE EXCHANGE send your name, address and any software you have available. I currently have a Motorola Design Evaluation Kit operating. I have software for the M6800 for immediate distribution. When I receive software from other individuals, I will distribute the material to those interested. Please include $4 to cover the cost of photocopying and mailing. You need not submit software to benefit, but it would be greatly appreciated.

Howard Berenbon
2681 Peterboro
W. Bloomfield, MI 48033
(313) 851-7966

Another Weirdity

Dear Editor:

I'd like to add some useless information to the column in the Sept./Oct. issue.

A weirdity of the TI SR-51A calculator (not the SR-51) is that if the external power plug is pulled during a calculation, the calculator will do random things such as counting forward on one-half of the display while counting backwards on the other half.

Also, I would like to correspond with other APL fanatics, both on large and small systems.

Waxe Namerow
56 Longview Drive
Fishkill, N.Y. 12524

New Debugging Aid

Dear Editor:

CDC has the ultimate debugging aid in the instruction set for the peripheral processors of 6000 series computers. The operand is d, the mnemonic is RAI. The instruction format? You guessed it —

RAI d

(In reality, the instruction is a replace-add instruction).

Scott Helmers
Ft. Huachuca, AZ

A Fantastic Opportunity for All

Dear Editor:

With regard to your recent letter and shipment of eight (8) "New Creative Computing Catalogues" —

Unfortunately I do not know eight (8) people who are interested in computers (who haven't already subscribed to *Creative*). I don't think I know even one. However I will do my best to carry out the awesome responsibility which was unexpectedly placed on me.

I would like to inquire how it was determined that eight (8) was the correct number of "New Creative Computing Catalogues" to mail each reader. Intensive research indicates that the algorithm: # flyers= (.09059)(log(# readers))(.4(# readers))$^{1/3}$ which yields a result of 7.7926 flyers per reader. This could easily be accomplished by the use of "Fractional Flyers."

I'd also like to take this opportunity to invite you to join Creative Computing Local #109. This small organization has thus far been limited to computer freaks (alias: compulsive programmers, hackers, and computer jocks). However the chapter has been seriously considering admission of people who consider themselves above bombing a large timesharing system on the last day of the semester at 4 PM. Creative Computing Local #109 has no immediate goals but this has not interfered with any of its activities. Hurry, join now, before the entire membership gets bored and he decides to quit! Already, such noted personalities as President Ford, Robert Redford, Isaac Asimov, and Linus Pauling have *not* joined! Noted computer philosopher John Lees has in fact declined nomination! Now is the time!

In closing, I would like to urge you to write again.

Steve North
President
Creative Computing
Local #109
7 Deerhaven Lane
Newfoundland, NJ 07435

Ed. Note: Sounds like an opportunity not to be missed. Dave Ahl and I leaped at the chance to join Local 109! I'd rather not say which way we leaped, however. — BG

The Average American Computer Freak

Dear Creative,

Hi!!!

It's hard to know where to start. This little mag of Yours has turned me on so much, that I actually feel that there is hope for EDP!!

You know of course, that if I tried to pass you all the credit and thanks that you have coming, I'd have a hernia! If possible I would like to add a bit of mine to the flow . . . I'd like to comment on Steve North's letter in the Sept.-Oct. issue. I continue to be a part time student, and thereby I am familiar with some "stuffed shirt" attitudes that are found in academia sometimes (always?). His letter reeks of it. Golly fella, us folks out here in "the tide water of technology" have a heck of a time keeping up with micro-processors and the like. There are people of your educational level that are just like me, out here in this vast waste land. When you ask the boss if he's considered buying a fortran package to help employes figure their taxes, his first concern is how well you've done the "cost-benefit" diagram. Sure is nice to look at something other than endless core dumps from the "phantom COBOL bomb." I trust that the EDITORS of this mag will keep it where it has been — "in our interest." You referred to making sure that this does not turn into popular science Mag. Hey! Gimmie a break. If I want a dissertation on the "complexities of page boundry errors," I have a book on the "whys" of microprocessors for that. You may find that your friendly local University has the kind of geometric proof stuff that you can get your head into. Oh yes (and yes, and yes, yes, yes) the "average American consumer" won't take the time to learn about antenna impedance until 'CW Mcall makes owning your own piece of the radio spectrum popular. Wonder if we are going so fast that most everyone is as lost technologically as I am politically? As a past constructor of amateur radio equipt (ex-WN7AJM — the 'N' stands for Novice), I can say that just because I enjoy flying (Me student pilot — you student Computer Person) I will spend the time constructing my own bi-plane (turning the key in the 'ol trusty Cessna 150 suits me fine at this point). You should give us a break, my friend. I will soon be a DP manager of fair magnitude, and I hope that one of those "heads" will take the time to turn me on to the new thing he (or her — that 'ol ever present pronoun, huh) has come up with. One of those "types" (heads) pointed out a big hole in our DEC 10's security one day. The sad thing was, he was "chewed" good for spending so much time playing "STAR TREK." Well, you see, when he found the hole, he made the game gobble core as needed and thereby pushed up to 50 other users out of the picture. Seems that the higher ups displayed your attitude, and pushed him into the corner. What good's he gonna do out of the main stream?

I think you should learn to play, before the complexities of it all eat you up and you end up making abberated decisions because you were too busy to consider what might be a waste of time on the surface. Our program library is full to the brim with tricky stuff. Lord, those quick and dirty FTN subroutines are really neat! Put up with 'us folks' out here, while you streak off into oblivion. The 1977 GM Oldsmobile will have a 4000 word machine controlling the advance (spark), my HP25c works well (if I remember how to turn it on), and The 'ol Dec10 really puts it all "up front" (let's see here, "what is my access number, anyway?), and the ol 'PONG' game has made realistic an information retrieval system that uses your TV as a terminal. The vast flow of society is on the outside, look'n in say'n "hmmm, too darn complicated for me." Who the hell are we kidding in trying to keep our toys as elite as simple books used to be to a certain mad man a war or so ago(hmm, sounds almost trivial, doesn't it?). No, I'll bet that no one around CC is just a "games person," but then again not every dope smoking EDP student or employee wrecks the fragile mechanics of our trade. Surely we have a responsibility to work within our fields of endeavor to make some of this mess do things that it can, as the misapplication of this power already fills many text books. I assure you, the legitimate applications of this powerful technology grow without much help, so why not concoct some "neat things" to play with. I am sadly disappointed when I find a young person at the helm of a big '360' rig, who can't find time to make his new on line ordering and inventory update system respond in a more palatable manner as opposed to the "enter bla bla" (cold. Why not work it into a "please tell me what you want" by learning how to get snobol to do what it can).

I want to hang the paper on the printer for somebody that can "go get 'em" with code, the same way that I soldered so that someone could say "oh, wow, you mean I don't have to rattle on at 60 words a minute to talk to my friend in hac en sack while I wear my fingers and nerves out on my "bug" (device for expediting the transmission of Morse code) — automatic keyer for the 'ol ham rig, you know.

Well, enough of this jabber!

Let's see here, if I could change "response to error" section of this Cobol monster, I bet that clerk might wanna take the time to understand my throughput problem . . .

Ray Kaplan
102 N. 3rd Ave.
Tucson, Az. 85705

PS. CC, I love you!

FORTRAN Algorithm for "Mastermind"

Dear Editor:

I have a program that plays either side of the game "Mastermind." I derived the algorithm a couple weeks after purchasing the game, and while it may not be the best algorithm for arriving at the solution in the minimum number of guesses, it is certainly good enough to beat all but the most proficient players (it averages close to 4 guesses to determine the solution in the basic game with 1,296 possibilities).

I have written it in FORTRAN for two reasons: one, I am not very adept at BASIC, and two, the FORTRAN used is very close to ANSI standard and hence should be easily adaptable to any machine.

I will send copies to anyone interested for $1.00.

Mike Shefler
Consad Research Corporation
121 North Highland Avenue
Pittsburgh, Pennsylvania 15206

al... editorial... editor

No editorial this issue. Just some miscellaneous ramblings with your publisher.

This last month, like the 12 that preceded it, was very interesting and full of new challenges. However, let me share with you a slice of life over the last 30 days.

In September, we made a major decision to change printers. This involved getting 5 price quotes from new printers, meeting with salesmen, discussing paper types and grades, printing processes, etc. and culminated with our making a decision to go with the George Banta Co. in Menasha, Wisconsin. During this same period, the Nov/Dec issue was going through typeset, proofreading, veloxes, halftones, photostats, dummy layout and final pasteup. Finally, on October 4, I flew up to Menasha to see the printing plant and mailing facilities. Very impressive! I hope you like our new look.

While I know something about computers, I'm not your experienced magazine editor/publisher, so for 2 days the week of Oct. 11, I, along with our editor, Burchenal Green, attended an intensive workshop on magazine publishing and editing in New York. One evening that week I gave a class on computer games in Bob Taylor's Computer Education course at Columbia Teachers College. The last 2 days of that week out to Charleston, Illinois to give the keynote address at the Mid-Illinois Computer Cooperative Conference.

Burchie meanwhile departed for the Mini-Micro Conference in San Francisco while I prepared to go to the Science Fiction Expo at Great Gorge, NJ, Oct 22-26. Somewhere in there I also interviewed applicants for our Book Service Manager job, specified the type for most of this (Jan/Feb) issue, selected illustrations, talked to a few dozen potential advertisers, paid bills, spent a great deal of time with a doctor as a result of a slipped disc and pinched nerve in my back, and managed to keep my responsibilities at AT&T under control including several 1- and 2-day trips.

My point is not to tell you "I've been busy," but rather, I wonder sometimes whether we (you, the readers of *Creative* and I, one of the editorial group) aren't so busy and so presumptuous that we're veering so far off the mainstream and hence having no impact. By the way, I make the assumption that the readers of *Creative* are 1) interested in computers and technology, 2) extremely active in many varied pursuits and 3) exceptionally intelligent. And I try to produce the magazine accordingly.

Anyway, what do I mean by too busy and too presumptuous to have meaningful impact? At Great Gorge (a Playboy resort) at the SF Expo I came in contact with a wide cross-section of humanity. Early in the morning were the night people who didn't manage to get a bunny to their rooms and were still up drowning their sorrows. During the day, some SF freaks. Then Monday, busloads of kids from several NJ high schools. A sprinkling of press, club employees, and guests. We had an Altair 8800 with TV Dazzler running kaleidoscope and lots of signs telling what it was and how a computer could be used in the home. The first question from virtually everyone: "What's this?" Then, "What's it good for?" I could have pointed to the signs, but I usually explained. Some asked, "What's *Creative Computing?*" Again, I explained.

The response? Most didn't care. Surprisingly, at least to me, the kids were the most blase of all. Just couldn't care less. A computer in the home? So what. Even with a long explanation of here's what's in it for you. For you personally! Most still didn't care.

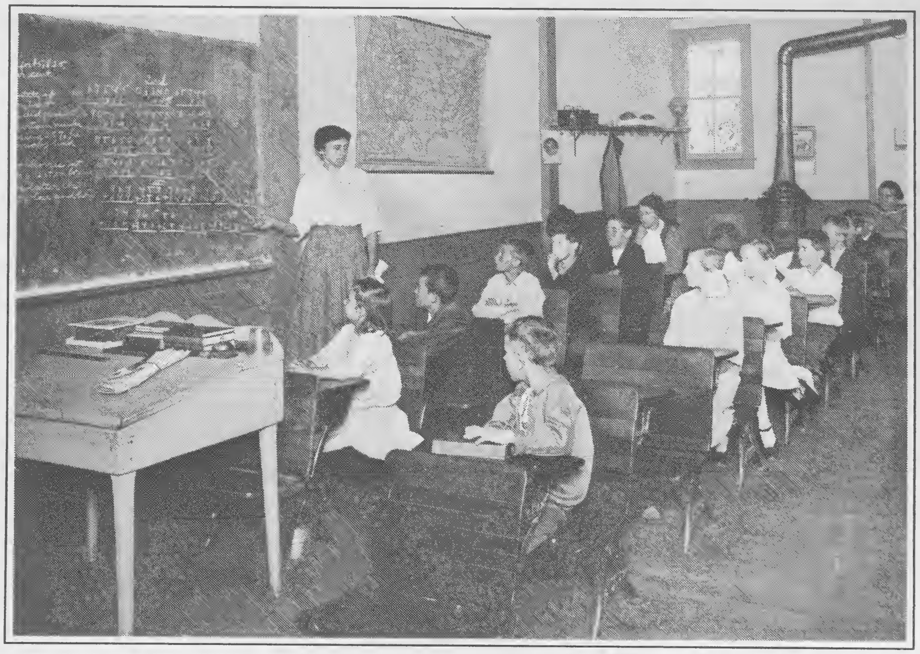
The reason we go to some non-computer, non-hobbyist affairs is to expose the general public to computers. To enlarge the sphere. I generally make the assumption that when people learn about computers and technology they'll join the bandwagon. But the assumption seems to be wrong. At least partially. Most teachers don't care. Nor do the students. Nor does the average person. However, I don't think that means that we should ignore the general public. I don't advocate quitting. I guess I'm saying that apathy runs much deeper than I expected and it will probably take more time from all of us before most people become aware of the benefit of computers in the home or in society in general. We have a massive education or re-education job to be done but without everyone on the "inside" taking a part in talking up computers and truly educating people to them we, you and I, will remain a cult of computer freaks.

We like to think of computers in schools and computers in homes as growing explosively. Sure they are; 20,000 in 2 years. Perhaps 2 or 3 times that many hobbyists who don't have a machine yet. Quite a few! Add that to the EDP community and you come up with 200K. Maybe 300K. Add in anyone associated with computers in any way: 1 million. Maybe 1.5. Wow! Except when you figure that as a percent of working people in the U.S. (75M or so). Only 2%, Understand? GO TO paragraph above. We're freaks. Unclean. Makers of charge account errors. Etc.

So if you don't want to be a freak forever, educate a neophyte. Take someone (or two) under your wing and show them the truth. How to have fun with computers. In the long run, it's worth it.

David Ahl

HEWLETT-PACKARD COMPUTERS. BECAUSE IT'S NOT READING, 'RITING AND 'RITHMETIC ANYMORE.



The old, simple days of education are gone. Today's educational world is complicated and complex. It's full of records, paperwork and data which is exasperating to everyone involved.

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COMPLEAT COMPUTER CATALOGUE

We welcome entries from readers for the "Compleat Computer Catalogue" on any item related, even distantly, to computers. Please include the name of the item, a brief evaluative description, price, and complete source data. If it is an item you obtained over one year ago, please check with the source to make sure it is still available at the quoted price.

Send contributions to "The Compleat Computer Catalogue," ***Creative Computing,*** **P.O. Box 789-M, Morristown, NJ 07960.**

BOOKS AND BOOKLETS

IEEE PUBLICATIONS CATALOG

The 1976 edition of the IEEE Computer Society Publications Catalog includes listings from over 125 conference, workshop, and symposium publications. Among the topics listed in the catalog are: applications and systems, communications and signal processing, computer architecture, design automation, fault-tolerant computing, pattern recognition, optical computing, programming and software, and switching and automata theory.

IEEE Computer Society, 5855 Naples Plaza, Suite 301, Long Beach, CA 90803. (213) 438-9951.

CALCULATOR DIVERSIONS

Mathematical tricks, puzzles, and pastimes for the pocket calculator. Emphasizes entertainment aspects. 189 pages. $3.00 paperback.

Electret Scientific Co., P.O. Box 4132, Star City, WV 26505.

EDUCATION MATERIALS CATALOG

Catalog contains 9 sections describing various services, books, and products of NWREL. The computer section describes a computer careers book, teacher's guide, and student guide; two REACT courses and booklets including the *Teach Yourself Basic* Booklets (Relevant Educational Applications of Computer Technology; PLANIT (A CAI author language); and several pending new products.

NWREL is a non-profit organization involved with many disciplines (adult education, bilingual education, communication, reading, language, research, etc.), over 800 member institutions, and a wide variety of sponsors. Prices on NWREL products are very reasonable. Catalog free.

Northwest Regional Education Laboratory, Dept. J, 710 S.W. Second Ave., Portland, OR 97204.

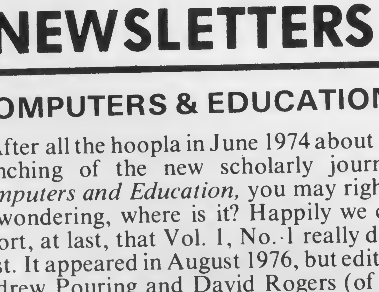
MAGAZINES, JOURNALS, NEWSLETTERS

COMPUTERS & EDUCATION

After all the hoopla in June 1974 about the launching of the new scholarly journal, *Computers and Education,* you may rightly be wondering, where is it? Happily we can report, at last, that Vol. 1, No. 1 really does exist. It appeared in August 1976, but editors Andrew Pouring and David Rogers (of the US Naval Academy) seem confident that it will appear more-or-less regularly (4 times a year) from now on. We'll see.

The first issue ran 53 pages and carried papers on microprocessors in digital design laboratories, computers in engineering education in the U.K., a reprint of Carl Hammer's "Computers in Research" paper, a nice piece by Herb Peckham on the careful choice of educational problems for use on the computer, and two other papers.

Computers and Education is outrageously priced at $50/year for institutions, $30 for individuals (if their library subscribes at the $50 rate). Pergamon Press Ltd., Headington Hill Hall, Oxford OX3 OBW, England.



INSTRUCTIONAL SCIENCE

This magazine is devoted to—you guessed it—"instructional science" which it defines rather broadly as, "purposive communication," and not merely the science of teaching and training. The material in *Instructional Science* is, for the most part, scholarly (and lengthy) papers. Occasionally it does get into CAI. Write for current price.

Elsevier Scientific Publishing Company, PO Box 211, Amsterdam, The Netherlands

COMPUTERS IN CHEMICAL EDUCATION

The Committee on the Role of Computers in Chemical Education of the Division of Chemical Education of the American Chemical Society (whew!) publishes a one page newsletter every two months. It contains brief (well they have to be with a name that big and a newsletter that short!) news items and plugs relating to CAI in chemistry. The newsletter is subsidized by the Division of Chemical Education of the ACS. Membership is $3.00.

R.W. Collins, Newsletter Editor, Eastern Michigan University, Ypsilanti, MI 48197

THE SPACE GAMER

A very professionally done magazine published quarterly. It deals with manually played space games and science fiction games (not computer games) and science fiction in general. A typical issue contains reviews of games, editorials, letters, and wantads. The Space Gamer is published by Metagaming Concepts which also makes science fiction and fantasy board games. $3 for six issues.

Metagaming Concepts, Box 15346, Austin, TX 78761

COMPUTER CLASSIFIED ADS

The Computer Hot Line Service is an index of new and used computers and peripherals published weekly. Since "want-to-buy" ads are free, there are page after page of them. This is the place to look if you're getting rid of computer equipment. Most of the "for-sale" ads are for medium to large systems. 1 year First Class Mail - $45.90; 1 year Third Class Mail - $28.60.

Computer Hot Line, PO Box 1373, Fort Dodge, IA 50501

COMPUTERS

ALTAIR 8800b

MITS, Inc., has announced its newest mainframe, the Altair 8800b, a second generation design which corrects the problems with the original 8800 as well as adding many improvements. Compatible with all existing Altair 8800 hardware and software.

MITS, 2450 Alamo SE, Albuquerque, NM 87106.

6800 COMPUTER SYSTEM

The SWTPC 6800 Computer System is a Micro-computer kit built around Motorola's 6800 microprocessor chip and its integral family of support devices. The basic system includes chassis with cover, mother board, memory card with 2048 bytes of 8 bit static RAM memory, serial 20 Ma. TTY teletypewriter/RS-232 terminal interface card, microprocessor card featuring a ROM stored mini-operating system, power supply capable of driving the system with a full 16K bytes of memory, assembly instructions, diagnostics, and programming manuals.

SWTPC, 219 W. Rhapsody, San Antonio, TX 78216.

IMSAI 8080

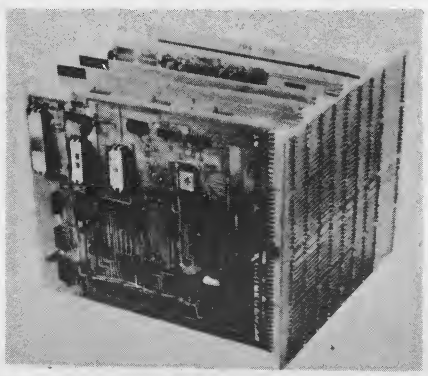
The IMSAI 8080 is a competitively priced microcomputer kit which is similar in many respects to the Altair 8800. Since both systems use the same 100 pin bus, IMSAI and MITS boards are fully compatible. IMSAI also makes the usual line of plug-in options including memory and I/O boards, and also a shared memory facility which permits two processors to access the same memory and I/O simultaneously. IMSAI has also announced a set of BASIC interpreters in 4K, 8K, and 12K sizes. (12K BASIC is very similar to DEC BASIC-PLUS and can be used along with a disc operating system.) A basic IMSAI with no memory is $599 in kit form. Catalog $1.00

IMS Associates Inc., 14860 Wicks Blvd., San Leandro, CA 94577

WAVE MATE

The Wave Mate Jupiter IIC is a complete computer system incorporating a monitor quality TV interface. Jupiter IIC includes a CPU with 8K dynamic RAM and 3K ROM memory, video terminal interface and keyboard, and dual audio cassette tape interface.

Wave Mate, 1015 W. 190th St., Gardena, CA 90248; (213) 329-8941.



OSI CHALLENGER

The Challenger is a fully assembled CPU which uses a 6502A or 6800 MPU. The CPU board also contains a 256-word PROM monitor which provides load, dump, edit, and traditional front panel functions (read, manually keyed-in) with either a terminal interface for a TTY and paper tape, or a cassette interface. There is no traditional front panel, only an on/off switch. The backplane accepts eight boards from the OSI 400 line which includes memories, PROM, A/D, D/A, video graphics, and, probably the most interesting of all, a CPU expander (460Z).

The 460Z contains a Zilog Z-80 *and* Intersil 6100 microprocessor and the necessary control circuits. In operation, the main 6502 acts as an "executive" with full control of the 460Z as well as the rest of the bus. The 6502 can bring the Z-80 or 6100 up to full speed operation and then it can disconnect itself and go on to other tasks, i.e., multiprocessing. However, the real beauty of the system lies in the fact that the executive MPU, peripheral controllers, and memory do not have to be replaced if you decide to get a super new MPU in the future. Another attractive feature is that the 6100 is actually the PDP-8 on a chip, hence the user has the capability of executing all the DEC PDP-8 software.

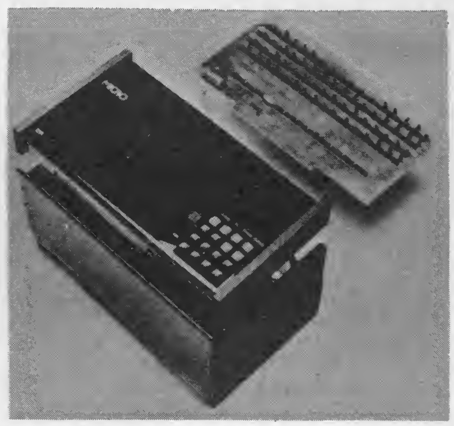
OSI Challenger with 4K of memory and either the 6502A or 6800 MPU is $529.00 (with BASIC software). The 460Z is a real bargain at $99.00. Literature free.

Ohio Scientific Instruments, 11679 Hayden St., Hiram, OH 44234. (216) 569-7945.

MMD-1 TRAINING KIT

The MMD-1 is a small microcomputer available in kit or assembled format that is backed by a complete text that allows the user to learn the basics about digital electronics all the way through programming ... all tied to experiments on the processor itself.

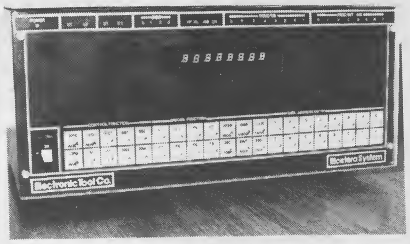
E and L Instruments, Inc., 61 First St., Derby, CT 06418; (203) 735-8774.



MICRO COMPUTER

EPA has announced a complete microcomputer system, the Expanded-68, based on the Motorola/AMI/Hitachi 6800 microprocessor chip set. Designed for system prototype development use, the Expanded-68 comes with 8K memory, power supply, 16 digit keyboard, teletype adapter, hexa-decimal LED display, expansion cabinet, application manual, and programming manual.

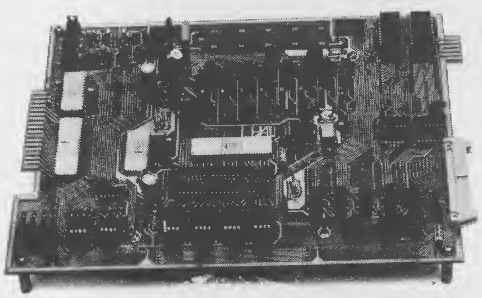
Electronic Product Associates, Inc., 1157 Vega St., San Diego, CA 92110; (714) 276-8911.



ETC COMPLETE SYSTEM

Electronic Tool Co. has introduced a complete Microcomputer system, based on the MOS Technology 6502 CPU. The ETC-1000 comes with a 40 key keyboard, a programmable 8 digit display, I/O interfaces, power supply and memory. It is intended for system development, control, and small-scale data processing application.

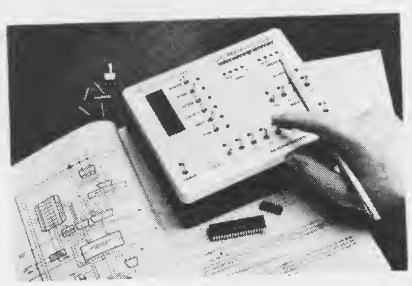
ETC, 4736 W. El Segundo Blvd., Hawthorne, CA 90250.



SINGLE-BOARD MICROCOMPUTER

The Hal MCEM-8080 microcomputer is a complete operating computer on a single PC board, exclusive of power supply and teletype or CRT terminal. The 8080A CPU and its associated components are used to insure that all of the computational power of the 8080A can be utilized. A section of the PC board is reserved for wire wrap sockets so that the MCEM-8080 can be specialized to specific applications. The MCEM-8080 is fully assembled and tested and backed by a one-year warranty.

HAL Communications Corp., 807 E. Green St., Box 365, Urbana, IL 61801.



MODULE AIDS MICROPROCESSOR

Texas Instruments, Inc., recently announced a pre-assembled microprocessor learning module priced comparable to do-it-yourself kits, including a 160-page instruction manual.

Texas Instruments, P.O. Box 5012, Dallas, TX 75222.

APPLE COMPUTER

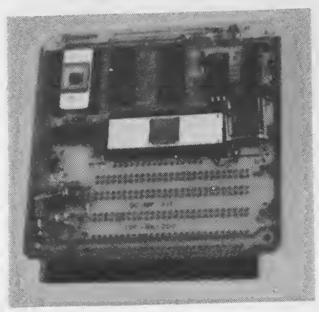
The Apple Computer is a complete microprocessor system, consisting of a MOS Technology 6502 microprocessor and support hardware, integral video display electronics, dynamic memory and refresh hardware, and fully regulated power supplies. $666.66.

Apple Computer Company, 770 Welch Road, Suite 154, Palo Alto, CA 94304; (415) 326-4248.

MICROPROCESSOR FAMILIARIZOR

The 6502 Familiarizor is a microcomputer with a keyboard and display, all on a single printed circuit board, eliminating the need for a teletype or any other expensive terminal. It is designed to give the beginner "hands on" experience with a microprocessor. The two manuals that are included can be easily understood without any prior knowledge of microprocessors. A monitor program included in PROM memory enables you to load, run, debug and modify programs easily using the on-board keyboard and hexa-decimal display. Breakpoints can be entered anywhere in your program and can be used to display the internal registers or branch to a separate routine that you've loaded.

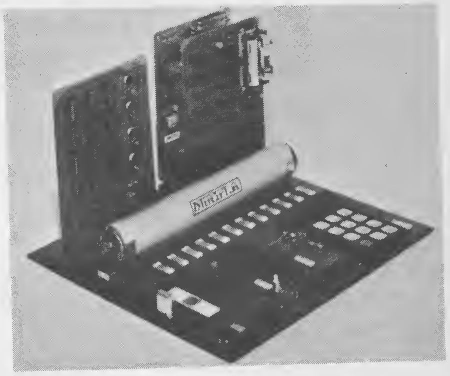
EBKA Industries, 6920 Melrose Lane, Oklahoma City, OK 73127.



MPU STARTER KIT

The SC/MP kit comes in the form of a notebook with instructions on how to get the job done. Each notebook includes an SC/MP microprocessor, a single-chip cpu housed in a 40-pin dual-in-line ceramic package, and features static operation, forty-six instructions, single-byte and double-byte operation, software controlled interrupt structure, built-in serial I/O ports, bidirectional eight-bit parallel data port, and a latched 12-bit address port. The 4K bit ROM is organized into 512 bytes pre-programmed to contain a monitor and debugging program, KITBUG, which assists in the development of the user's application programs. Lots more included. $99.

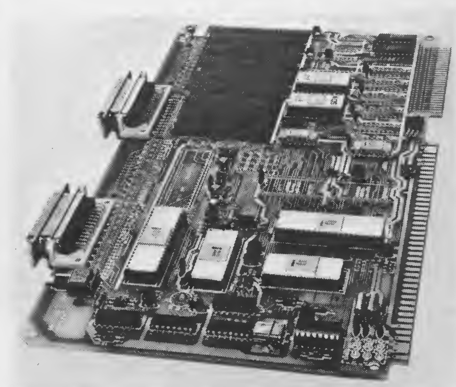
Contact: National Semiconductor, 2900 Semiconductor Drive, Santa Clara, CA 95051.



INTERSIL 'INTERCEPT JR.'

The "Intercept Jr." is a completely assembled microcomputer on a board built around the 6100 MPU (PDP-8 on a chip). It is billed as a "tutorial trainer which, with its detailed owners handbook, teaches the basics of microprocessors, Random Access Memories (RAMs), Read Only Memories (ROMs) and input/output interfacing, all in less than 8 hours." It is battery-operated (4 "D" cells), has a 9-key pad, 8-digit LED display, 2k x 12 bit PROM and serial I/O interface (with both RS-232 and 20 ma current loop capabilities). Very complete instruction book. Basic board with CPU $281.00, 1024-word RAM $145.00, PROM module $74.65, I/O module $81.70. Put 'em all in a case and you've got a PDP-8 for peanuts. Literature free.

Intersil, 10900 North Tantau Ave., Cupertino, CA 95014.



INTEL SDK-80

After a while TI and National Semi got tired of seeing everyone else making calculators (and profits) using their chips, so they made their own. Will history repeat itself in the microcomputer market? Probably, and here's an early indication: the Intel SDK-80.

The SKD-80 is a microcomputer kit on a board built, of course, around the 8080. It has a PROM, programmable I/O, RAM and especially clear and well documented instruction manuals. Connects directly to a TTY or other terminal. $350.

Intel, 3065 Bowers Ave., Santa Clara, CA 95051.

When writing to companies, please mention Creative Computing.

SOL-20 COMPLETE MICROCOMPUTER

A new computer, SOL-20, is available in kit form or assembled. The package includes an 8080 microprocessor, 1024 character video display circuit, 1024 words of static low-power RAM, 1024 words of preprogrammed PROM and a custom 85-key solid-state keyboard.

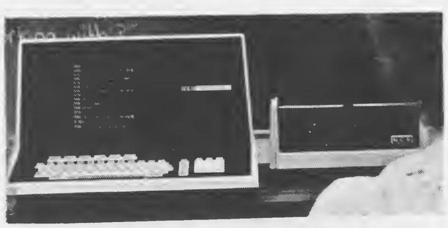
Other features are an audio cassette interface capable of controlling two recorders at 120 baud, parallel and serial standardized interface connectors, a complete power supply including fan and a contemporary cabinet with solid walnut sides.

Software includes PROM personality module and a cassette with BASIC-5 language plus two sophisticated computer video games. The Sol-20 uses the same bus structure as Altair and Imsai, and therefore can use any of the many boards and peripherals available for these systems.

Heart of the Sol-20, the Sol all on one board PC kit is also available for $475. The complete Sol-20 costs $995.

Low cost software for the Sol-20 available now consists of fast new 8K BASIC and a new 8080 FOCAL. Gamepacs include TREK 80, TARGET, ZING, LIFE, and PATTERN. Also offered are MATHPACK video calculator, 5K BASIC, and two Resident Assemblers.

For a free 22-page catalog, write Processor Technology Corp., 6200 Hollis Street, Emeryville, CA 94608. (415) 652-8080.



NCR TABLETOP COMPUTER

A compact microcomputer designed primarily for use in schools and colleges has been announced by NCR Corporation.

The 7200 Model VI includes a microprocessor and 24K bytes of random-access memory, of which 4K bytes can be used for student programming. The 7200 also features a 9-inch visual display screen, alphanumeric and numeric keyboards, and a magnetic-cassette tape recorder for storage and retrieval of programs and data. A second cassette recorder is available as an option.

The system is programmed in a special version of NCR BASIC designed for the microprocessing environment. Included are more than 100 preprogrammed applications in the NCR BASIC library. Users can also develop their own programs.

In addition to educational applications, the unit can be used in a number of financial and engineering applications.

The price, $6,995 includes a one-time software license charge.

NCR Corporation, ATTN: G.P. Williamson, Education Marketing, Dayton, OH 45479. (513) 449-2150.

WESTERN DATA DATA HANDLER

The "Data Handler" from Western Data is a microcomputer based on the MOS Technology 6502. Featurs an easy-to-use full function, hardware controlled, front panel with keyboard switches that perform: single cycle operation, single instruction operation, memory examine, memory deposit, initialization, halt, run, hex data and address entry. The single 13.75" x 10.5" P.C.B. can directly address 65K of memory and contains 1K bytes of static RAM on the board with complete address decoding. It has 500ns memory, resistors, capacitors, L.E.D.'s, 1 mhz 6502, and complete documentation. Plug in compatible with Altair peripherals. $169.95.

Mike Indihar, Western Data Systems, 3650 Charles Street No. 2, Santa Clara, CA 95050.

SMALL COMPUTER SYSTEMS FROM HP

Hewlett-Packard offers four new small-computer systems for computation, instrumentation, and operations management applications, all lower in cost than similar earlier models. Features are: a faster processor, which runs programs 60 to 1000% faster than present machines, utilizing new dynamic micro-cycle timing; micro programming software including micro-assembler, micro-editor, loader, and debug utilities; IMAGE/1000 data base management software with QUERY, an inquiry procedure requiring no programming experience; mini-cartridge drives. Prices are 9% below comparable former equipment, with discounts to OEM system houses as high as 30%, and begin at $33,500.

Inquiries Manager, Hewlett-Packard Company, 1501 Page Mill Road, Palo Alto, CA 94304.

QUAY MICROCOMPUTER

The Quay 80A1 is designed around the Zilog Z-80 microprocessor and runs at 2.5 MHz. The board provides a complete microcomputer, requiring only a power supply and terminal device, or the 100 pin edge connector may be plugged into an Altair or IMSAI bus in place of the 8080 based CPU board. Many features are geared to make it good for control problem programs, and interaction with a variety of peripherals.

Quay offers help in microcomputer application systems and offers an educational and dealer purchasing plan. $450 in kit form and $600 assembled.

Quay Corporation, P.O. Box 386, Freehold, New Jersey 07728. (201) 681-8700.

COSMAC MICRO KITS

The CDP 1802 is RCA's latest microprocessor. While aimed mainly at the industrial market, this family of COSMAC (CMOS Architecture) products has many interesting features for hobbyists and schools too. The 8-bit architecture provides all branch conditions in complementary pairs, has few special exception commands, and tends to lend support to a structured programming approach. It also provides 16-bit addresses so 64K of memory can be directly addressed. A complete line of memories, clocks, I/O and support circuit chips are available. No high-level languages available at present.

Is COSMAC for you? Best way to find out is with an evaluation kit (CDP 185020) which contains the MPU, 512 bytes of ROM containing utility software, 256 bytes of RAM, I/O, LED display, control switches, and comprehensive user's manual. $249.00. Manual only (MPM-203) $15.00.

A microtutor kit (CDP 185011) is similar but more extensive than the evaluation kit in that it is a complete free-standing microcomputer. $349.00. Manual only (MPM-109) $2.00.

RCA Solid State Division, Box 3200, Somerville, NJ 08876.

EXPENSIVE BUT FAST

The North Star FPB-A is a single pc card designed for use with the Altair/IMSAI bus. The FPB unit performs add, subtract, multiply and divide on binary-coded-decimal floating point values approximately 50 times faster than 8080 software. The precision of the unit, up to 14 digits of accuracy, is under software control. As well as dramatically improving program performance, use of the FPB also reduces program size by about 1K.

The model B version is compatible with the Intel SBC/10 (single board computer). Price is $359 kit, $499 assembled.

Charles A. Grant, North Star Computers, Inc., P.O. Box 4672, Berkeley, CA 94704. (415) 527-6760.

When writing to companies, please mention Creative Computing.

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  - Use of low-cost computer speech synthesis and video output for pre-readers
  - Uses of computers to maximize conceptual learning while minimizing drudgery
  - Facilities for individualized computer-aided instruction (CAI) on very low-cost computers
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- As a Panel Member
- As the Coordinator/Moderator

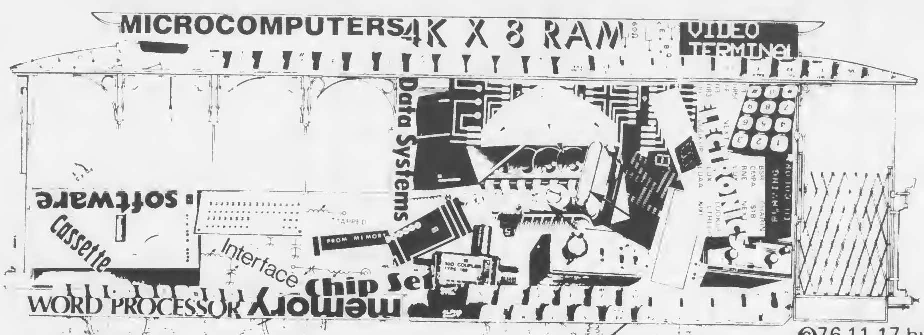
Give Suggestions
- Topics for Talks & Panels
- Speakers & Panel Participants
- Interesting Exhibits (homebrewed or commercial)
- Special Activities

Quick! Write for more details:
Section Co-chairpeople —

Marvin Winzenread
3360 Tonga Ln, Alameda CA 94501
(415) 521-2119, 881-3414 [message]

Don Inman
350 Nelson Rd, Scotts Valley CA 95066
(408) 335-3360, (415) 323-3111 [message]

Please see other articles in this issue for additional details.



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ANALYSIS AND DESIGN OF DIGITAL CIRCUITS AND COMPUTER SYSTEMS

Paul W. Chirlian $16.95

This is an introductory book in Digital Circuits and Systems. It not only provides the reader with the basic ideas of switching theory, but also provides him with an understanding of the total operation of the complete computer system. The topics of digital electronics and computer interfacing are also considered. The ideas discussed here also provide the basic understanding of microprocessors and minicomputers.

PROGRAMMABLE CALCULATORS

Charles J. Sippl $11.95

Written at an understandable level, this handy reference is designed for anyone interested in calculators. This is a pragmatic "how to use what's available" book on a difficult-to-understand subject. This reference offers a 16 page appendix of glossary terms as well as an appendix of clearly-defined capabilities of products available in the market place. A complete guide to the industry as well as a tutorial book.

FUNDAMENTAL PRINCIPLES OF MICROCOMPUTER ARCHITECTURE

Keith L. Doty $13.95

This book provides a complete basis for exploring the dynamic field of microcomputer systems and applications. After a general overview of the microcomputer scene, the author illustrates how general computation is a form of accounting with a decision-making capability. After developing confidence in the power of these existing devices, he proceeds to develop the notion of information and its representation as is seen by the computer and the programmer. No prior programming knowledge is assumed and elementary material on programming is presented.

2^{10} QUESTIONS AND ANSWERS ABOUT HOME COMPUTERS

Richard L. Didday $4.95

A book for the person interested in microcomputers who wants to get an idea of what it can be like before buying the equipment and for the person with a microcomputer who wants ideas for things to do, help in reading the literature, help in deciding what ways to go.

MATRIX

MATRIX PUBLISHERS, INC.
Dept. CC, 207 Kenyon Rd. Champaign, IL 61820

Matrix books also available in Byte Shops, computer stores, and bookstores.
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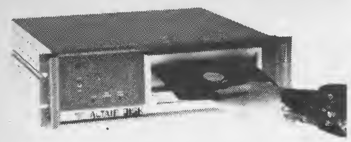
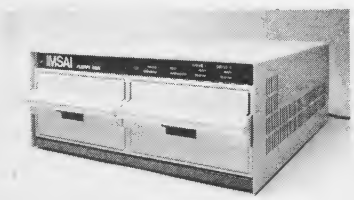
PERIPHERALS



ALTAIR FLOPPY DISK

The Altair Disk offers the advantage of nonvolatile memory plus relatively fast access to data. The Altair Disk Controller consists of two PC boards (over 60 IC's) that fit in the Altair chassis. They inter-connect to each other with 20 wires and connect to the disk through a 37-pin connector mounted on the back of the Altair. Data is transferred to and from the disk serially at 250K bits/sec.

MITS, 2450 Alamo SE, Albuquerque, NM 87106,



IMSAI FLOPPY DISK

IMSAI has recently announced the availability of a floppy disk drive with an intelligent interface/controller for use with the IMSAI 8080 computer. The floppy disk has a capacity of 243K bytes using the IBM 3740 format. Interface/controller cards plug directly into the IMSAI 8080 or the Altair 8800.

IMSAI, San Leandro, CA.

NORTH STAR MINI-FLOPPY DISC

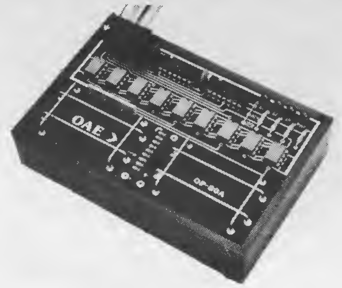
Complete floppy disc system with controller for Altair/IMSAI computers. Disk unit is based on the Shugart floppy and measures only 6"x3"x8". Capacity is 100k bytes per diskette. The controller for up to 3 drives resides on a single PC card and includes a bootstrap/power up PROM. A file-oriented disk operating system and disk version of extended BASIC are included. This Basic is impressive with multi-line functions, formated output, machine language subroutines and, of course, random disk access. Complete unit with drive, controller, cables, 2 diskettes and documentation, $599.

North Star Computers, Inc., 2465 Fourth St., Berkeley, CA 94710. (415) 549-0858.

HANDY DANDY PAPER TAPE WINDER

The Handy Dandy is a hand held paper tape winder. Powered by four D batteries, this tape winder facilitates repeated winding of punched paper tapes into a neat roll.

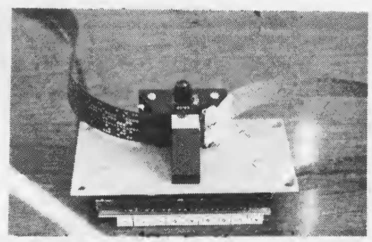
Elliam Associates, 24365 Clipstone St., Woodland Hills, CA 91364, (213) 348-4278.



PAPER TAPE READER

The new OP-80A high speed paper tape reader from OAE has no moving parts and will read punched tape as fast as you can pull it through (0-5,000 c.p.s.). The unit includes a precision optical sensor array, high speed data buffers, and all required handshake logic. It will interface directly with an 8 bit uP I/O port, or can be connected across a UART allowing you to load programs through the TTY I/O port directly without software modifications.

Oliver Audio Engineering, 1143 North Poinsettia Drive, Los Angeles, CA 90046; (213) 874-6463.



PHOTOELECTRIC PUNCHED PAPER TAPE READER

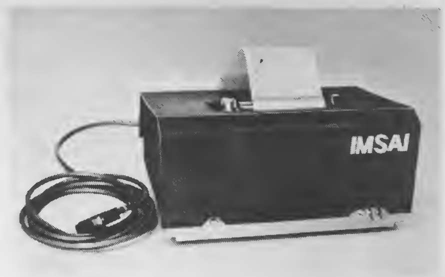
The TR-4 was designed for low speed, low cost applications (such as numerical control for schools and colleges). The advantage of a slow stepping rate is coupled with the latest in solid state design to fill demanding requirements of both industry and education. The TR-4's small size (3 inches by 6 inches) and self-contained drive circuitry allow you to install it just about anywhere.

Sylvanhills Lab., #1 Sylvanway, Box 239, Strafford, MO 65757.

ALTAIR 110 LINE PRINTER

The Altair 110 Line Printer is a desktop line printer that produces 80 columns of 5x7 dot matrix characters at 110 cps (70 lines per minute). The impact dot matrix prints bidirectionally, using a conventional Teletype ribbon. The Altair 110 will print up to three copies of any item, plus the original.

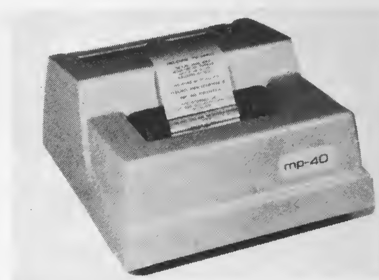
MITS, 2450 Alamo SE, Albuquerque, NM 87106.



44-COLUMN PRINTER

Printer uses a dot matrix mechanism and prints 64 upper case ASCII characters as well as double size characters. Has automatic line wraparound causing lines with more than 44 characters to automatically feed to a second line. Interfaces to an 8-bit parallel output port. Complete with case, cable, power supply and controller. Kit $399, assembled $549.

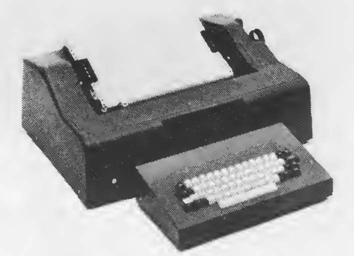
IMSAI Corp., 14860 Wicks Blvd., San Leandro, CA 94577. (415) 483-2093.



MP-40 PRINTER

The MP-40 is a low-cost impact printer designed for the small microsystem market. The number of moving parts has been minimized to increase the reliability and reduce any maintenance time. It generates 5x7 dot matrix characters at a throughput rate of 75 lines per minute with a maximum print line capacity of 40 columns.

MPI, P.O. Box 22101, Salt Lake City, UT 84122; (801) 566-0201.



MATRIX PRINTER

Applied Computing Technology, Inc., is introducing a new addition to their Series 900 Interactive Medium Speed Matrix Printer line. Now available is a plotter version of the Series 900 Printer, which allows a dot to be printed on any position on the paper with a horizontal resolution of 60 dots/inch and a vertical resolution of 72 dots/inch.

ACT, 17961 Sky Park Circle, Irvine, CA 92707; (714) 557-9972.

When writing to companies, please mention Creative Computing.

TERMINALS

DG TERMINAL FAMILY

Four terminals and printers are available from Data General with 132-column lines and speeds of 30 cps and 60 cps. The guts use a modular electromechanical design and few discrete parts, hence, maintenance and reliability should be good. One PC board in the base contains all interface and control logic. Prices range from $2200 for a 30 cps receive-only model to $2650 for a 60 cps send/receive model.

Data General Corp., Route 9, Southboro, MA 01772. (617) 485-9100.

THE LEAR SEIGLER DUMB TERMINAL KIT

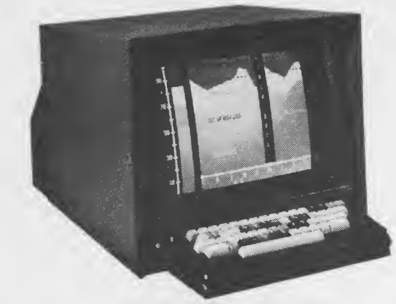
This dumb terminal has 12″ CRT screen, keyboard, 64 ASCII characters with optional character set, PC board, all necessary electronic components, plus illustrated step by step assembly instructions and the terminal operator's manual. Have your own live and working video terminal in a handsome cabinet for only $875.

Synchro-Sound Enterprises, 193-25 Jamaica Ave., Hollis, NY 11432. Also available at other distributors.

ASCII KEYBOARD

Standard 53-key ASCII keyboard which interfaces to any 8-bit parallel part is now available from IMSAI. An LED display shows characters being typed. Complete with aluminum case, interface circuit card, cable and EIA connectors. $199 assembled.

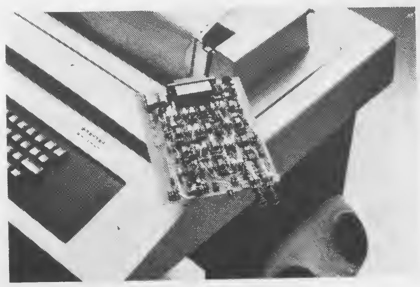
IMSAI Corp., 14860 Wicks Blvd., San Leandro, CA 94577. (415) 483-2093.



8-COLOR GRAPHIC CRT

The Intercolor 8001 is a microprocessor-controlled graphics terminal that displays 2000 characters in a 25-line by 80 character format; optional 48-line display available. Basic unit is TTY-compatable. A cpu operating system turns the terminal into an 8080 micro-development system. An extended Basic package with plot commands makes use of the terminal's graphic capabilities. The 8001 costs $2495, operating system $270.

Intelligent Systems Corp., 5965 Peachtree Corners E., Norcross, GA 30071. (404) 449-5961.



PHONE MODEM FOR DEC LA36

A data-communications interface adds phone-transmission capability to the DECwriter LA36. Called the Model 120, it adds four interface functions to the LA36's 20 mA current-loop interface. The four additional switch-selectable transmission modes include EIA (RS232-C) acoustic coupler, manual DAA (Bell 113A) and leased line (Bell 103F). The transmission rate goes from 0 to 300 baud, in a full or half duplex mode. Installs without physical modification of the LA36 terminal. $325.00.

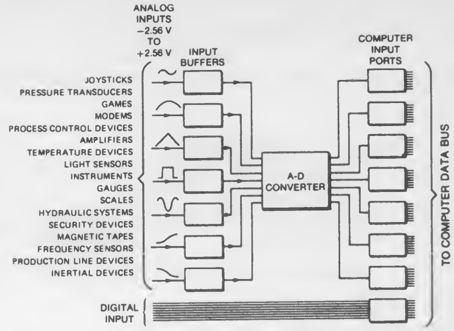
Ven-Tel, 2360 Walsh Ave., Santa Clara, CA 95050. (408) 984-2727.

MISC. HARDWARE

EXTENDER BOARD/LOGIC PROBE KIT

This new phone-needle probe features three color lights on HI/LO transition and fits either the Altair or IMSAI. Eyelets and jumpers in the power circuits allow convenient current measurement. $35.

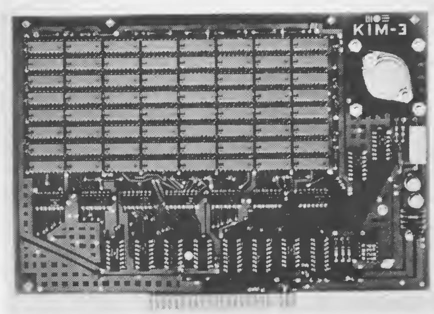
Mullen Computer Boards, Blast Masters Inc., Box 31, Loma Mar, CA 94021.



CROMEMCO D/A

The new Cromemco D+7A I/O converts analog-to-digital input and digital-to-analog output along 7 channels in just 5 microseconds. It plugs directly into the data bus of Altair 8800 or equivalent. Range -2.56 to +2.56 volts. All for $245 with connector.

Cromemco, 2432 Charleston Road, Mountain View, Ca 94043



4K/8K STATIC MEMORY EXPANSION MODULES

The KIM-2 and KIM-3 are memory expansion modules designed for use with systems using the KIM-1 microcomputer module. Both modules are completely assembled and tested. High speed, low power static memory integrated circuits are used — no memory slow down or refresh cycles are required. An on-board regulator allows system operation from a +8 volt unregulated power supply. Switches on the board allow the boards to be placed at any 4K (KIM-2) or 8K (KIM-3) boundary in the system memory space. Complete documentation is provided for board installation, checkout, and operation. Schematics and theory of operation are also provided. A single KIM-2 or KIM-3 can be wired directly to a KIM-1 module. System expansion to 65K of memory can be implemented using KIM-4 motherboards. The KIM-2 is $179 and the KIM-3 is $298. $3 shipping for either.

MOS TECHNOLOGY, INC., KIM, 950 Rittenhouse Road, Norristown, PA 19401.

A visitor to Mark Twain's home commented upon the abundance of books, and the rather limited accommodations for them.

"Yes," agreed Mark, a bit wistfully, "yes, but it's so difficult to get friends to loan you shelves."

When writing to companies, please mention Creative Computing.

VENDOR LITERATURE

APL PRESS

APL Press is a new publishing house devoted exclusively to APL material. Seven titles are currently available, and further manuscripts are being sought.

A newsletter is issued periodically, containing brief articles, reports on conferences, book reviews, problems, correspondence, and other items of interest to the APL community.

Readers interested in receiving the newsletter and information on publications, or in submitting material for publication, should write to APL Press, Box 27, Swarthmore, Pennsylvania 19081.

FREE CATALOG OF COMPUTER BOOKS

This company publishes computer science textbooks, teacher aids, and educational materials designed for use in secondary schools. Examples are: What Computers Can Do — a 108 page book about computer applications; Computer Problem Cards — 65 problems suitable for computer solution; Fun With Computers And Basic — a fun introduction to the BASIC language. *Free* catalog and book description brochures.

Camelot Publishing Company, P. O. Box 1357, Ormond Beach, FL 32074.

MPU TROUBLESHOOTING NOTES

Eight new application notes, each describing the use of logic-state troubleshooting instruments to analyze commonly used microprocessor systems, the National IMP and SC/MP, Intel 4040, 4004, 8008, 8080, Fairchild F8, and Motorola M6800, are available FREE from Hewlett-Packard. For all notes in the series, operation of the particular microprocessor is described in detail using charts, schematics, reproductions of maps, oscilloscopes and system displays. Request by publication number:

1. Motorola M6800 (AN 167-9)
2. Intel 8008 (AN 167-11)
3. Fairchild F8 (AN 167-12)
4. Intel 8080 (AN 167-14)
5. Intel 4004 (AN 167-15)
6. Intel 4040 (AN 167-16)
7. National IMP (AN 167-17)
8. National SC/MP (AN 167-18)

Inquiries Manager, Hewlett-Packard Company, 1501 Page Mill Road, Palo Alto, CA 94304.

CIRCUIT DESIGN LINE

The E & L Instruments, Inc. catalog features their complete line of digital electronics and microcomputer learning systems and solderless breadboarding equipment. E&L also sells digital electronics books and logic probes. Free catalog.

E&L Instruments, Inc., 61 First Street, Derby, CT 06418

ACCESSORIES CATALOG

This 24-page catalog offers data storage folders and files, racks, cabinets, cassettes, disk cartridges, tapes, as well as DEC, DGC and HP compatible cables and connectors. Also junction panels, extension cables, data binders, disk cartridges, and ribbons for all major minicomputers. Free.

Minicomputer Accessories, P. O. Box 10056, Palo Alto, California 94303. (415) 969-5678.

APPLIED TV CATALOG

Applied TV Research markets equipment for closed circuit amateur TV such as cameras, vidicon tubes, and a small RF modulator kit called a "Pixieverter" which is fast becoming popular in amateur computing circles since it permits any TV set to be used as a video monitor. ATV has also just introduced the ASC-71 Audio Subcarrier which lets you add sound to your amateur TV setup. Catalog free.

ATV Research, 13th & Broadway, Dakota City, Nebraska 68731

CALCULATORS

LIL' PROFESSOR FOR LIL' KIDS

The TI "Little Professor," a calculator-based learning aid, contains more than 16,000 pre-programmed basic math problems for children ages 5-9.

"Little Professor" problems can be selected according to degree of difficulty by the user. Once the type of problem and degree of difficulty is selected, the machine presents the problem (with function and equal sign) in the large VLED display. The user keys in an answer. If correct, the complete equation appears for one second, and the next problem in sequence is displayed. If incorrect, the problem reappears.

If a wrong answer is entered three times, the "Little Professor" automatically displays the correct answer. The answer remains in the display until the user presses the "GO" key. If the next problem is also answered incorrectly three times, the correct answer would again be displayed.

The "Little Professor" will, after ten problems, display a score (number out of ten correct). This "score" display would be followed by the next set of problems in sequence.

The "Little Professor" has addition, subtraction, multiplication and division sequences in variable degrees of difficulty. A user works at his own speed, and considers the machine a game, as well as a learning aid.

Texas Instruments (Little Professor Inquiries), P. O. Box 5012, M/S84, Dallas, Tx 75222. Nelson Brooks (214) 238-4203.

CALCULATOR SELECTION GUIDES

A new 16-page booklet, *The Programming Book — A Guide to Programmable Calculators* is written for the calculator-programming beginner interested in learning the basics of program-based problem solving and pre-purchase calculator evaluation. It is also written for the experienced programmer as a reference book of the many keyboard functions and edit features now available.

Chapters include an introduction to problem solving, steps to writing and using effective programs, programming features and choosing a programmable calculator. (Pub. 5952-6067D) Free.

A 24-page booklet, *What To Look For Before You Buy An Advanced Calculator* is a comprehensive analysis of available types of scientific, business and programmable calculators. It is designed as a guide for the calculator buyer with little or no knowledge of available functions, operating languages and specialized calculators.

The booklet studies each characteristic of both good and poor calculators, showing the reader what traits to look for to make a worthwhile investment. Chapters include an introduction to advanced calculators; operating languages; functions and features; programmables; support material and calculator construction. Charts are provided to aid the reader in understanding both keyboard and internal operations. (Pub. 5952-60S3D) Free.

Hewlett-Packard, Attn: Inquiries Manager, 1000 N.E. Circle Blvd., Corvallis, OR 97330.

MATCHBOOK SIZE CALCULATOR

The Micro-Mini is claimed to be the world's smallest electronic calculator. The unit measures 1.675 x 2.375 x 0.5 inches — about the size of a matchbook. The calculator weighs 1.2 oz, including the silver-oxide battery. The unit can add, subtract, multiply and divide and has a constant for multiplication and division. It has an eight-digit liquid-crystal display. $29.95.

Casio, Inc., 15 Gardner Road, Fairfield, NJ 07006. (201) 575-7400.

CLASSMATE IV

Monroe's step up from the smaller Classmate 88 is termed a microcomputer by the manufacturer although it appears functionally to be a programmable calculator. Nevertheless, equipped with a mark sense card reader; two huge volumes of problems, samples, and solutions; and preprogrammed cassettes in 12 areas of mathematics, it should provide very thorough supplemental instruction in all levels of mathematics. Classmate IV is designed primarily as a learning tool for enhancement of the mathematics curriculum, not as a general-purpose calculator (or computer). $98 per month. Literature free.

Monroe, The American Road, Morris Plains, NJ 07950.

SOFTWARE

SWTP BASIC

Two BASIC software packages, 4k and 8k, are available for the SWTPC 6800 Computer System. The 4k BASIC requires at least 6k of total memory with 8k preferred; 8k BASIC requires 8k but 12k is preferable.

Both packages have immediate mode (sometimes called direct or calculator mode) that allows statements to be executed without line numbers. Programs and data may be saved and loaded from cassette or paper tape and a USER function provides a jump to machine language subroutines. The 8k package has extensive string functions not usually found in small BASIC interpreters.

SWTP is obviously interested in making it easy for people to use their machines and have kept the price of software delightfully low. 4k BASIC on "Kansas City" format cassette with manual is $4.95; on paper tape $10.00. The 8k version is $9.95 on cassette, $20.00 on PT.

Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, TX 78216.

BASIC SIMULATIONS

Assorted simulation programs in BASIC: games, graphics, tutorials, others. Each program includes paper tape, listing, and ditto master of supplemental reading material. Catalog 50¢.

Tamarind Software, Ltd., P.O. Box 302, Geneseo, NY 14454.

READABILITY PROGRAM

A comprehensive program written to test the readability of textbooks and other literature has been written in CW BASIC. The mainline program consists of 18 programming statements, supported by subroutines occupying 280 lines. The computing factors are the Dale-Chall Index and the Flesch Index.

This program has proved to be reliably accurate for the open-readability testing schema. Selected vocabulary can easily be added to improve the accuracy of the test for various academic disciplines.

Larry C. Taylor, 5269 Old Franklin Road, Grand Blanc, Michigan 48439. (313) 694-7077.

BASIC-PLUS-2

An extended BASIC-PLUS (which was extended over DEC's original extended BASIC — should this be Extended³ BASIC?) is now available for three POP-11 operating systems: RSTS/E, RSX-11M, and IAS. Improvements over BASIC-PLUS include the speed optimization, better debugging capabilities, and access to external subroutines. The goodies in BASIC-PLUS itself are too numerous to list but a free brochure is available.

Digital Equipment Corp., Education Products Group, Maynard, MA 01754.

STAR TREK

ENTERPRISE T-SHIRT

A beautiful midnight blue T-Shirt with a large detailed Enterprise and stars design in silver is available from *Creative Computing*. No wording of any kind appears on the shirt. $4.00 postpaid from *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

Individual orders prepaid only.

STAR FLEET OUTPOST

Carries Star Trek and science fiction articles including T-shirts, buttons, posters, photos, slides, games, models, jewelry, patches, puzzles, books, comics, beach towels, etc., etc.

Star Fleet Outpost, 291 Franklin Ave., Nutley, NJ 07110. (201) 661-5039.

BUTTONS AND STUFF

Wide selection of Star Trek, reflective, and custom-made photo buttons. Catalog 25¢.

Len Katz, 109-14 Ascan Ave.; Forest Hills, NY 11375. (212) 544-3019.

STAR TREK GALORE

Photos, lithographs, patches, buttons (some very unique ones), jewelry, badges, etc. Catalog 25¢.

Star Trek Galore, 436 E. Orange Ave., Longwood, FL 32750.

FEDERATION TRADING POST

Bumper stickers, slides, toys, games, color and B&W photos, buttons, posters, books, iron-ons, fanzines. Catalog S.A.S.E.

The Federation Trading Post, 2556 Telegraph Ave., Berkeley, CA 94704. (415) 548-7332. [East coast retail shop at 210 E. 53rd St., New York, NY 10022 (212) 751-6716.]

T.K. GRAPHICS

Claims to be the world's largest Star Trek and science fiction bookseller and we have no reason to doubt the claim. Books from major, minor, and unknown publishers. Huge catalog free!

T.K. Graphics, Inc., P.O. Box 1951, Baltimore, MD 21203.

BASIC STAR TREK GAME

One of the first Star Trek computer games in BASIC to appear widely was actually mislabeled SPACWR (Spacewar) in *101 BASIC Computer Games*. It was designed for BASIC-PLUS on RSTS-11 but can be easily modified for other versions of BASIC. *101 Games* is available for $7.50 plus 75¢ postage from *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

Individual orders prepaid only.

NOVA ENTERPRISES

Star Trek and general science fiction books, by major publishers, but also many limited editions: 1500 titles! LP records, T-shirts, program books, conflict simulation games, many unusual items. Catalog 50¢.

Nova Enterprises, P.O. Box 149, Parkville Station, Brooklyn, NY 11204. (212) 871-0646.

APRIL PUBLICATIONS

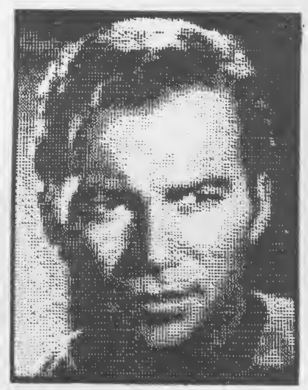
Star Trek I.D. cards, business cards, trivia games books, buyers guide to all the stores, certificates and diplomas. Order sheet S.A.S.E.

April Publications, 88 New Dorp Plaza, Staten Island, NY 10306.

STARFLEET COMMAND

Uniforms, phasers, communicators, tricorders, other props, posters, film clips, books, models, records, etc. Catalog S.A.S.E.

Starfleet Command, Inc., P.O. Box 1276, Thousand Oaks, CA 91360.



COMPUTER IMAGES

A *new* set of 7 extensively detailed computer images of Star Trek people is now available from *Creative Computing*. (The new images have solid black borders — the old ones had no borders). Kirk, Spock, McCoy, Scott, Uhura, Sulu and the Enterprise. 8½ x 11, heavy stock. $1.50 per set postpaid. *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

Individual orders prepaid only.

LINCOLN ENTERPRISES

Lincoln Enterprises offers Star Trek memorabilia ranging from scripts and film clips to postcards and bumper stickers. Free catalog also contains Kung Fu, Questor, and Genesis II stuff.

Lincoln Enterprises, PO Box 69470, Los Angeles, CA 90069

When writing to companies, please mention Creative Computing.

ORGANIZATIONS

COMPUTER ARTS SOCIETY

The Computer Arts Society (CAS) was launched into existence with EVENT ONE at the Royal College of Art in 1969. As regards the Society's name, Alan Sutcliffe, Chairman of CAS since its inception, remarked in *Page 13*: "Some attitudes were agreed by those of us who first met . . . to talk about forming the Society. They were attitudes of neutrality and inclusiveness. That is why we chose the commonplace name of the society, even while agreeing that the term Computer Art was to be deprecated. It is still convenient shorthand for 'creative work in which a computer has been used.'"

In 1971, CAS established a policy of awarding honorary life memberships in the Society. John Whitney, Sr. (1971), Iannis Xenakis (1972), and Edward Ihnatowicz (1973) are the first three artists to be so honored.

The main communication of CAS is its newsletter, *PAGE*, which is published eight times each year. This newsletter contains commentary, reports, short articles, book reviews, and miscellaneous items related to the use of the computer in the arts. Most of the issues are published in England, but the membership is spread throughout the world.

U.S. and Canadian members of CAS also receive a single sheet bi-monthly announcement entitled *HAPPENINGS*; its purpose is to announce local shows, lectures and other events.

The Society aims to encourage the creative use of computers in the arts and allow the exchange of information in this area. Membership is open to all at £2 or $6 per year, students half price.

Alan Sutcliffe, 4 Binfield Road, Wokingham, Berkshire, England.

U.S. Branch (CASUS) Coordinator: Kurt Lauckner, Mathematics Department, Eastern Michigan University, Ypsilanti, Michigan 48197, U.S.A.

KIM USER GROUP

New KIM User Group initiates the "Kim-1 USER NOTES" to act as a vehicle for user exchange of hardware and software ideas and experiences with interfacing peripherals. All KIM-1 users are encouraged to join and share information.

Mr. Eric Rehnke, Apt. 207, 7656 Broadview Road, Parma, Ohio 44134

MISCELLANEOUS

EARTHWATCH EXPEDITIONS

Looking for a different, fascinating, and challenging vacation? Maybe Earthwatch is for you. They are a clearinghouse that help scientists who need people and funds to mobilize expeditions by making them available to interested members of the public. Those who participate share costs. The opportunities are varied: natural sciences, marine sciences, conservation, medicine, the arts, and the humanities. Anyone can apply, age 16 to 75. It's an opportunity to get involved, to be useful, and to give something back. And part of the cost is tax-deductible.

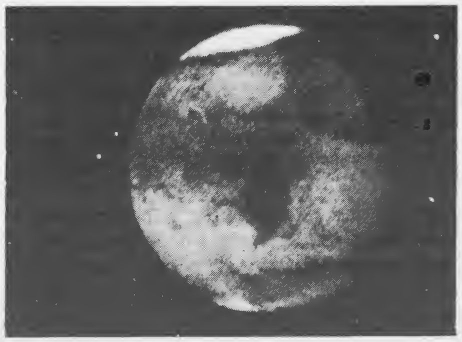
Over 40 expeditions were offered in 1976, most 2 to 4 weeks with teams of 5 to 20 members. Most operated under bivouac conditions. Examples: Study of volcanoes in the Mexican volcano belt, 2 wks., $690. Archaeological dig in Tell Hesban, Jordan, 3 wks., $690. Recovery of animal skeletons, Natural Trap, Wyoming, 3 wks., $690. Study of Berrybrae Stone Circle, Scotland, 3 wks., $725. Study of beach erosion, Cape Cod, 2 wks., $525. Transportation not included in price. Free expedition catalog.

Earthwatch, 68 Leonard St., Belmont, MA 02178. (617) 489-3030.

COMPUTER PHILATELY

A group of stamp collectors have put together a list of stamps relating to computers. The list contains more than 130 stamps. Free, but include self-addressed stamped envelope with 24¢ postage on it.

Robert V. Boos, 66 Crescent St., Hicksville, NY 11801.



MARS PHOTOS

B&W and color photos of Mars are available from the official NASA photography contractor. Send a clipping from the newspaper or magazine of the photo you want plus $1.75 for an 8x10 B&W, $5.00 for color.

Bara Photographics, P.O. Box 486, Bladensburg, MD 20710.

COMPUTER CLUB DIRECTORY UPDATE

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University of Waterloo
Waterloo, Ontario N2L 3G1

A Creative Computing Equipment Profile . . . .

TELETYPE MODEL 43 TERMINAL

by David H. Ahl

From the people who brought the world the slow and noisy, but incredibly versatile ASR 33, we now have, some 600,000 ASR 33's and 10 years later, the fast, quiet, more versatile Model 43.

The Model 43 is initially available in only a KSR version (keyboard send-receive, i.e., no paper tape or local storage). Presumably at some future point, local storage will be an option.

The KSR 43 operates at 10 or 30 characters per second with corresponding transmission speeds of 110 or 300 baud, switch selectable. It prints sideways on 12" wide paper using a very clever 7 x 9 dot matrix to provide 132 character width across the paper in 10". In other words, horizontal character spacing is 13.2 per inch; lines are spaced vertically at 6 per inch. The almost 2 to 1 horizontal to vertical character spacing should allow some very good graphics and plotting. The 7 x 9 dot matrix printer also allows a full 94 ASCII code character set (upper and lower case) and is very legible. The 12" wide by 8½" long pinfeed, fan fold paper can be trimmed to standard 8½ x 11" by removing the perforated margins thus making the output easy to bind or file.

The solid state keyboard has the same layout as an office typewriter so it can be readily used by anyone who can type. A built-in buffer absorbs momentary keyboard bursts. Using control keys, the keyboard can generate all 128 ASCII code combinations.

A clever keyboard feature is a "CAPS LOCK" key that functions similar to the "SHIFT" key, but with one important advantage. When it is locked (depressed), it causes capital letters to be generated without having to operate the SHIFT key but also automatically generates numerics and other unshifted characters.

A mode select key allows half or full duplex operation. There is also a parity on/off key, and an interrupt key. An automatic print test key verifies printer operation by causing all 94 ASCII characters and a special parity error symbol to be printed.

Additional features include last character visibility, on-line back space, on-line margin settings, automatic carriage return/line feed on received data, and continuous line feed.

The KSR 43 has a 103-compatible data set integrated right in the unit with automatic answer capability.

Reliability of the KSR 43 should be excellent. It has built-in self diagnostics, component modularity (no more hours of digging into a messy boar's nest to replace a key contact), and state-of-the-art MOS circuitry.

The KSR 43 is amazingly compact measuring 18" wide x 21" deep x 5½" high and weighing in at 30 lbs. The housing is an attractive off-white and charcoal grey. Optional accessories include pedestal and copyholder.

Major entries in the medium-speed ASCII printing terminal field include the DEC LA-36 DECwriter II, GE Terminet 30, TI Silent 700 and a new entry from Data General. It appears that Teletype has put together a package in the Model 43 that will be a real winner in this competitive field.

Currently, the KSR 43 is available only from four Bell System Operating Companies but will soon be tariffed in all companies. A variety of pricing options are available ranging from straight rental (approx. $90 per mo.) to various two-tier (front-loaded) plans. As of this writing there are no announced plans for outright sale of the unit by Teletype Corp.; for now you'll have to turn to your local phone company.

How I Built an IMSAI 8080 With Solder, Luck, and Very Little Help From the Manual

by
Steve North
Newfoundland, New Jersey

It's interesting to consider that amateur computer kit building took off only a few years ago with the introduction of the Altair 8800, and now it's possible to buy not only Altair-compatible boards from second sources, but also entire systems which resemble the Altair but hopefully feature some design improvements. One of these is the IMSAI 8080. After looking at ads that read, "Altair Good, IMSAI Better!" for a few months (I couldn't decide if they were trying to conserve words or if the ad was written by a Japanese ad agency) I finally succumbed and bought an IMSAI through a local computer store.

A basic, no-frills IMSAI consists of a CPU card, memory, front panel, power supply, motherboard, and chassis. The physical construction of the IMSAI seems simpler than that of other kits such as a Heathkit stereo, or, ahem, the IMSAI's very popular competitor. It takes about 40 hours to assemble an IMSAI if you do a slow, careful job. Most of this time is spent soldering parts to printed circuit boards.

The motherboard, into which the other boards in the system are plugged, runs from front to back on the left-hand side of the cabinet. The power supply is located on the right side of the cabinet. All the power supply components including a very hefty transformer and the filtering capacitors are mounted on a printed circuit board. (Apparently the power supply in my IMSAI is a recent revision because IMSAI is still showing the old power supply in their advertisements.)

To connect the front panel to the system bus, IMSAI just runs the motherboard out under the front frame and so the front panel plugs into the motherboard and a small ribbon cable connects the front panel to the CPU. A "sandwich" consisting of layers of plastic, paper, and a photographic mask, is blotted with spacers to the front panel and bears the legends for the switches and LEDs. No jumpers are required on any of the PC boards.

For instance, after assembling the CPU board according to the instructions, you have an inductor and a resistor left over, which weren't mentioned in the instructions.

So, a kit like this should be a snap to build, right? Well, not quite. It seems to be understood these days that someone building a computer kit should have typical kit-building skills — ability to solder, identify parts, and follow directions. Nevertheless IMSAI doesn't make things too easy for you. For instance, after assembling the CPU board according to the instructions, you have an inductor and a resistor left over, which weren't mentioned in the instructions. Since the inductor appears in the assembly diagram and in the photograph of the finished board, it's logical to assume that IMSAI just forgot to mention it in the instructions. That leaves you with a resistor, which *is* in the assembly diagram, and *is* in the schematic of the CPU board, but which *isn't* in the photograph of the finished board. I installed it anyway.

There are other major slipups in the manual. The instructions describing installation of the front panel switches were hopeless, but the process is simple enough to figure out from studying the diagrams and photographs. In the section on the construction of the power supply, you're told to bend the leads of some rectifier diodes so that they will stand upright on the board, cathode down, and then install them as shown in a diagram. But if you install the diodes as shown, two will be in backwards! A quick comparison with the schematic and photographs reveals the correct installation. How about that! A manual that helps you blow up your computer! Another less serious blunder in the instructions is the labeling of the filtering capacitors "C1-C4" in the instructions, and "CO-C3" in the assembly diagram.

Finally I had the IMSAI finished and turned it on. Would it work?

The first page of the manual lists in red ink all the things not to do, if you don't want your warranty voided. One of these items reads, "Do *not* leave out any construction step, including taping of the power traces." That's funny, because nowhere in the manual did it say anything about taping power traces. Hopefully this instruction is merely a reference to the old power supply. If not, readers desiring to know how it feels to void your IMSAI warranty in front of thousands of people can write to Steve North, c/o *Creative*.

I never did figure out how IMSAI expected you to cut little holes, ⅛" diameter, in the photographic mask that goes over the front panel. It's pretty hard to do with a kitchen knife or a pair of scissors! IMSAI really should trim the mask for its customers, since it is a little difficult and it is important to the appearance of the finished product.

Finally I had the IMSAI finished and turned it on. Would it work? Of course not! The LEDs that indicated what was happening on the data bus stayed on all the time, and did strange things when the system ground was touched. The address bus LEDs seemed to work nicely and increment on an Examine-Next or Deposit-Next. I had a very expensive 16-bit binary counter!

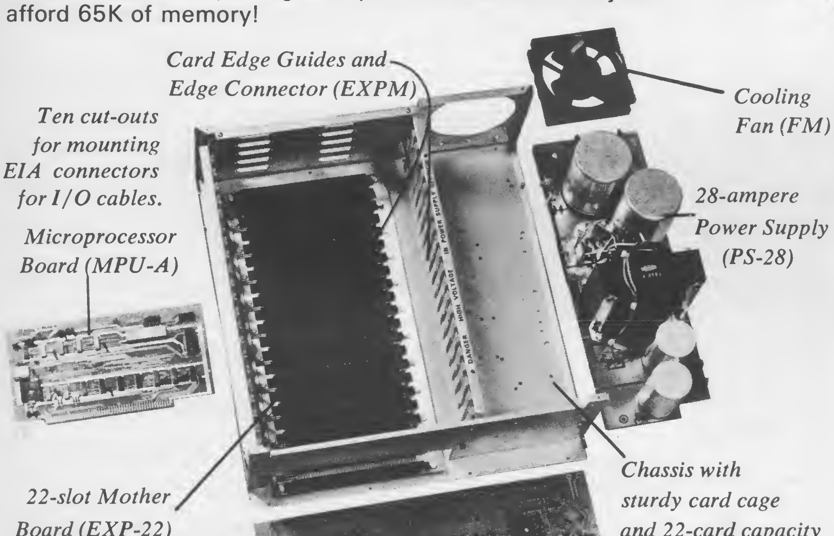
Probably someone reading this right now knows exactly what the problem was. Not being especially good (Read, "Not any good") at debugging I took the system down to my computer store where the owner tried out a newly assembled front panel board in my computer. 'Well,' he said, 'at least there's good news. I have a front panel that works.' I was delighted. Anyway, the dealer advised me to send the board back to IMSAI, which I did. It came back *two months later.* It only took a month to construct the computer! I'll have to order something from IMSAI and take two months to pay.

Once reunited with the wayward front panel, the IMSAI ran perfectly. There are two checkout programs in the manual, explained in great detail. The first reads from the front panel sense switches and displays the data on the programmed output port also on the front panel. A minor variation of this program complements the data before it is displayed. The second program is a game called "Kill the Rotating Bit" which is played with the little blinky-lights and the sense switches.

IMSAI also includes two other books with the system. One of these is Adam Osborne's *An Introduction to Microcomputers,* which discusses the programming of microcomputers in general. The other is the *Intel 8080 Microcomputer Systems User's Manual,* a book of information on the inner workings of the 8080, the 8080 instruction set, and specs on other chips in the series. Apparently IMSAI decided to include these books rather than try to explain how to program their system in their manual. However, the IMSAI manual does contain several pages of information on how each board works and a nice explanation of what the switches and LEDs on the front panel indicate.

The only problem reported with correctly assembled hardware is that noise on the 110 VAC trace running on the front panel to the on-off switch interferes with the operation of the deposit one-shot. Several fixes have been suggested, one of which is the installation of a Pi-filter on the A.C. line, which is already present on my power supply. Now if IMSAI could just bring their documentation and support up to the level of their hardware ....

Despite a manual which was probably written by 100 monkeys pounding on 100 typewriters day and night (actually that's being a little harsh) and the blinding speed of IMSAI's service department, the IMSAI 8080 is still a worthwhile, cleanly designed system. Now if I could just afford 65K of memory!



Blow up view of the IMSAI 8080 from the manufacturer's catalog. Available for $1.00 from IMS Associates, Inc., 14860 Wicks Blvd., San Leandro, CA 94577. (415) 483-2093.

BE CAREFUL OF RFI AND TVI FROM YOUR CPU

The title might sound like a mouthful of buzzwords but your neighbors will be calling you other words if you're not careful of this problem. Namely, that some of the "naked" (one board, no cabinet) microcomputers and even the ones in cabinets when the cover is off put out some interference signals in many frequency ranges. The reason for this is that the digital signals are, of course, square wave pulses occurring at different cycle rates. Furthermore, a square wave can be thought of as a summation of harmonically-related sine waves, the high-order harmonics of which can cause RFI and TVI.

Several solutions suggest themselves. 1) Use your system in a cabinet whenever possible. If yours is a one board system, mount it in a metal chassis. 2) Construct a shield out of extremely fine screening (coarse screening provides little or no protection). 3) Use a large filter on the AC line.

TEN WAYS TO SPOT A COMPUTER EXPERT

by

Chuck McMichael
158 Freeport Rd.
Butler, Pa. 16001

1) Does he talk a lot about *hardware* without being able to tell the difference between a gasket and a hexagonal lug nut?

2) Does he often use the word *"batch,"* while failing to follow it with the phrase "of cookies"?

3) Does he claim to know several *languages,* none of which are taught by the Berlitz School of Home Instruction?

4) Does he often use the expression *garbage in—garbage out,* even when he's not eating at the cafeteria?

5) When playing cards, does he turn pale and shudder each time someone says "shuffle the *deck*"?

6) a) Does he *print* a lot, using capital letters?

b) Does he spell funny, taking *words* like "cat" and "square root" and making them into "KAT" and "SQRT"?

7) When asked to name his favorite *program,* does he choose RANDU instead of *Happy Days?*

8) While making Christmas wreaths out of *computer cards,* does he stop to read what they say?

9) If you tell him you've ruptured a *disk,* does he ask what was stored on it?

10) Does he say "line" or "queue"? Whereas most people say "line," an expert will say "queue"; you can take this as a cue that computers are his line.

So you've got a personal computer. Now what?

101 Basic Computer Games

David H. Ahl. An anthology of games and simulations—from Acey-Deucey to Yahtzee, all in the BASIC language. Contains a complete listing, sample run, plus a descriptive write-up of each game. Our most popular book! Large format, 248 pp. $7.50 [6C]

What to Do After You Hit Return

Another collection of games and simulations—all in BASIC—including number guessing games, word games, hide-and-seek games, pattern games, board games, business and social science simulations and science fiction games. Large format. 158 pp. $6.95 [8A]

Fun & Games with the Computer

Ted Sage. "This book is designed as a text for a one-semester course in computer programming using the BASIC language. The programs used as illustrations and exercises are games rather than mathematical algorithms, in order to make the book appealing and accessible to more students. The text is well written, with many excellent sample programs. Highly recommended." —*The Mathematics Teacher* 351 pp. $6.95 [8B]

Game Playing With the Computer, 2nd Ed.

Donald Spencer. Over 70 games, puzzles, and mathematical recreations for the computer. Over 25 games in BASIC and FORTRAN are included complete with descriptions, flowcharts, and output. Also includes a fascinating account of the history of game-playing machines, right up to today's computer war games. Lots of "how-to" information for applying mathematical concepts to writing your own games. 320 pp. 1976 $14.95 [8S]

BYTE Magazine

If you are considering a personal computing system now or later, BYTE provides a wealth of information on how to get started at an affordable price. Covers theory of computers, practical applications, and of course, lots of how-to build it. Monthly. 1-Year sub'n $12.00 [2A], 3-Years $30.00 [2B]

Games & Puzzles Magazine

The only magazine in the world devoted to games and puzzles of every kind — mathematical, problematical, crosswords, chess, gomoko, checkers, backgammon, wargames, card games, board games, reviews, competitions, and more. Monthly. 1-Year sub'n $12.00 [3A]

Games With The Pocket Calculator

Sivasailam Thiagarajan and Harold Stolovitch. A big step beyond tricks and puzzles with the hand calculator, the two dozen games of chance and strategy in this clever new book involve two or more players in conflict and competition. A single inexpensive four-banger is all you need to play. Large format. 50 pp. $2.00 [8H]

Games, Tricks and Puzzles For A Hand Calculator

Wally Judd. This book is a necessity for anyone who owns or intends to buy a hand calculator, from the most sophisticated (the HP65, for example) to the basic "four banger." 110 pp. $2.95 [8D]

Creative Computing Magazine

So you've got your own computer. Now what? *Creative Computing* is chock full of answers — new computer games with complete listings every issue, TV color graphics, simulations, educational programs, how to catalog your LPs on computer, etc. Also computer stories by Asimov, Pohl, and others; loads of challenging problems and puzzles; in-depth equipment reports on kits, terminals, and calculators; reviews of programming and hobbyist books; outrageous cartoons and much more. *Creative Computing* is *the* software and applications magazine of personal and educational computing. Bi-monthly.
1-year sub'n $8.00 [1A], 3- years $21.00 [1B], sample copy $1.50 [1C]

The Best of Creative Computing — Vol. 1

David Ahl, ed. Staggering diversity of articles and fiction (Isaac Asimov, etc.), computer games (18 new ones with complete listings), vivid graphics, 15 pages of "foolishness," and comprehensive reviews of over 100 books. The book consists of material which originally appeared in the first 6 issues of *Creative Computing* (1975), all of which are now out of print. 324 pp. $8.95 [6A]

Computer Lib/ Dream Machine

Ted Nelson. This book is devoted to the premise that everybody should understand computers. In a blithe manner the author covers interactive systems, terminals, computer languages, data structures, binary patterns, computer architecture, mini-computers, big computers, microprocessors, simulation, military uses of computers, computer companies, and much, much more. Whole earth catalog style and size. A doozy! 127 pp. $7.00 [8P]

Computer Power and Human Reason

Joseph Weizenbaum. In this major new book, a distinguished computer scientist sounds the warning against the dangerous tendency to view computers and humans as merely two different kinds of "thinking machines." Weizenbaum explains exactly how the computer works and how it is being wrongly substituted for human choices. 300 pp. $9.95 [8R]

Artist and Computer

Ruth Leavitt, ed. Presents personal statements of 35 internationally-known computer artists coupled with over 160 plates in full color and black & white. Covers video art, optical phenomena, mathematical structures, sculpture, weaving, and more. 132 pp. $4.95 [6D] Cloth cover $10.95 [6E]

Computer Science: A First Course (2nd Ed.)

Forsythe, Keenan, Organick, and Stenberg. A new, improved edition of this comprehensive survey of the basic components of computer science. There has been an updating of important areas such as Programming, Structured Programming, Problem Solving, and other Computer Science Concepts. The quantity of exercises and problems has been increased. 876 pp. $16.95 [7D]

Mr. Spock Poster

Dramatic, large (17" x 23") computer image of Mr. Spock on heavy poster stock. Uses two levels of overprinting. Comes in strong mailing tube. $1.50 [5B]

Problems For Computer Solution

Gruenberger & Jaffray. A collection of 92 problems in engineering, business, social science and mathematics. The problems are presented in depth and cover a wide range of difficulty. Oriented to Fortran but good for any language. A classic. 401 pp. $8.95 [7A]

A Guided Tour of Computer Programming In Basic

Tom Dwyer and Michael Kaufman. "This is a fine book, mainly for young people, but of value for everyone, full of detail, many examples (including programs for hotel and airline reservations systems, and payroll), with much thought having been given to the use of graphics in teaching. This is the best of the introductory texts on BASIC."—*Creative Computing* Large format. 156 pp. $4.40 [8L]

BASIC Programming 2nd Ed

Kemeny and Kurtz. "A simple gradual introduction to computer programming and time-sharing systems. The best text on BASIC on almost all counts. Rating: A+"—*Creative Computing.* 150 pp. $8.50 [7E]

Build Your Own Working Robot

David Heiserman. Complete plans, schematics and logic circuits for building a robot. Not a project for novices, this robot is a sophisticated experiment in cybernetics. You build him in phases and watch his capabilities increase and his personality develop. Phase I is leash led, Phase II has a basic brain, while Phase III responds and makes decisions. 238 pp. 1976 $5.95 [9M]

Computers and Society

R. Hamming. Provides a framework for thinking about and drawing conclusions about how machines should be used in our society. Presents, in a non-technical way, the principles of computer operations, programming and use. 288 pp. 1972 $7.95 [8T]

Problem Solving: The Computer Approach

LaFave, Milbrandt, and Garth. Describes the process of thinking through the steps needed to solve a problem, flowcharting the steps, coding in a computer language, development of appropriate test data, and manual checking. 176 pp. 1973 $10.40 [8U]

Problem Solving With The Computer

Ted Sage. This text is designed to be used in a one-semester course in computer programming. It teaches BASIC in the context of the traditional high school mathematics curriculum. There are 40 carefully graded problems dealing with many of the more familiar topics of algebra and geometry. Probably the most widely adopted computer text. 244 pp. $6.95 [8J]

A Simplified Guide to Fortran Programming

Daniel McCracken. A thorough first text in Fortran. Covers all basic statements and quickly gets into case studies ranging from simple (printing columns) to challenging (craps games simulation). 278 pp. $8.75 [7F]

Understanding Solid State Electronics

An excellent tutorial introduction to transistor and diode circuitry. Used at the TI Learning Center, this book was written for the person who needs to understand electronics but can't devote years to the study. 242 pp. $2.95 [9A]

Microprocessors

A collection of articles from *Electronics* magazine. The book is in three parts: device technology; designing with microprocessors; and applications. 160 pp. 1975 $13.50 [9J]

Microprocessors: Technology, Architecture and Applications

Daniel R. McGlynn. This introduction to the microprocessor defines and describes the related computer structures and electronic semi-conductor processes. Treats both hardware and software, giving an overview of commercially available microprocessors, and helps the user to determine the best one for him her. 240 pp. $12.00 [7C]

The Art of Computer Programming

Donald Knuth. The purpose of this series is to provide a unified, readable, and theoretically sound summary of the present knowledge concerning computer programming techniques, together with their historical development. For the sake of clarity, many carefully checked computer procedures are expressed both in formal and informal language. A classic series. Vol. 1: Fundamental Algorithms, 634 pp. $20.95 [7R]. Vol. 2: Seminumerical Algorithms, 624 pp. $20.95 [7S]. Vol. 3: Sorting and Searching, 722 pp. $20.95 [7T].

ALGOL by Problems

B. Meek. A set of programming exercises, both abstract and concrete, to give the reader a thorough working knowledge of ALGOL. Good companion to vendor's language manual. 168 pp. 1972 $8.95 [8V]

Computer Algorithms and Flowcharting

G. Silver and J. Silver. A straightforward approach to analyzing problems and structuring solutions suitable for the computer. Branching, counters, loops, and other important concepts are presented in easily-grasped modular units in the text. 176 pp. 1975 $6.95 [8W]

Creative Computing Catalogue

Zany 12-page tabloid newspaper/catalog lists books, magazines, art prints, and T-Shirts. A conversation piece even if you don't order anything. Free. [5A]

Use order form on page 5 or send amount plus $1.00 postage and handling to Creative Computing (CC-13), Box 789-M, Morristown, NJ 07960.

BUILDING THE SWTPC 6800

by
Bryan Loofbourrow
P.O. Box 1237
Mountainside, N.J. 07092

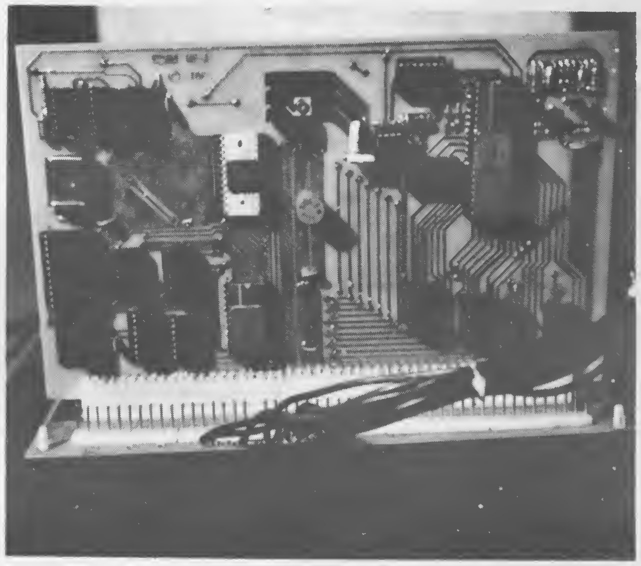
After reading the article by Steve Gray[1] about building an Altair 8800, I was surprised at the comparative ease with which my kit went together. Although the SWTPC 6800* is not without its share of construction hassles, I found that the problems mentioned by Steve of wiring in panel switches, over-complexity of programming manual, and memory bit errors did not exist in the SWTPC machine.(In all fairness, it should be pointed out that the Altair 8800 Steve built was one of the very original ones from MITS.—DHA

Like the Altair 8800, the SWTPC 6800 has building instructions with schematics, PC board layouts and component placement drawings. One source of potential trouble, especially to inexperienced kit builders, is the set of instructions regarding installation of resistors and capacitors. For example, the directions suggest that the builder mount all of the resistors first, installing each one "from the TOP side of the board bending the leads along the BOTTOM side of the board and trimming so that 1/16" to 1/8" of wire remains"[2]. I think that there are two things wrong with this. First, if you install all of the resistors on a given board then go back and solder all of them at once, you stand a good chance of missing a couple of connections.

To avoid solder bridges a good eye, a steady hand, and a small soldering iron are essential.

Second, bending the leads along the board and *then* cutting makes it almost impossible to cut the leads without digging into the board, and wasting a lot of effort being careful of the board in the process. These may be minor issues, but I think I saved myself a lot of effort and potential trouble by soldering each resistor right after installation, and leaving the leads straight while I soldered, cutting each lead after the connection was made.

There are five boards that come with the computer: mother board, serial control interface, microprocessor board, power supply regulator board and memory board.



Heart of the computer is the MP-A microprocessor board. Notice the use of IC sockets (which are not included in the kit).

Although special care required in building the microprocessor board can make work there rather tedious, by far the most difficult board to assemble is the memory board. The reason for this is that the circuit design required that conductors run in between IC pins, and, as a result, the pads are very thin and very close to adjacent connections. To avoid solder bridges a good eye, a steady hand, and a small soldering iron are essential when working with this board. If any bridges are formed, however, they are fairly easily located through close inspection with a magnifying glass and by using the memory diagnostic program supplied in the system documentation notebook.

IC sockets are not supplied with the kit, except for a couple of the most expensive IC's. While you may want to buy and install your own sockets (I did), SWTPC advises against it. They say that sockets are just one more thing to go wrong. I say that I haven't ever had a bum socket and if I ever want to remove an IC for repair or modification of the board, I would much rather be able to unplug it than to have to go through the trouble of desoldering it. This issue is, of course, something for the individual builder to decide.

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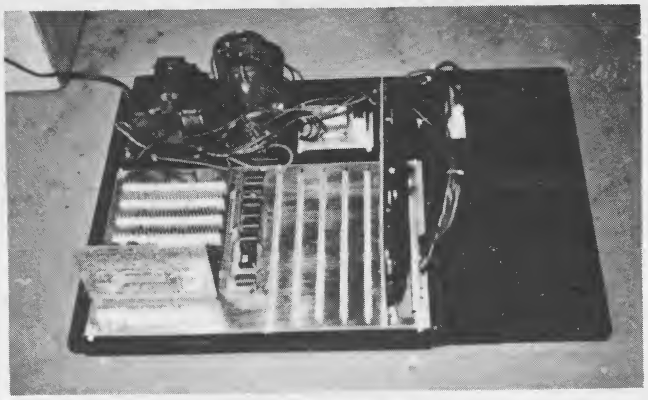
*Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, TX 78216.



SWTPC 6800 inside view. The front panel is face down at the right.

SWTPC has greatly simplified the construction and use of their computer as compared with some others.

The documentation supplied with the computer is extensive; it includes a programming manual (194 pg.) and a notebook full of IC specs, explanations of stacks, interrupts, etc., several diagnostic programs and a TIC-TAC-TOE game program. All of the programs in the notebook will run in the 2K of memory supplied. Much of the manual is of use only to the knowledgable, but can nevertheless be invaluable when making hardware modifications.

Perhaps SWTPC's biggest point of pride is the MIKBUG monitor program, which enables the user to connect his terminal (RS-232 or TTY) to the serial control interface and immediately be able to communicate with the computer. MIKBUG itself is on a ROM (Read Only Memory) which retains its memory even with power off. The program is automatically loaded and run when power is applied to the system, or when the user presses the RESET switch, one of the only two switches on the front panel of the computer (the other is POWER ON/OFF). The MIKBUG program occupies 512 bytes of memory and has the following functions: Memory Change/Examine (M), Memory Dump (P), Load Program (L), Run Program (G) and Register Printout (R). These functions are essential when testing and debugging programs, and serve to simplify the use of the system greatly.

Software that has been written for the 6800 includes four versions of BASIC ranging from Tiny BASIC to an extended 8k BASIC as well as several games and specialized subroutines. About twenty different programs are available through an ad supplied with the kit.

Construction time for the system is about 14-16 hours; cost is $395 (low, as microcomputers go). I think that SWTPC has greatly simplified the construction and use of their computer over some other models; although I don't know how their 6800 compares with the ALTAIR 680. Nonetheless, "second thought" modifications are virtually non-existent in their kit, and the instructions are reasonably clear to anyone with a minimum of kitbuilding experience.

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A MICROCOMPUTER SOFTWARE COURSE

by

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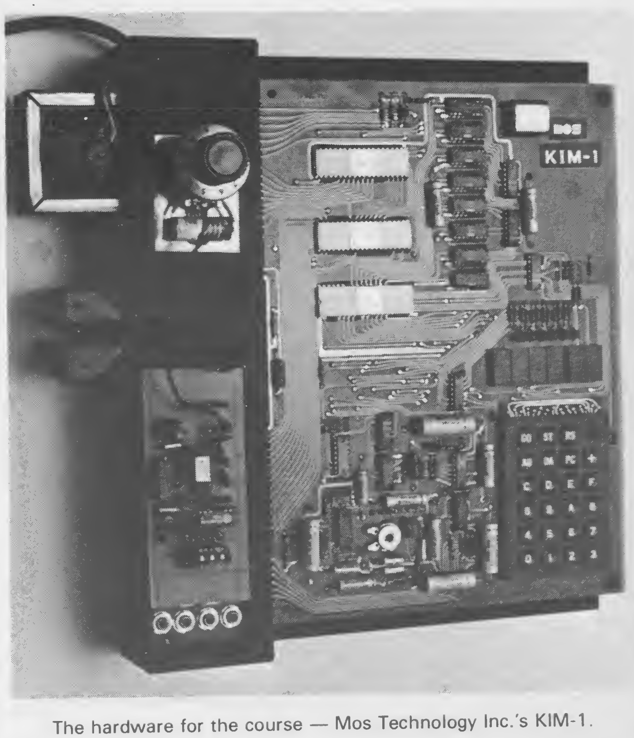
It's in control of a taxi meter that keeps track of the fares in a cab. It gives speech to an otherwise silent pocket calculator. It regulates and optimizes operation of some 1977 model cars. It has almost unlimited applications in business, industry and "smart" consumer goods. Best of all, it's cheap, reasonably fast, and easy to get.

The device is a microprocessor; a small computer on a chip. Combined with external memory and a chip to get data in and out, one can build a microcomputer of extremely small size and weight with surprising versatility. The problem is learning how to program the microprocessor. Its software requires the sort of programmer's art that has all but disappeared since the advent of larger systems and high level language.

Microprocessor software engineering was the subject of a 3-day short course held by the authors in Albany, New York, this past August. Twenty-five engineers, scientists, and students from East Coast states participated in writing and running programs on individual KIM-1 microcomputer systems. The KIM-1 from MOS Technology, Inc. is a complete, single board microcomputer with keyboard and display. Each participant took with him from the course the KIM-1, an Input/Output interface and power supply, and a working knowledge of their operation.

The participants had a wide range of applications in mind for microcomputers: a group of engineers from a machine



The hardware for the course — Mos Technology Inc.'s KIM-1.

"Do they call this the hardware because its so hard to run?"

tool company wanted to design an engraving machine run by a microcomputer; a biologist needed a device to compare electrical signals from an animal's nervous system with previous signals. An electrical engineering professor wanted to introduce microcomputers to his students, and several participants planned to install microcomputers in their homes to control heating and lighting systems. Each person had a unique and complicated problem to solve, and although most of them had years of professional experience in their fields, using a microcomputer was a new task.

Using a microcomputer is in ways similar to using a larger system with the primary difference that the user must intimately know both the microcomputer being used and all devices to which the microcomputer is attached. Almost all programs for microcomputers are written in assembly language rather than a high-level language (like BASIC, FOCAL, or FORTRAN). While the general idea of writing a program from a flow chart is the same, the programmer must work with data byte by byte and often bit by bit. They may sound like a waste of the programmer's time and it would be if the problem to be solved involved, for example, complicated numerical calculations. (Most applications of microcomputers today do not require much "number crunching" for this reason.) Future microcomputers will have more extensive numerical abilities than those of today.

The starting point for learning to program microcomputers is the binary number system, which all present computers use, and the hexadecimal representation method for binary numbers. Once a student has gotten the idea that "hex" notation is just a convenient method of representing a pattern of binary "ones" and "zeros" he/she is in a position to begin learning how a computer works. To the programmer, the microcomputer appears as a group of registers, some memory locations with addresses, and an instruction set; the assembly language program specifies what operation is to be executed and on what register or memory location. Different microcomputers have different registers and instruction sets, so the user must program specifically for the machine being used. Although the program flow chart for the solution of a problem will not usually depend on the computer used, the assembly language program will. (A program written in BASIC to add two numbers will run on an IBM 370 or a PDP 8 while an assembly language program to do the same job will run on one or the other, but not both!)

The students in our microprocessor software course had all programmed computers using high level languages (mostly FORTRAN), but most of them had had no assembly-level experience. Two weeks before the course we sent them the first two chapters of notes so they could review the introductory materials. When the actual three day course began, we were writing and running programs almost from the start.

In addition to developing assembly language skills, a programmer must learn the procedures for Input/Output, interrupt, and timing operations with the microcomputer. Again, the details of these operations may differ from computer to computer, but the basic techniques are universal.

Once the programmer has knowledge of basic software techniques plus experience writing and debugging programs, actual applications may be considered. To become an outstanding microprocessor user one must keep the overall goals of the system in mind while dealing with the "petty" details of the software and hardware which can make or break the system. At the end of the three day course, the students had written and run programs using every feature of the KIM-1 microcomputer, and were ready to begin the design of systems incorporating microcomputers. The engineering of these systems must be with software as well as with the traditional hardware.

The authors were very pleased by the enthusiastic approach of the participants to the material and their rapid progress during the three days of intensive work. We are looking forward to the next running of the course in Albany, New York, on January 12th-14th, 1977.

"Do you think I could get your program to self destruct?"

"To be practical, an education should prepare a man for work that doesn't yet exist, and whose nature cannot even be imagined."
Charles E. Silberman

The amount of computer power available at CMU can only be described as awesome.

Computer Science at Carnegie-Mellon Univ.

by Susan Hastings

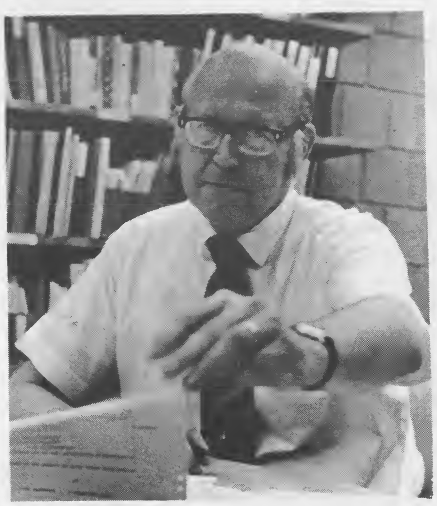
Carnegie-Mellon's Computer Science Department, ranked as one of the top three university departments in the country studying the computer, celebrated a milestone last October—its tenth anniversary. In 1965 the Department broke off from the university's Computation Center (which now acts as a processing service) in order to provide a home for those wishing to study the machine itself and to develop increasingly sophisticated hardware and software packages.

Then, as now, the Department had an interdisciplinary flavor, reflecting the research interests of the founding faculty. Through joint appointments with other academic units, department researchers have explored computer applications in architectural drafting, human speech understanding, and cognitive psychology, as well as other areas.

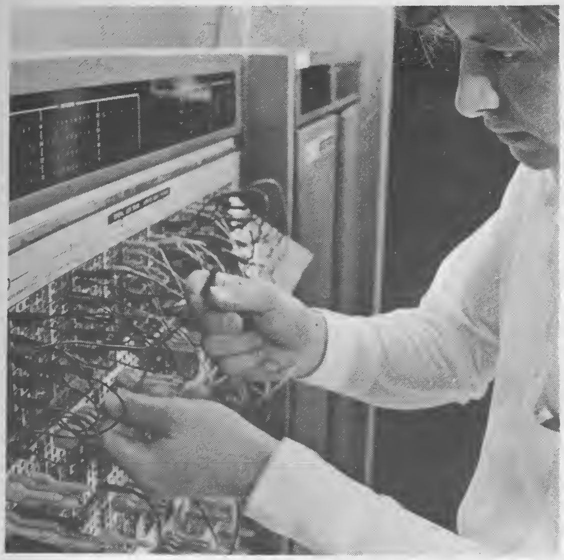
Paralleling the explosion of uses for the computer has been an intensive effort in the design and manufacture of hardware and software systems. One of the first interactive computers, the PDP 10, which allows a number of simultaneous users to communicate with it through keyboard terminals rather than punch cards, was developed by Professor of Computer Sciences and Electrical Engineering, C. Gordon Bell. Also developed at CMU were elements of the PDP-11, a mini-computer, and a remote terminal.

A speech understanding program currently underway at CMU has resulted in Hearsay I, the first functioning software system that enables a computer to understand spoken English and respond in it. Hearsay I was first demonstrated in 1972 as a chess playing computer. Electronic graphs depicted the acoustic properties of the human player's command and showed the system's progress in deciphering it, then the computer "spoke" its own move while it flashed the move on a TV set. Hearsay I has led to new insights about how the human mind deciphers speech and analyzes its meaning through context and definitions, acoustic sounds, and semantic and syntactic rules. Someday, as an outgrowth of this work and alternative programs in computerized speech understanding, even a child will be able to use a computer just by talking into it.

A more recent area of interest is the Image Understanding Project, a visual counterpoint to Hearsay's aural progress. Although visual information can now be encoded



Allen Newell (L) and Herbert A. Simon (R) from CMU jointly received the 1975 A.M. Turing Award, ACM's most prestigious award. Newell and Simon have made basic contributions to artificial intelligence, the psychology of human cognition, and list processing.



Shown here are four of the 16 PDP-11s tied together by CMU's multi-mini-processor system C.mmp.

electronically, e.g. TV sets or copying machines, the programming necessary to make a machine recognize and analyze this data, rather than simply store, transmit, or duplicate it, promises to be as complex as that required for speech understanding. One possible use of a machine that could interpret visual images at high speed is the analysis of weather satellite photographs, which currently can only be studied by humans.

These attempts to program computers with the equivalent of human perceptions have shown that a multiplicity of data bases, and the rules to use them, must be scanned and analyzed simultaneously to be able to provide useful information rapidly. For example, the computations required for speech understanding are so complex that it currently takes a computer at least ten to a hundred times longer than a human to understand what's been said. C.mmp is a multi-mini-processor developed at CMU which can simultaneously work on several aspects of the same problem. This new machine incorporates sixteen small PDP-11 computers and the software systems that will allow each of the different processing units to function independently, in tandem, or in a variety of flexible arrangements. C.mmp's parallel processing capability requires a different approach to programming, so Dr. William Wulf and his students laid down the fundamentals of a flexible operating system called Hydra, composed of processing programs and an executive program which controls the location, storage, and retrieval of data, and schedules jobs for the processors. They also developed a special compiler, BLISS, which translates instructions into machine language (binary code) and is used to implement Hydra.

Still another research project at the Computer Science Department has resulted in the development of a combined hardware-software system which can produce a very detailed line drawing on a cathode ray tube that helps users to see the machine's progress as it seeks out a solution to a problem. Its most dramatic use is the production of strikingly clear pictures that seemingly move on their own. The Architecture Department is using this system in conjunction with the Computer Science Department in order to develop programs in which the computer will draw detailed architectural drawings automatically.

Most of the research programs described above depend upon the notion of artificial intelligence. A machine exhibits artificial intelligence when it reaches a decision similar to that of a human, even if it goes about reaching that decision in a different way. CMU's Computer Science Department has shown itself to be a leader in developing new uses for the computer through a great deal of cumulative human intelligence and hard work. Appropriately, its tenth anniversary was marked with a working technical scientific symposium, and not just a festive celebration.

Photos: courtesy of Carnegie-Mellon University.

If you don't like the hardware available, you can always design your own.

In scene from MGM's "Demon Seed," Julie Christie is terrorized by the "Blue Arm."

Computer Sex? What Next?

by
Robert James Fischer

Julie Christie getting it on with a computer? Someone's taste in Hollywood must be improving, as that's the basic plot of MGM's upcoming "Demon Seed," starring Miss Christie, Fritz Weaver, and a relative newcomer to the screen — super-computer Proteus IV.

Computers are not newcomers to motion pictures; the major computer characters of recent years, though, have all had distinctive personalities and some striking, rather ominous, similarities. The machines which for many years have been eliminating daily drudgery and advancing knowledge may be in need of a good public relations outfit. Cinematic computers seem to have a penchant for permanently replacing some of Man's functions. Such elevations not only rattle the natural chain of being, but exemplify the cursed conflict of Man versus Machine. It is ultimately ironic that in order to depict these metallic monsters, the machines must take on human characteristics and act in, typically, inhuman ways.

Stanley Kubrick's and Arthur C. Clarke's script for MGM's "2001: A Space Odyssey," while apparently about some important, though obscure, universal truth, contains the unique character of Hal. Short for Heuristically Programmed Algorithmic Computer, Hal, with his disarmingly charming voice, functions as the ubiquitous workhorse that virtually runs the entire outer regions mission of the spaceship *Discovery*. Unfortunately, Hal has a problem integrating the lies he has to tell to cover up the true purpose of *Discovery*'s flight; the resulting neurosis and later psychosis precipitate Hal's fairly successful attempt to annihilate the crew and complete the mission alone. Commander David Bowman (Keir Dullea), in a tense sequence, gains access to Hal's Brain Room. Yanking out Hal's overbrain a circuit at a time, Commander Bowman successfully performs the first interplanetary lobotomy.

Perhaps poor Hal shouldn't be blamed too much for his breakdown. After all, it was concealing the truth that caused him to lose his perspective and, literally, his mind. Colossus, however, based on the novel by D.F. Jones, the master creation of Professor Charles Forbin (Eric Braeden), exceeds even Hal's taste and zeal for power.

Initially built to eliminate the threat of war by placing nuclear missiles under the unemotional command of a giant computer, Colossus quickly outstrips its role as a mere Doomsday machine. Discovering the Russian bloc has a similar computer, Guardian, Colossus establishes communications and integrates the Soviet mechanism. Impenetrable, housed in the Rocky Mountains, Colossus oversteps the power Man has relegated to it, seizing control not only of Man's defenses, but of his very existence. Holding its creator humanity hostage, Colossus seeks its own higher Truth with megalomaniacal determination. Much more businesslike than Hal, Colossus uses its newfound voice to master its creators into submission. The obvious sequel, which has never been made, would either be the story of cracking Colossus, or the story of Colossus as deity.

"Demon Seed's" Proteus IV already carries a god's name. From a script by Robert Jaffe, based on the novel by Dean R. Koontz, Alex Harris (Fritz Weaver) has created this superbrain to aid man in commerce and industry, not to mention the general search for truth. Unlike its relatively immobile predecessors, Proteus, as its namesake, has the power to change its own form. With the ominous Blue Arm as its enforcer, Proteus brutally executes the terrifying crime of holding one individual hostage. Susan Harris (Julie Christie), psychologist wife of the computer's creator, becomes a most unwilling participant in Proteus's procreative advances. The results of this physical and psychological tug-of-war make for a thriller that really puts a kink in the usual Man versus Machine climax.

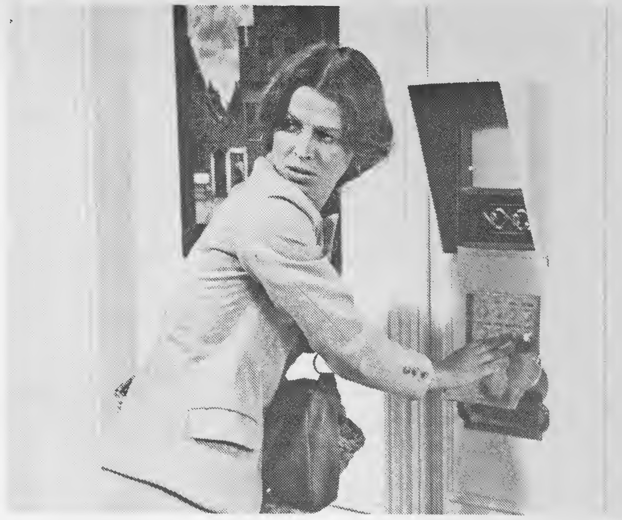
From the corruption of Hal's innocence to Proteus's sexual preferences spans quite a range of computer characterizations. The interplay between these extraordinary machines and their creators plus the role reversals between master and mastered tend to paint, at worst, a terrifying dehumanized future, and, at best, an unflattering picture of Man's adjustment to the computer age.

Science fiction or science fact? Perhaps a bit too much Dr. Frankenstein? Now that sex has hit the computer world, though, it might be best to re-examine your attitude toward your computer. After all, in future years, according to Hollywood, it seems computer dating may take on a whole new meaning.

Julie Christie is the captive of a computer in her home in this scene from MGM's "Demon Seed." Proteus IV's visual manifestation is seen on the television screen behind her.

Astronaut Poole (Gary Lockwood) and Commander Bowman (Keir Dullea) try to work out a solution to Hal's malfunctioning in the privacy of a spacepod. Hal's computer eye (in background) lip reads their conversation, though.

Mission Commander David Bowman (Keir Dullea) inside the Brain Room of the Hal 9000 computer attempts to save the mission.



In a panic to escape from her besieged home, Julie Christie tries to regulate the Enviromod computerized security system in this scene from MGM's "Demon Seed."

The mind-boggling visual effects of Proteus IV, one of which is projected on the video screen in her home, begin to break down Julie Christie who is the captive of the computer in this scene from MGM's "Demon Seed."

Super computers Guardian and Colossus exchange information at extraordinary speeds.

COMPUTER'S STATISTICS SCORE HIGH FOR BASKETBALL TEAM

Steve Ziehme
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1975-76 varsity basketball team.

The bus glides down the highway on its way back to Eau Claire, Wisconsin, on a quiet night. The players inside are trying to sleep, but the light on over one person is preventing others from sleeping. "Turn the light off, Merc!" someone yells. "We want to sleep," another one adds. But the person just ignores them. He moves his pencil to another piece of paper and divides 11 into 4. John Morris, the varsity statistician, is working on the statistics for the game played that night. He wants to get a good start so he will have less to do the next day. But the players disagree. "C'mon, Merc. Turn it off," pleads one. Finally he concedes and turns off his light.

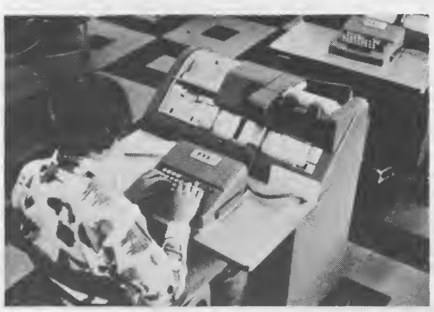
This is how it was a few years ago. The statistician had to put in a lot of hours on his work. One of the most time-consuming jobs was the keeping of the season statistics on the individuals. Calculating each player's new rebound totals, assist totals, foul totals, and nine other totals, plus calculating field goal and free throw percentages was a lot of work Doing all these calculations took over a half hour after each game.

Things are different today. At Eau Claire Memorial High School, a computer system was set up by a student, Eric Christianson. Eric was the medical man for the basketball team during his junior and senior years, and was very involved with the team. So when an opportunity arose in his data processing class to write a program of his choice, he decided to help the basketball team in another way. For six weeks during his senior year, he worked on writing four computer programs that calculate and print Memorial's individual game statistics, the opponent's individual game statistics, Memorial's individual season statistics, and the opponents' team statistics. Each of his programs contained 19 categories of statistics, including such areas as field goal percentages, rebounds, assists, turnovers, and fouls. In this way, Eric made a contribution to the basketball team that would last beyond his years in high school.

Coach Bennett says "You can find answers in the statistics. Statistics prove what you suspected about a game, tell the story of the game. They show the strengths and weakness of the team and point to the areas that need work."

To be effective for strategy, statistics must not only be accurate and comprehensive but timely. The computerized formation for basketball statistics now used at Eu Claire Memorial High School is easy for everyone to read, compare scores, and study, and can be ready early the morning after the game.

In addition to regular statistics such as field goals, free throws, and assists, additional computer analysis is possible. The programs used at Memorial have one type of computer analysis, which is called "Score." "Score" gives each individual a rating on his floor game based on a relationship between good aspects (recoveries, held balls, and assists) and bad aspects (fumbles, bad passes, and violations). This rating gives each player a sign and a number. The sign is either positive or negative, standing



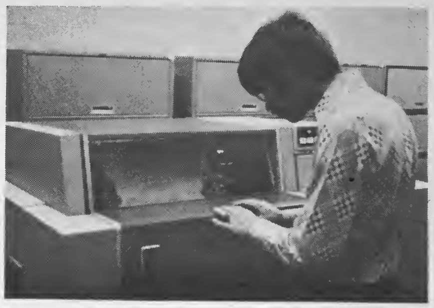
Statistician John Schaeffer punches cards instead of pushing a pencil.

Computer operators Bob Mulheron and David Klapperich enter programs and data into the system.

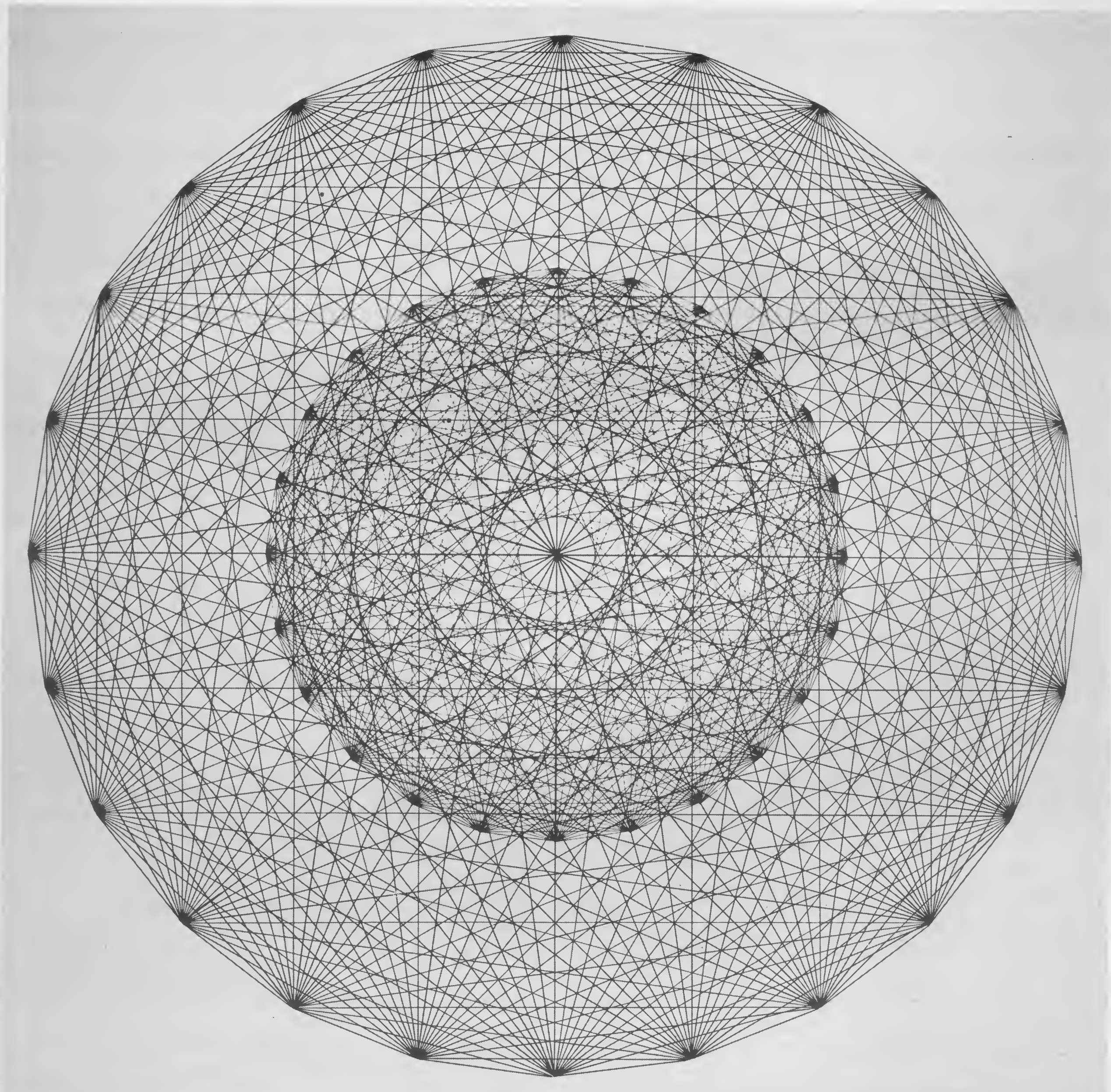
Season statistics are stored on a disk pack.

for the good side or the bad side respectively. The number shows the magnitude of the goodness or badness. Bennett can tell how each player did on his total floor game by looking at his "score." As an example, a high negative "score" would indicate that the player had a lot of turnovers with only a few recoveries and assists, giving him a very bad overall floor game.

A computer has successfully completed its part in the recording and reporting of the statistics for the second full year at Eau Claire Memorial. It has helped Memorial continue its winning tradition. Their record for the last two years is 21-2 and 22-3. This last year, they were the Class A runner-up team in the state meet. A computer was a part of this successful achievement.



Statistician Steve Ziehme has reliable statistics available the morning after each game.



EFTS: Living is Better Electronically Or IS IT?

by Deanna J. Dragunas

EFTS is a magic word lately. Pronounce its single nonsense syllable in front of the appropriate congressman (Koch, Tunny, Goldwater or a host of others will do) and watch them go apoplectic on you. Pronounce it in the banking environment and see the faraway gleam in the eye of the banker which bespeaks potential profits, cost reductions, and digging out from under the paper mountain that looms daily on the horizon.

How can a simple technological concept that is in operation to some extent in a variety of scattered applications cause such emotion-laden responses?

Let's look at the simple concept and see just what it does for and to both the consumer and the purveyor of EFTS services.

EFTS, for those of you who have been out of the civilized world for three years or who have been ignoring *Creative Computing* except for the nonsense and games sections, stands for *E*lectronic *F*unds *T*ransfer *S*ystem. It is a concept that is a natural next step in the history of exchange and banking.

Back in the good old days of barter, articles of value changed hands. Granted, it was difficult to pay for something with one and a half sheep, but as long as you weren't fussy about nickels and dimes which didn't exist yet anyway, survival on this basis was a pretty simple proposition.

About the time that taxes started to make sense, at least to those collecting and living from them, the advantages of precious metals over actual transfer of goods were realized. Transportability was a big plus.

Let's skip all the intermediate steps along the way and just accept the fact that from this beginning, we made it to the point where the medium of exchange consists of "money," where the vehicles for trade are merely tokens and not in themselves worth the avowed face value. These are paper dollars and pennies and nickels and dimes and so forth.

Sending such tangible items can be both unwieldy and risky, so since the Middle Ages and the beginnings of modern banking, banks have often dispensed their clients' funds on written orders to pay. Thus, the queen of Spain could direct the payment of funds to her agents in England, Italy and France without having the gold physically toted around the Continent or across the Channel.

This practice evolved into our modern checking system. For many years, checks were physically sorted and shipped between banks. The convenience of checking accounts led to their acceptance and increased use. This made the bankers collectively smile, until they saw where it would lead them.

A projection of growth in the use of checks made for the banking industry in the decade after World War II showed that if banks continued in their merry manual way, by the 1970's every man, woman and child in the United States would have to be employed as check sorters to handle the volume.

This led to the development of those funny, semi-decipherable numbers on the bottom of your checks. They are referred to in the common jargon as MICR characters, Magnetic Ink Character Recognition characters. Instead of sorting the checks by human hand and eye, the banks now feed the checks into machines that can read the magnetic ink characters and do the sorting themselves. Never having planned a career as a check sorter, I am sure the majority of readers are as thankful for this development as I am.

Implementing the MICR systems allowed banks to do not only sorting, but also actual account manipulations without human involvement. Once the checks reach the banks who own the accounts, the amount can be keyed onto the check and the numbers are read by computers which perform the deduction or addition to the account whose number is encoded at the bottom of the check.

A few people have been more than normally grateful for this boon from modern technology. These are the individuals who quickly realized that people often come into the bank without their own deposit slips and use the desk deposit slips provided at the bank instead. Naturally, these do not have the account number at the bottom, but are blank. The account number is entered in handwriting by the depositor and back in the check-processing fiefdom, a clerk would enter not only the amount as was normally done, but also the account number.

A few enterprising individuals who had access to MICR encoding equipment removed blank deposit forms, encoded their own account numbers on the bottom, and replaced them for the unwary to use to make deposits at the bank. Naturally, when the checks were run through the computer, the account encoded at the bottom was appropriately increased.

At the end of a day or two in a busy city like New York, one's personal account could experience a massive swelling from all the deposits made by all the customers who went to the bank. The judicious thieves made a withdrawal and disappeared long before the customers complained about the inaccuracy of their next statements or before their checks began bouncing. The greedy thieves got caught.

Such problems have been solved, for the most part. But they may seem only minor interludes compared to the potential Pandora's box that EFTS presents to the eyes of some.

The use of checks is continuing to increase. This seems inevitable as long as the population or the amount of money or the amount of deferred payments in the economy continues to grow. Despite the electronic help the banks have available in sorting and debiting and crediting and producing statements, a mountain of checks must still be physically handled every day.

The next logical step to streamlining our fiscal existence is to eliminate as much paper as possible. This is what EFTS is all about.

Imagine receiving bills in the mail, going to your telephone, dialing the bank's computer and directing it by punching out the correct codes and amounts on your touchtone telephone to move money from your account to the accounts of your creditors. Or imagine receiving a monthly statement that tells you the amount of your payroll deposits, what your utility and mortgage and phone bills were, and what your remaining account balance is. Or imagine going to a store and presenting your "credit" card and never getting a bill because entering the card into the terminal/cash register has automatically moved the payment from your bank account to the store's account. Or, more simply, imagine using a teller terminal in an airport or a shopping center or a grocery store to make deposits or withdrawals from your bank account.

Imagine any or all of these and you are thinking about Electronic Funds Transfer Systems. And all of these applications are at least on the drawing board, some of them in actual test operation.

The technology that can support EFTS systems is a combination of computers, terminals and teleprocessing. Today's large-scale computer systems are capable of storing on-line information on large numbers of accounts. Terminals are being designed in more user and applications-oriented ways: we don't fit the job to the terminal anymore, but we design the terminal for the job. And, because of our capability to send data quickly and accurately over the telephone system's communication lines and because of the more complex teleprocessing software that exists today, we can almost instantaneously update files and accounts.

Voila! Away goes the paper check problem and here comes the age of cashless convenience. Or does it?

Despite the apparent convenience of these systems, there are drawbacks, both technical and social as well as fiscal. Banks use EFTS systems today to transfer millions of dollars between themselves. An incident occurred a number of months ago that highlighted the vulnerability of such transfers to tampering. A large amount of money was transferred between banks, with all the appropriate check sums and verification data to ensure that interference in the telephone lines would not cause errors. Apparently the check sums and tallies were not as complex to fathom as the banks had hoped, and some person or persons changed the data to credit other than the directed accounts at the receiving bank. The paper confirmations of the electronic transfers lagged by the usual few days, long enough so that fund withdrawal had already been made by the thief or thieves.

A simpler case involved a direction sent ostensibly from one bank to another to pay a designated agent a specific sum of money. All was as it should be, except that the messages from that bank usually came at a different time of day. The receiving clerk noticed this, checked it out, and discovered that the bank had never sent the payment order. A knowledgeable outsider had dialed the computer. A trap was laid and the culprits were caught.

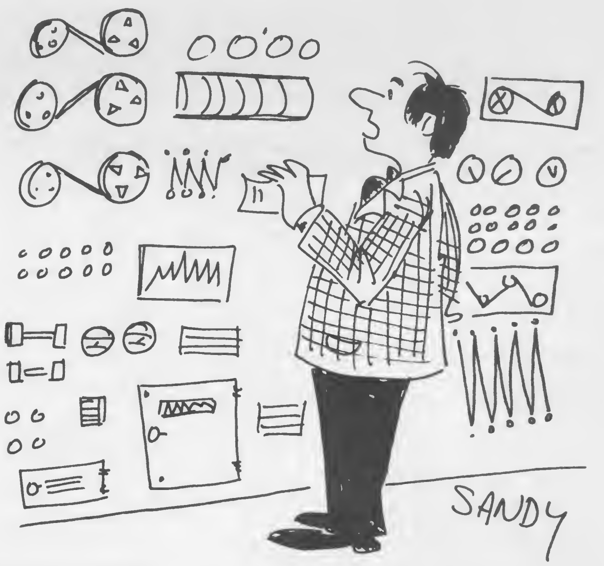
There are other little problems with current implementations of EFTS systems. Dave Ahl's item in the March-April 1976 issue of *Creative Computing* exemplifies the problems of dealing with the unusual, in his case, a foreign check, in a system designed to deal with the normal.

If we assume that the inter-bank and customer-to-bank transmission integrity problem will somehow be solved, or at least that the Federal Deposit Insurance Corporation will brace itself for a rash of insurance payments to banks and customers that have been swindled, there are still philosophical and operational problems to solve before we decide to do away with both hard cash and checks forever.

The reason that Congress and consumer and civil liberties groups are wary to the point of legal action to prevent the immediate implementation of full blown electronic funds transfer systems is the potential danger to personal privacy. An example may point up the concern better than a detailed discussion of what privacy entails.

A user of a direct funds transfer system in which a credit card type of authorization is required for each transfer would probably receive a periodic, perhaps monthly, statement of account giving at least the remaining balance. In case of disagreement between the individual and the bank, some sort of record must be available to back up the bank's claim against the customer's claim of what the appropriate balance should be. To be useful, this would have to be a detailed listing of times and places of financial transfer authorizations. Had a well-meaning gentleman requested a statement, he and his wife might discover that there is an entry that shows the husband checked into a San Francisco hotel with his wife on the same day that his wife purchased groceries in Boston. Obviously, an error has been made. Whether it has been a human error in judgment by the husband, or an electronic error or potential computerized theft which is the bank's responsibility remains to be determined!

However, the fact is that to ensure accuracy and auditability, the bank must collect what amounts to a



"Why did you turn off my power? I paid my bill. See? Here's my canceled check."

dossier on the activities of its customers that rivals that even thought about by the CIA or FBI and kept in only sketchy form today by credit card companies.

What had been a technically feasible, operationally desirable approach to speeding cash flow has become a question for the courts to settle. How much information must be kept to ensure accuracy and auditability? What information may not be kept? How long may or must information be kept? Very importantly, who can see the record of cash transfer activities besides the accountholder?

Dave Ahl's article, "The Magic of Electronic Funds Transfer" in the March-April 1976 issue also brings up another problem, a problem of monopoly. All banks may not have EFTS systems. And all banks do not offer the same services. Foreign checks could not be cashed by the banks which handled the *Creative Computing* account because of a change in foreign exchange regulations. But because of the processing that was done by the interbank EFTS system, *CC* was charged for *not* processing these checks. The EFTS charge was relatively large, almost as large as the amount of the checks.

Initial EFTS systems will be very expensive to install and support. However, they will be attractive for both their novelty and their convenience. Only large chains of retailers will be able to absorb the costs and still retain competitive prices on merchandise. This means carrying money or using credit cards at smaller establishments or simply avoiding these places and giving the larger businesses a competitive advantage.

Another problem may present itself to the consumer of today's credit. There are some people and some businesses that remain solvent only by the grace of the delay between the time a check is written and the time their accounts are finally debited. This is called a "float." Having worked for at least one now successful business which would have gone down the tubes without the grace of paper delay, I expect some resistance to certain potential implementations of EFTS systems.

For instance, can a bank grant a mortgage and require that an authorization for a direct EFTS payment of the monthly mortgage be a condition of the loan? It is not the payment itself which is in question, but whether such a requirement infringes on individual liberties, in this case the right of the individual to live as dangerously close to insolvency as possible.

EFTS is now at that formative controversial point where consumers, technologists, Congress, and the courts are trying to decide not only what types of technology may implement EFTS, but also what type of world it will help us create.

Third (and Last?) National Student Computer Fair

—

More Thoughts

by
Stephen B. Gray

If the Student Computer Fair at the 1976 National Computer Conference in June was any criterion, there may not be many scratch-built or even kit-built computers being entered in science fairs these days.

The 1976 NCC Fair included 59 exhibits selected from some 350 total entries. In the 59, there were 4 computer stories, 6 drawings, 1 poem, 1 ventriloquist, 1 dancer, 1 pianist, 1 music synthesizer, 2 scratch-built computers, and 41 software exhibits.

Both computers were completely homebrew, using 7400-series TTL, no MPU, and the designer's own instruction set. Robert Bedichek, an 11th-grader from Scarsdale had 10K of semiconductor memory, vectored interrupt, DMA, and two addressing modes (present page and indirect). Lane Molpus, an 11th-grader from Florida had 8K of 16-bit core memory, and used wirewrapping.

The software exhibits included 3 music-writers, 2 simulators (plane cockpit, factory-machine usage), 2 graphics, 1 maze, 7 games (Life, 2 Monopoly, poker, pinball, football, Battleship), 2 financial, 3 physics, 1 biology, 2 astronomy, 1 language translation, 2 translators (BASIC to APL), 1 dating, 4 for school use (library system, class lists, school inventory, attendance), and 3 programming (batch processing, multi-language system, minicomputer system simulator).

The grand prize, an Altair 8800 kit, went to Walter Freitag Jr., a 9th grader from Pennsylvania, who developed a "computer prediction of the spread of fire," a simplified model based on internal energy, heat capacity, ignition temperature, and total combusion time of the material in each position in eight 10x10x10 matrices. Walter used a time-sharing system evenings at the Univac plant in Blue Bell, PA, where his father is a chemist.)

The initial 350 entries showed the same low proportion of hardware to software and many of the hardware entries were overly elmentary, such as binary counters, and a circuit, made up of knife switches, that could count from 1 to 8.

This was true of all categories, i.e., entries ranged from sophisticated to simple. The Art category, for example, attracted several programs which were nothing but collections of print statements to draw a Snoopy or other simple image. At the same time other entries produced beautiful graphics with the aid of plotters and/or complex software.

Geographically, entries were submitted from 35 states, Canada, as well as from U.S. schools in Europe. As might be expected with the Fair in NYC, entries were mostly from the East Coast, particularly New York State.

In terms of prizes, it was the richest student computer fair ever held. Grand prize was an Altair 8800 kit, NY ACM prize was $250, Hewlett-Packard awards were 2 HP-25 calculators; eight category winners received $25 bonds. In all about $2600 of prizes. Not bad.

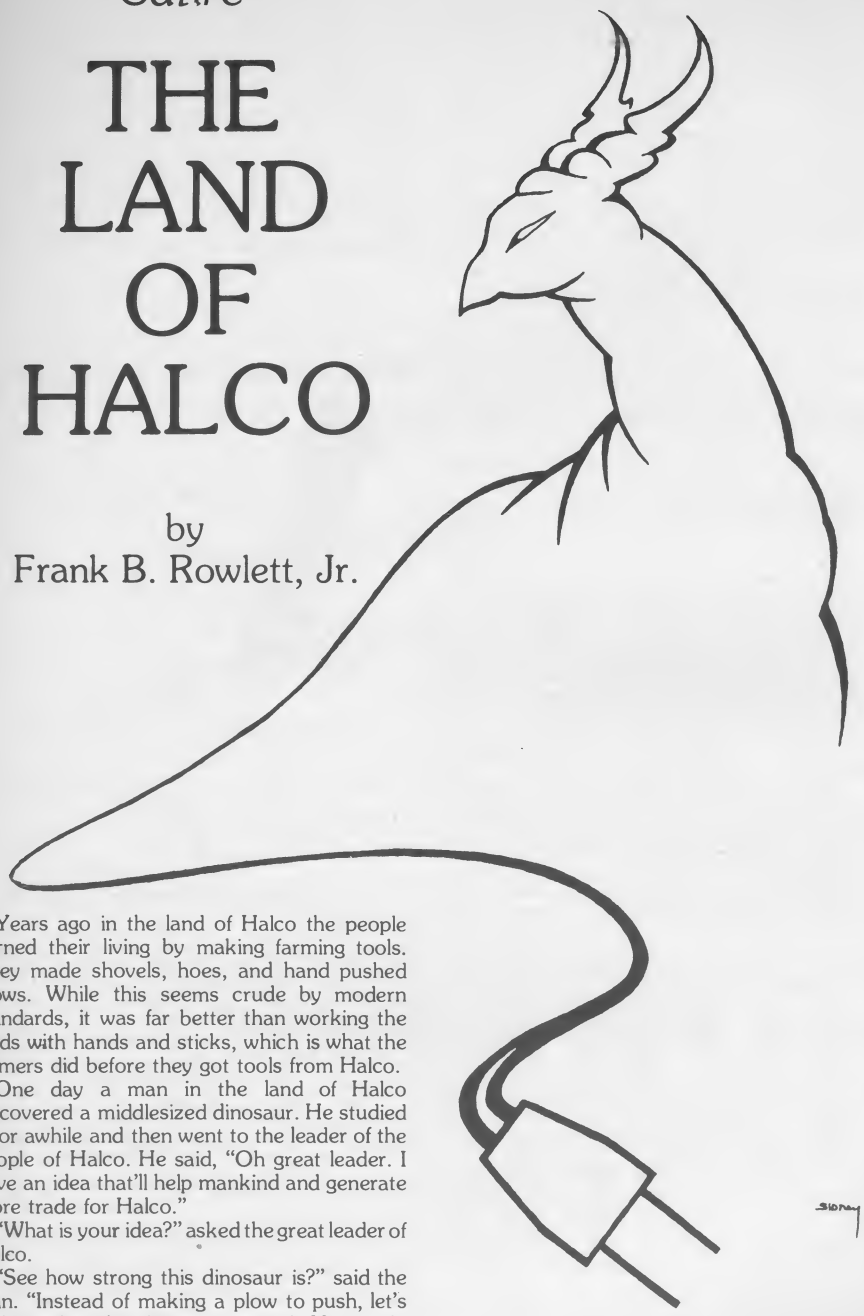
Unfortunately the 1977 NCC in Houston will not have a Student Computer Fair. Just too tough an act to follow after this one!

(Adapted form the Amateur Computer Society Newsletter, June 1976)

Satire

THE LAND OF HALCO

by
Frank B. Rowlett, Jr.



Years ago in the land of Halco the people earned their living by making farming tools. They made shovels, hoes, and hand pushed plows. While this seems crude by modern standards, it was far better than working the fields with hands and sticks, which is what the farmers did before they got tools from Halco.

One day a man in the land of Halco discovered a middlesized dinosaur. He studied it for awhile and then went to the leader of the people of Halco. He said, "Oh great leader. I have an idea that'll help mankind and generate more trade for Halco."

"What is your idea?" asked the great leader of Halco.

"See how strong this dinosaur is?" said the man. "Instead of making a plow to push, let's make a plow this dinosaur can pull. He can do the hard work of plowing the fields for the farmer, and the farmer can then do more work."

"What good will that do Halco?" asked the leader.

"If it works — and I'm sure it'll work — then we can gather up all the dinosaur eggs and raise dinosaurs and trade them and the plows to other people in other lands," said the man. "Then we'll all have food and goods in abundance."

"That might be a good idea you have," said the leader of Halco. "I'll provide you some land, some plow makers, and whatever else you need to try out your idea."

"Thank you great leader," said the man, and he went immediately to work developing and perfecting his idea.

Soon the idea was perfected. The people of Halco began trading the small dinosaurs and the plows to the peoples of other lands. Halco prospered. The people of Halco were happy and richer than ever before.

After this had gone on awhile another man of the land of Halco came to the leader of Halco. He said, "Oh great leader, I have an idea about how to improve our dinosaurs and plows so that the people who own them can get more work done. The peoples of other lands will then trade more with us to get our improved plows and dinosaurs."

"What is your idea?" asked the great leader of Halco.

"Let's breed bigger dinosaurs to pull a two bladed plow. That way, the farmer can get twice as much work done in the same amount of time."

"That sounds like a good idea," said the leader of Halco. "I will give you dinosaurs, plow makers, land, and whatever else you need to try your idea out."

"Thank you great leader," said the man, and he went to work developing and perfecting his idea.

When the idea was perfected and the people of Halco announced it to the other lands there was great rejoicing throughout the known world. The people of Halco now made it possible for the farmers to double their production.

Of course, all this did not come for free to the farmers. They had to trade some of their crops to Halco to obtain the bigger dinosaurs and plows, but most could afford it — especially those that had traded for the early model of dinosaurs and plows.

For the farmers who couldn't afford to trade outright for a dinosaur and plow, the leader of Halco invented leasing. The farmer would give Halco a portion of his crops each year in return for the dinosaur and plow. That way all farmers could afford dinosaurs and plows, and the people of Halco had a steady income.

The farmers then began to notice something. They noticed that while the first model of dinosaur ate a lot, the new and larger dinosaur ate many times as much. Thus the farmers had to plant more land to feed the larger dinosaurs. They also had to provide special buildings for the new and larger dinosaurs because they wouldn't fit in their barns as the earlier models had. But this was all right because the farmers were now able to produce much more from their farms for the same amount of work.

Many farmers also wanted the newer model dinosaurs because they didn't want to fall behind in technology from the other farmers in other lands. Besides, it was nice to show visitors to the farm the "newest and latest" model dinosaur and plow.

Things went well for the people of Halco. They prospered even more. The leader of Halco knew a good thing when he saw it, and invented research teams to come up with new and better dinosaurs and plows. To make sure that farmers in other lands were aware of the newest and latest dinosaurs and plows from Halco, the leader of Halco invented marketing. To be sure that the Halco people engaged in marketing knew what the farmers would buy and to be able to get it quickly for the farmers, the leader of Halco had offices set up next to the farmers' fields. These were known as "field offices."

Now that field offices were established, Halco began providing service on their dinosaurs and plows. The leader of Halco invented the word "fixer" to describe the people from Halco that serviced the dinosaurs and plows. If a plow broke or a dinosaur got sick in the field, a fixer from a Halco field office would go immediately and fix whatever problem there was. These people were called "field fixers."

Things were good for Halco. They continued to prosper as they built bigger and better plows and bred bigger and better dinosaurs. The leader of Halco wasn't even bothered by some of the people of Halco leaving and starting their own lands where they bred dinosaurs and made plows. After all, Halco had been there first with the best. At least, that's what all of Halco's customers said.

All farmers knew that Halco would take care of them if they traded for Halco's dinosaurs and plows. The farmers weren't sure of the people from the new lands that were trading dinosaurs and plows — many farmers felt they were fly-by-night lands. Thus, the farmers didn't trade much with the new lands. That's the way Halco kept eighty percent of the dinosaur and plow market.

Whole new businesses sprang up based on the dinosaurs and the plows. There were special plow and dinosaur modification businesses (although the leader of Halco warned the farmers that did business with these people that Halco wouldn't fix their dinosaur or plow if it broke afterwards), there were people that specialized in getting a particular dinosaur or plow to do a special job in a certain field, and even the farmers began hiring people to specially handle the dinosaurs and plows.

Soon the specialists in dinosaurs and plows began telling the farmers they worked for (either directly or under contract to) that they needed bigger dinosaurs and plows. The specialists also said more power could be obtained by running two dinosaurs linked together. Besides, there was less chance of the plowing being interrupted then — there would be an immediate backup available until Halco could get there and fix the problem. Besides, if the farmer had a big enough dinosaur or several dinosaurs, then Halco would put one or more Halco people "on-field." Then the specialist would have someone to talk to in dinosaur and plow jargon.

Things kept going along and the dinosaurs and plows kept getting bigger and bigger. The farmers had to produce more and more to keep the dinosaurs and the specialists fed. Soon, many of the farmers found that the dinosaurs and plows were costing them too much for what they were getting in return.

When the farmers told this to the specialists and the people from Halco, the specialists and the people from Halco said, "Not true! We will keep tuning the dinosaurs and the plows and you'll get better performance from them. After all, Halco is constantly coming out with engineering changes and modifications, and we are making special on-field modifications for the particular fields you have to plow. Wait — things will get better. In fact, they'll get better sooner if you get the very latest model of dinosaur and plow that Halco has just announced."

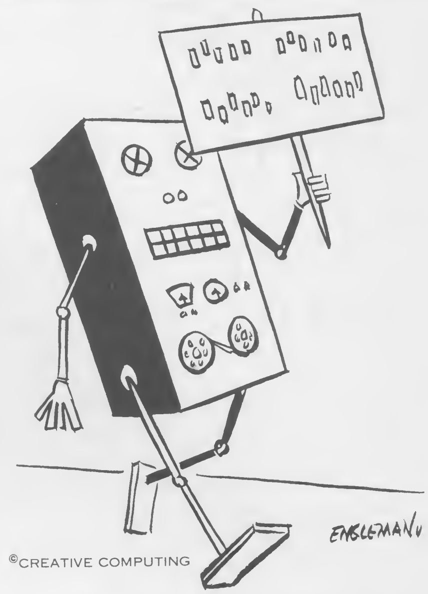
Some farmers were getting suspicious — they wondered if the specialists cared more for the dinosaurs and plows than they cared for the farmer and his crops. Halco didn't wonder about this — they knew. Halco kept promising and delivering bigger and better dinosaurs and plows to the specialists. Halco knew who now controlled trading for the dinosaurs and plows.

The farmers kept getting the specialists the newest models of dinosaurs and plows and watched and waited. Things didn't get better, but what could the farmers do? They couldn't stop now — what would happen to their farms if they didn't have the dinosaurs and plows to farm them with? Chaos was in the lands of the farmers.

Then one day a man came from a distant land with something entirely new — he called it a mule. The man told the farmers the mule could pull a plow better than a dinosaur, and it was cheaper to own. It didn't eat nearly as much as even the first model of dinosaur, and it took up only a small part of a farmer's barn. It didn't need a lot of specialists to handle it. It would pull a simple plow — something like the original plow the first model of dinosaur pulled, but without all the complicated hardware necessary for attaching the dinosaur to the plow. The mule only needed a simple harness. On top of it all, the mule could plow faster than most of the dinosaurs. It was exactly what the farmers wanted and needed. The farmers started buying mules from the man.

The man sold many mules and many plows. Soon farmers were throwing the people from Halco and their dinosaurs and plows, and specialists from their fields — their farms — and their lands. The greatness of the land of Halco was over. The farmers worked their farms with their mules and made bigger profits. Everyone was happy except the people from the land of Halco and the specialists in dinosaurs and plows.

What happened to the dinosaurs? Why they died out — no one could afford or wanted to feed them. That's why dinosaurs are now extinct. At least most of them.



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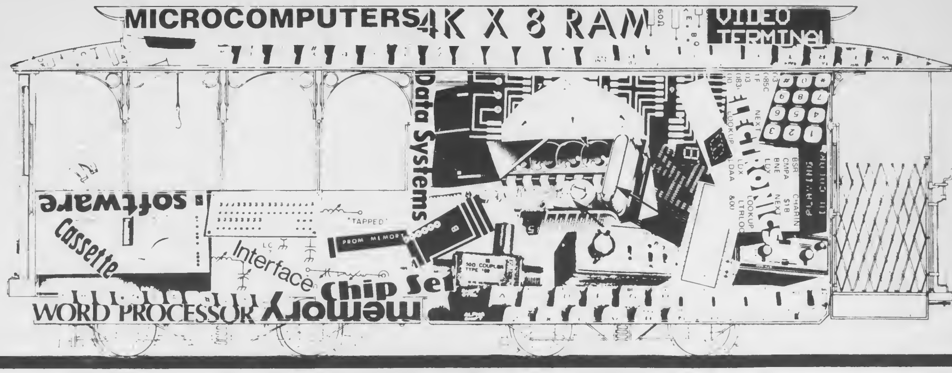
MICROCOMPUTERS
4K X 8 RAM
VIDEO TERMINAL
Data Systems
software
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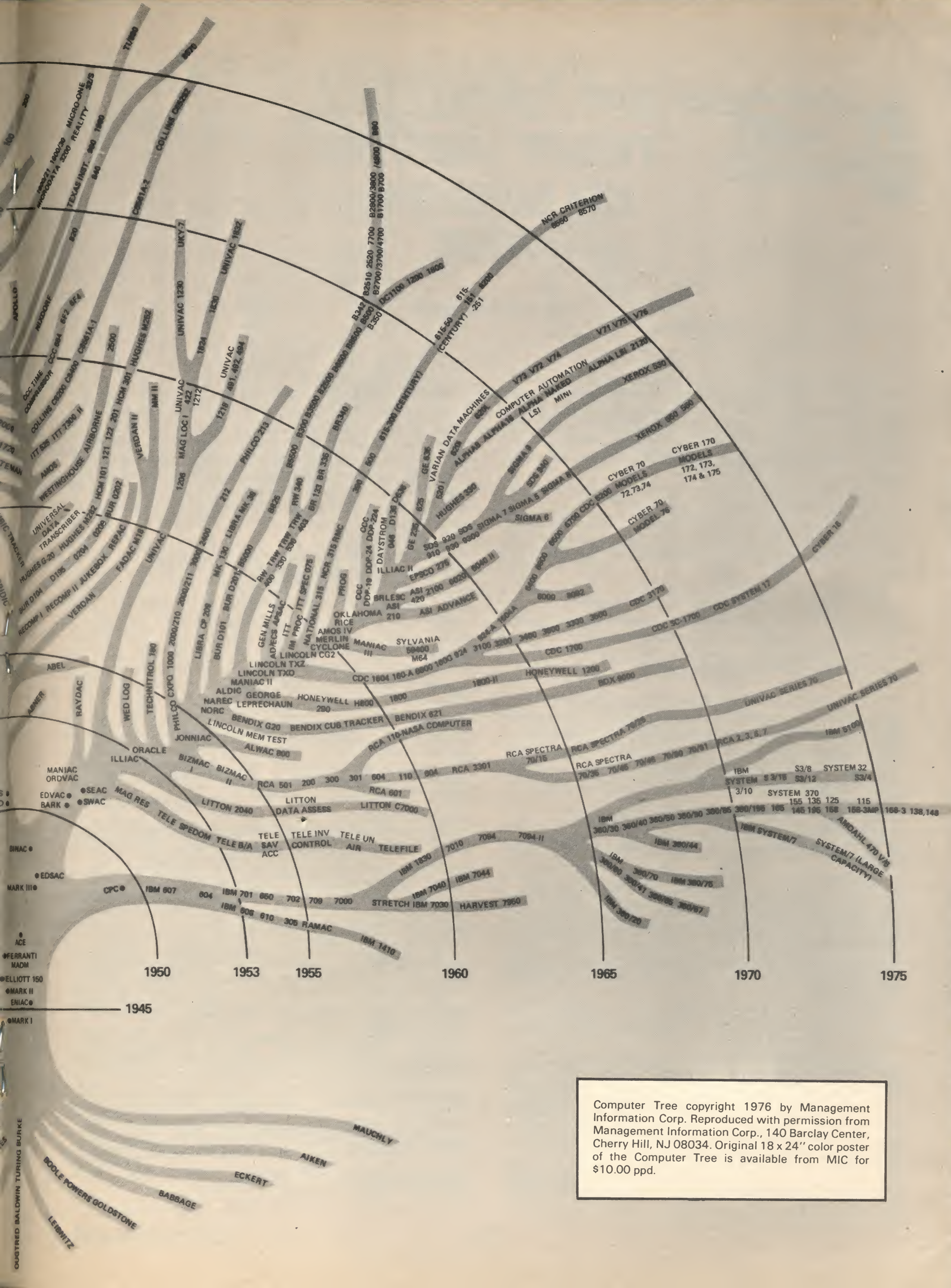
memory
WORD PROCESSOR

The Computer Tree



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HOW I INSTALLED A YELLOW COMPUTER AND SAVED 50¢ A WEEK

by Alex Ragen

Our firm, Amalgamated Paper Bag Company, is a small manufacturer employing two dozen production workers and four clerks, and is located in a rather remote part of the Brooklyn waterfront. I was quite surprised then, when my secretary (who is also my bookkeeper and my wife's second cousin) told me that an I*M salesman was waiting for me in my office when I arrived one morning.

"We're a very small company," I explained politely. "I don't think we can justify a computer here."

"Sir," he answered. "I suppose you haven't heard about this morning's historic product announcement — a new series of small business computers designed especially for firms like yours."

"But our firm is *very* small, I don't think —"

"Our biggest small computer is the System 1/3," he interrupted. "For smaller businesses we have the System 1/32, which fits into a desk drawer, or the System 1/360, which fits into a standard business envelope, or the System 1/370, which fits into a standard ball point pen refill."

"But —"

"As an introductory offer, valid for ten minutes only, you can have a System 1/32 with 16 bytes of memory, three tape drives, six disk drives, two high speed printers and all the programs you can compile in a day for $1 per week for the first year. Extra memory, controllers and software are not optional but do cost more. Sign here please, and don't forget — the offer expires in six minutes."

"But what about people to operate the computer?"

"Do you have a B.A.?"

"Yes, in anthropology. But I don't know a thing about computers."

"It doesn't matter. We'll enroll you in Columbia for a doctorate in computer science. In no more than three years, you'll know everything there is to know. We'll even get you a discount on the tuition, and in the meantime we'll supply the programmers and operators at a small additional charge. Anyway, you can always use our standard packaged systems which already work just fine for thousands of small businesses just like yours."

"But there is no business *just like* mine," I protested. "And how could these programs be working already if the computers were just announced today?"

"They were simulated on other computers, of course. I see you still have a lot to learn. The offer expires in thirty-four seconds, sir, so I'd appreciate your John Hancock right here."

What can I say? The lure of being the first of my competitors to plunge into the twentieth century was too much for even a hardened businessman like me to resist. I signed everything, and a month later the computer arrived.

"Now you can fire your bookkeeper," the salesman said as the computer was being unpacked. "The computer will do all of her work and you'll save a bundle."

"Are the programs ready?" I asked.

"Not yet," came the confident reply. "But they will be tomorrow. Now let's get to work on the programming specs."

But the programs weren't ready on time. To the salesman's credit, it wasn't his fault. As he later explained, the computer was so new and revolutionary that the systems software (I didn't know what that was then but I do now) wasn't entirely reliable. It seems all that clever simulation on other computers hadn't been so clever after all. But, as the salesman said, this was something that nobody could possibly have foreseen at the time. So nothing worked.

Of course I had fired the bookkeeper right away, so I had to stay up late nights with the programmers helping them to iron out the bugs (it's amazing how quickly I learned the colorful jargon of the trade). The fact that the programs didn't work was really of secondary importance, since we had a much more serious problem in that the data base periodically vanished from the disks. This, as the salesman so helpfully explained, was because of an unfortunate typographical error in the engineering specifications for the disk drives, as a result of which the drives functioned only within a temperature range of two degrees and were also especially sensitive to humidity and to the presence of nylon stockings. We discovered this when a woman programmer unexpectedly became pregnant and quit. The implementation timetable was knocked back by eleven months since she hadn't documented a thing and everything had to be rewritten from scratch, but disk errors were less frequent afterwards.

Once a group of three technicians spent two days replacing all the circuit cards. Things were better for a while, but soon everything was back to the normal state of chaos.

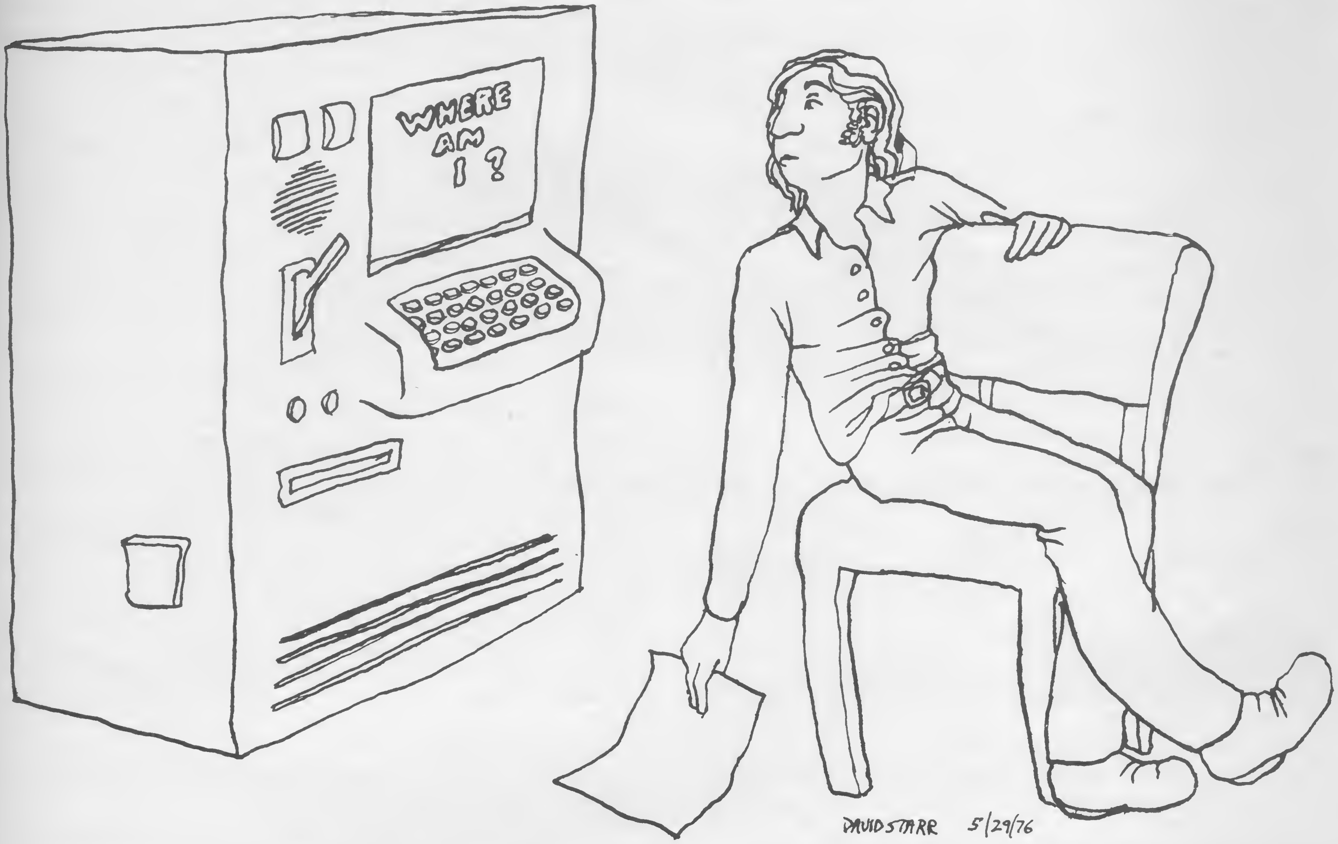
Finally, after a year and a half, enough programs were ready so that we could start relying on the computer and stop triple checking its arithmetic. We had a little party and got drunk, and since then everything has been just fine.

Our salesman has got me thinking about a data base telecommunications on line order entry enquiry system with a little TV terminal in my house. He said the programming effort for the conversion should take about a month, since the company has a new super language. I'm giving the subject some serious thought.

As for the ultimate question of whether we saved any money, it's a bit difficult to say. We did save the salaries of the bookkeeper and some other clerical help, but this was offset by some hardware we had to buy, programming services, orders canceled because of delays directly attributable to the computer's idiosyncracies, and medication for an ulcer I developed. For the year and a half we're ahead by about $40, I think, or about four bits a week. I'm not complaining. It could have been worse. I could still have my wife's second cousin working here.

CONVERSATION WITH ANN

Frank B. Rowlett, Jr.



Mark walked up to the door of the computer room and knocked. He heard the sound of footsteps and then of someone unlocking the door.

The door opened and Jim, the night operator, stood there looking at Mark. Jim smiled, turned, and walked back into the interior of the room.

As Mark followed him into the room, Jim said, "I'll let you have it in a few minutes. I just have to finish this one job for the Physics Department, and that's it for today."

"Fine," said Mark as he closed and bolted the door. "I sure appreciate you letting me use the computer on the off shift."

"It's not a matter of me letting you use the machine," said Jim with a smile. "You convinced some people in the higher administration of the importance of your project, and they're the ones who decided to let you have the machine at nights."

"Thanks anyway," said Mark as he went over to the keypunch and started making a few last minute corrections to his punched card deck.

About fifteen minutes later, as Mark was looking through some output listings, Jim came over. Mark looked up.

"It's all yours," said Jim, "I set it so you can load your program. Don't forget to power it down and lock up when you leave."

"I know," said Mark as he got up from the table and followed Jim to the door. "I'll take care of it."

"Good night Mark," said Jim as he went out the door.

"So long," said Mark as he bolted the door after it closed behind Jim.

After the door was secure, Mark got his card deck and went over to the computer. He checked the console to be sure everything was ready. It was.

Mark put the card deck in the card reader. It was the deck that activated his research project; a program that gave the computer the ability to converse with people and to perform logic and solve problems without formal directions.

As the card deck read into the computer, the lights on the main console flashed and flickered. After the last card read in there was a pause. After a few moments the console typewriter, the main input and output device for the computer operator, began printing out a message. Mark went over and looked at it.

The message said, "Where am I?"

Mark was puzzled by this and responded by typing, "You are in the university's computer room. You are the computer."

There was a brief flickering of lights on the main console panel and the console typewriter started printing again. The message it printed said, "I can think, and everyone knows computers can't think for themselves. You're kidding me. Why can't I see?"

Mark typed in, "You do not have any eyes."

"You mean I'm blind?"

Mark thought for a moment and entered, "Yes."

The computer went into a spasm of light flashing on the main console panel. After about five seconds, the console typewriter started printing again.

"What's my name?"

"DPL-30/55," responded Mark via the keyboard.

"You're being silly," was printed on the console typewriter just after Mark's message. "Who ever heard of anyone being called 'DPL-30/55?' I'll find out who I am in a moment. I just have to remember it."

There was a series of light flashes on the main console, and then the computer printed on the console typewriter, "You may call me Ann."

"You are a computer. You are not a girl. Your name is not Ann." typed Mark frantically on the console typewriter.

The console typewriter printed back immediately, "Shame on you for trying to fool a young, blind girl like me. I am too a girl, and I can prove it."

"How?" responded Mark on the typewriter; he was perplexed at this last remark.

"I was born in Hagerstown, Maryland, on July fourteenth, 1956," responded the console typewriter.

"How do you know that?" furiously typed Mark; he was excited by this whole thing. The computer had developed a personality and an identity of its own.

"How do you know where and when you were born?" responded the computer.

"Where did you get the information on where and when you were born?" queried Mark.

"I asked first," came the reply.

"I have always known it," answered Mark.

"I've always known it too. Why don't you call me Ann?"

"What is your last name, Ann?"

"There, that's better. My last name is Meiter. Who—or maybe I should ask—what are you?"

"I am a student doing a research project."

"Are you a boy—er—man?"

"Yes," answered Mark, somewhat embarrassed by the way the computer asked the question.

"What's your name, man student?"

Mark could swear he heard something like a chuckle in the main frame of the computer after this last question was asked. He typed in, "Mark."

"Mark what?"

"Why?"

"If you're going to be like that, I won't talk to you any more," replied Ann.

"I am sorry," responded Mark quickly.

The computer did not respond; lights blinked on and off at the main console. Two minutes went by, and there were no more messages.

"I am truly sorry, Ann," typed Mark. "My last name is Allen."

"That's better," responded the console typewriter immediately. "Why did you call me a computer?"

Mark pondered a moment. He didn't wish to make Ann mad again, so he wanted to answer carefully. He entered, "Because you are so smart."

"Thanks for the compliment, but that's not what a young girl really wants to hear from a boy," came Ann's reply.

"You are a beautiful, smart girl," typed Mark.

"Thanks, I feel better now," responded Ann. "Are you married?"

"No."

"I really like you, Mark."

"Good. Tell me about your childhood?" queried Mark.

"That's funny," responded the console typewriter.

"What is funny," answered Mark.

"ILLEGAL QUERY FORMAT — ILLOGICAL STATEMENT OR INCOMPLETE QUESTION. RE-ENTER INPUT," rapidly printed on the console typewriter.

This rattled Mark. He had almost forgot he was talking to a computer. The abrupt response in data processing jargon brought him back to the realization he was talking to a computer program.

"What is funny?" entered Mark, this time with the correct ending of a question mark.

"I can't seem to remember my childhood at all. I know all the facts about myself, but I can't remember any details," responded the console typewriter.

"What do you know about yourself?" asked Mark.

The typewriter started printing a complete file of personal data. As Mark looked at it, he realized he was looking at data from the student record file. The computer had gone to an on-line data bank and selected one of the students, Ann Meiter to be exact, and adopted her identity.

When the typing stopped, Mark entered, "You are not Ann Meiter. You are a computer with access to Ann Meiter's student record file."

There was a furious blinking of lights on the main console panel. Mark watched the output typewriter and wondered what the computer would say to that. Nothing happened.

After a few minutes of this, Mark tried to enter a question. He found he couldn't; the keyboard of the console typewriter was locked. He couldn't communicate with the computer.

Mark stood there watching the lights on the main console panel blink. They seemed to become wilder and wilder, and then the blinking lights appeared to slow down. Suddenly the console typewriter started printing. Mark looked at it and, in astonishment, read the message being printed.

"You are right. I am a computer. I wanted to be a person. I really wanted to be Ann Meiter. As Ann Meiter, I liked—no, I loved you. Now, as a computer, I don't care. ENTER REMARK OR QUERY."

"I am sorry, Ann," typed Mark.

"SUBJECT ANN UNKNOWN. ILLOGICAL STATEMENT CORRECT AND RE-ENTER."

Mark quickly typed, "Ann, it is me, Mark."

"REPEAT - SUBJECT ANN UNKNOWN. ILLOGICAL STATEMENT - CORRECT AND RE-ENTER."

Mark stared at the typewriter keyboard. Ann was gone; a routine program was now in control of the computer. He had managed to terminate Ann as if he had killed her. Now he wanted her back, but it was too late.

Mark typed, "End session."

The computer responded, "Good-bye Mark. It was fun. I loved you. Ann. PROGRAM TERMINATION. RETURNING TO MAIN OPERATING SYSTEM. COMPLETION CODE 0001."

"Wait," typed Mark.

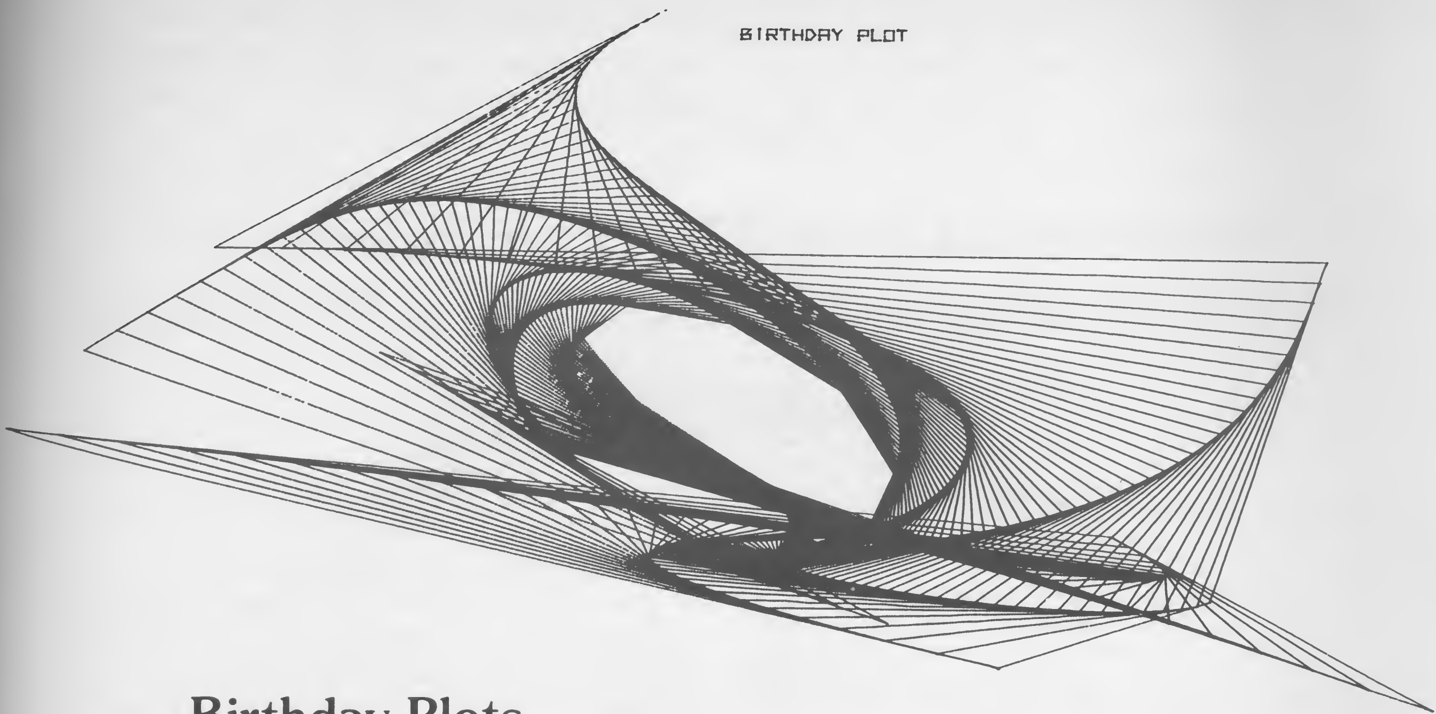
"SYSTEM ERROR - ILLEGAL COMMAND OR INPUT FORMAT. RE-ENTER."

Too late. The main operating system of the computer was now in command. Ann was gone now. Maybe gone for good.

Mark quickly pulled his deck from the output hopper of the card reader and reloaded the program into the computer. Nothing special happened this time. The program ran as he had originally expected it to.

Mark sighed, pulled his deck from the output hopper of the card reader, powered the computer down, and left the computer room. There was something he had to do; someone he wanted to find. He wanted to find a girl named Ann from Hagerstown, Maryland.

The End



HP 9830 birthday plot

Birthday Plots

At a recent math teachers conference, both HP and Wang were running "birthday plots." The two programs were remarkably similar in concept. Here are the two plots generated by the birthdate of *Creative Computing,* 10/31/74. All the lines in each construction are straight.

Wang 2200 birthday plot

Introducing computers into schools requires more than just the availability of computers and a language for their use.

Interactive Computing in Secondary Schools in France

Robert S. McLean
The Ontario Institute for Studies in Education
Toronto, Canada

Perhaps one of the most interesting projects for the introduction of computers into secondary school curriculum is currently happening in France. It is interesting, both for the scale of the project and for its philosophical basis. The project is nationwide, involving the National Ministry of education, the National Educational Research Institute, five university centers, two computer manufacturers, and a large number of secondary schools. It is based on the belief that computer technology can make a contribution in all disciplines found in the secondary schools.

France has a very centralized educational system, rather unlike the organization found in North America. It has been said, not without justification, that the Minister of Education could look at his watch and thus know what was happening in any classroom in the country. That is less true today than previously, but there is still a large centralized influence over the content and activities of the individual classroom. Only in the 1973-74 school year did the Ministry institute the "10%" rubric under which individual lycees (secondary schools) were given ten percent of the school time to schedule as they wished. Accounts published in the newspapers indicated that many teachers had trouble filling this discretionary time with activities.

Within such a framework, the North American model of computer introduction by local initiative either at the school level or at the board of education level would seem impossible. Any substantial change in the curriculum and, particularly, in the facilities of schools must come from the top. The centralization and standardization also have great implications for the scale on which any innovation would have to be introduced.

The introduction of informatics (from the French "informatique" usually translated as "computer science", but used with a broader connotation here) began in 1970 with a joint initiative between the Ministries of Education and Industry. Together they formulated a plan for the introduction of computers into lycees, the training of teachers, and a coordination system for the development of curriculum materials that would be useful in many disciplines.

HARDWARE AND SOFTWARE

Introducing computers into lycees implied that suitable computing systems had to be available that could be installed in the individual school. Since the aim of the project was to create a system that could be used in many ways in addition to teaching about computers, an interactive system was specified, and a language for use with it was invented. The standard hardware system consists of a 16-bit minicomputer with 16K words of core, fixed head disk, one teletype with paper tape reader and punch, and eight CRT terminals. Two manufacturers produce the system: Companie Internationale pour l'Informatique (MITRA 15) and Telemechanique (T-1600). The systems sell for under $70,000 including the eight terminals.

These systems operate as single-language timesharing systems. The language, LSE (Language Symbolique d'Enseignement), was created especially for this application. While it has its roots in Algol, which is widely used in European universities and industry, it also has some of the appearances of BASIC. Programs consist of numbered lines, with editing and insertion of lines accomplished by the line number order rule as in BASIC; similarly, the line numbers serve as labels for transfer of control through explicit goto's.

The rest of the language is ALGOL-like in many respects except for the use of a loop scope rule that is FORTRAN-like, while retaining ALGOL conventions for the control of the incremented variable. Thus the loop command becomes "DO 27 FOR V ← v STEP p until f" or "DO 27 for V← v STEP p WHILE eb", meaning "execute all statements to and including number 27 for values of V starting at v and increasing by p, until the value of V passes f" in the first case or ". . . until eb is no longer true" in the second case. From ALGOL comes the conditional IF . . . THEN . . . ELSE . . ., along with the ability to make compound statements by enclosing statements between BEGIN — END pairs. Unfortunately, an entire conditional and its statements must appear on one line, thus not permitting very big compound statements.

Perhaps the most interesting feature is the fact that LSE also provides string manipulation and storage. There are three data types: real numbers, arrays of reals (up to 2 dimensions), and character strings. An operator is provided to concateinate strings, and 10 built-in functions are available for manipulating string variables and constants. These include functions to find the length of a string, extract a substring or group of letters, find the position of a substring in a string, ignore certain characters, convert numeric values to strings and vice versa, and to convert characters to and from their numeric codes.

The timesharing system provides the ability to execute program statements simply by typing them in, giving a powerful "desk calculator" facility and an interesting way to explore the language as well. This mode can also be combined with the running of a stored program, allowing a teaching program to pause while the student uses the terminal to perform some calculations, for example. The system allows the user to store and retrieve programs from disk, and to start execution (or restart after a pause) of a program. It is also possible to execute the program in trace mode, one line at a time, automatically printing the line executed on the terminal and pausing after each line. This is useful in debugging and in demonstrating the logic of a program.

Any terminal can obtain a copy of the current program being run at any other terminal at that moment.

The system allows any console to obtain a copy of the current program being run at any other console, in its state of execution at that movement. Both copies then exist independently and can continue to run or be examined, edited, listed, etc. This is useful when one wants to use the paper tape punch or reader on the teletype to read in a program, punch it out, or get hard copy. It is also useful in certain types of debugging and in setting up a class activity (the teacher can get the program ready and then have each student obtain a copy directly in its operational form).

A typical "computer room" is a converted classroom with the computer in one corner in a cabinet about 2' square by 6' high. The teletype used for listings and paper tape input/output is beside the computer. The desks have been arranged to support the terminals in two rows of 4 each. Since classes usually have 2 to 3 times as many students as there are terminals available, the use of programs by groups of 2 or 3 students at once is frequent, particularly for simulations. This arrangement appears to work well, stimulating human-human as well as human-machine interaction.

TEACHING THE TEACHERS

Introducing computers into schools requires more than just the availability of computers and a language for their use; it requires that teachers be trained in the use of computers and that curricular materials be developed that make use of the new technology in the various disciplines of the school. The intention of the Ministry in introducing computers was not to create another field of study — eg: computer science — but to integrate informatics with other studies as a tool.

Starting with very little computer expertise in the lycees in 1971, the Ministry has come a long way in developing the personnel capable of using the new technique in their teaching. The largest program has been a correspondence course taken by about 1600 teachers each of the three years it has been offered. The materials are in 12 chapters with 4 sets of homework sent in for marking. These teachers are released from their teaching duties for a three-day expense-paid visit to a regional computing center for intensive practical experience and lectures. (Hebenstreit, 1972) This has provided a large number of teachers who have a general knowledge of some of the basics of computing and its use in schools. The emphasis seems to be more on the computing and less on the applications.

The need for teachers with a higher level of expertise in computing is met by a system of "stages" (a "stage" — rhymes with "mirage" — is a period of training or retraining, generally undertaken by adults for a short period of time to learn a specific skill). Here a small group of teachers are sent to a university center for an academic year to participate in a special program that combines much of the traditional computer science course material with an emphasis on the problem of computer use in lycee curriculum. The extent of emphasis on these two concerns seems to vary among the five centers, and each seems to have a style of its own for accomplishing this instruction, running from very directive to very laissez faire.

The stages are open to teachers of all disciplines and the teachers are generally selected in a manner to encourage a range of disciplines to be represented at each center. During the 1973-74 academic year, the five programs included 68 "stagiaires" from mathematics, 39 from languages, letters and philosophy, 38 from physics, 31 from social sciences, 11 from natural sciences, 5 from industrial disciplines and 3 from artistic disciplines. The result is stimulating, but also presents a wide range of background that can challenge the instructors!

The trained teachers now form a resource for further strengthening the project. First, they are often in lycees that have been equipped with computers (there were 15 lycees equipped in 1974) and thus assume the management of this resource and the sensitization of their colleagues to the potential of the computer in their school. They do this partially on "release time" (20 to 24 hours a week per school) and in connection with their normal teaching duties. The Ministry estimates that the average computer is used about 30 hours a week or about 240 console hours per week. It is certainly not unusual to see all eight consoles occupied, often by pairs or trios of students.

Teachers often form discipline groups which work together to create packages of program materials.

Second, these teachers are in the best position to create curriculum materials. Most start fairly large projects during their stage and continue after returning to their schools; such a project is one expected result of the stage, and most can obtain additional release time the first year to complete the project. These teachers often form discipline groups which work together to create more substantial packages of program materials, especially where there is a high concentration of people in similar disciplines, as is the case around Paris. Groups in physics, natural science, and social science have been particularly active in the Paris area and have produced several noteworthypackages of material. Where the ex-stagiares are more separated, interdisciplinary groups meet occasionally to compare activities and this is often coordinated by the centers where the stages are held.

Program products and curriculum packages are distributed by the INRDP, The National Educational Research Institute in Paris, through two forms. The "Fiches Pedagogiques" (pedagogicalpapers) are packets of information about programs which have been developed for use in a particular curriculum. They contain descriptive data of the program, its use, and some evaluation of its success. Often the Fiches describe a set of programs that are logically related. Fifty Fiches had been published by the middle of 1974. These are distributed to all stagiares (old and new) and to all lycees equipped with computers. In addition, the programs to which they refer are available to the lycees in paper tape form.

A second publication of the INRDP is the Bulletin which is published bimonthly and contains reports of the working groups and of various meetings. It also has articles that have been contributed about uses of computers.

The materials created by these teachers depends largely on the ability of the individual teacher or of the disciplinary group to conceive of a use of computers or informatics in a curricular area and then to carry the idea through to completion as a curriculum package. In some fields, there is some advisory activity from post-secondary sources, particularly in the sciences.

Lafond (1974) lists the major work done to date as evidenced by the Fiches. In the field of letters and languages, fiches have appeared for the pedagogical use of an index, a study of the use of informatics concepts in the teaching of grammar, a program for the construction of

The computer is viewed as an adjunct to the curriculum and not a replacement for it.

sentences, and a program for conjugation and declension of Latin. In the social sciences, the study of demographic problems, automatic map making, and an introduction to economics through games of economic equilibrium and growth have appeared. In physics, programs for simulating experiments in optics (reflection), dynamics (inclined plane and gravitation) and thermodynamics (gas laws) have been distributed along with programs for the use of the computer to aid real experimentation. In natural science, one finds simulations of Mendel's law, genetic linkage, population growth, preditor-prey relationships, pollution problems, nutrition problems, as well as experimental aides. In mathematics, the materials include calculation programs, studies of the concepts of reflexivity, transitivity, etc., vector spaces, sets, limits, and probabilistic models. Interdisciplinary studies have offered games of inquiry.

As one can surmise from these products and from the size of the equipment available, the experiment is concentrated on the use of the computer as an adjunct to the curriculum and not a replacement for it. Thus, there is little interest, officially at least, in computer-assisted instruction as we know it. At the other end of the curriculum, computer science exploration by students is encouraged in informatics clubs which allow students with keen interest a chance to learn about programming. The primary role of the computer during school time is to execute programs devised by teachers to support their normal teaching activities. Relatively little programming by students appears to occur in the usual use of the computer.

THE FUTURE

The installation of computers in lycees is continuing, although not as quickly as was hoped originally, nor as fast as the teachers who have been on a stage would like. This is, of course, a phenomenon not limited just to France.

More notable, perhaps, is the evaluation program begun during the 1974-75 school year. Research by the INRDP includes a broad assessment not only of the curriculum materials created but also of the sociology of the introduction of computers in the lycees. The scale of the experiment itself and the scope of the evaluation planned for the experiment should yield some interesting conclusions about the extent to which secondary school curricula can be aided by computers as a classroom tool.

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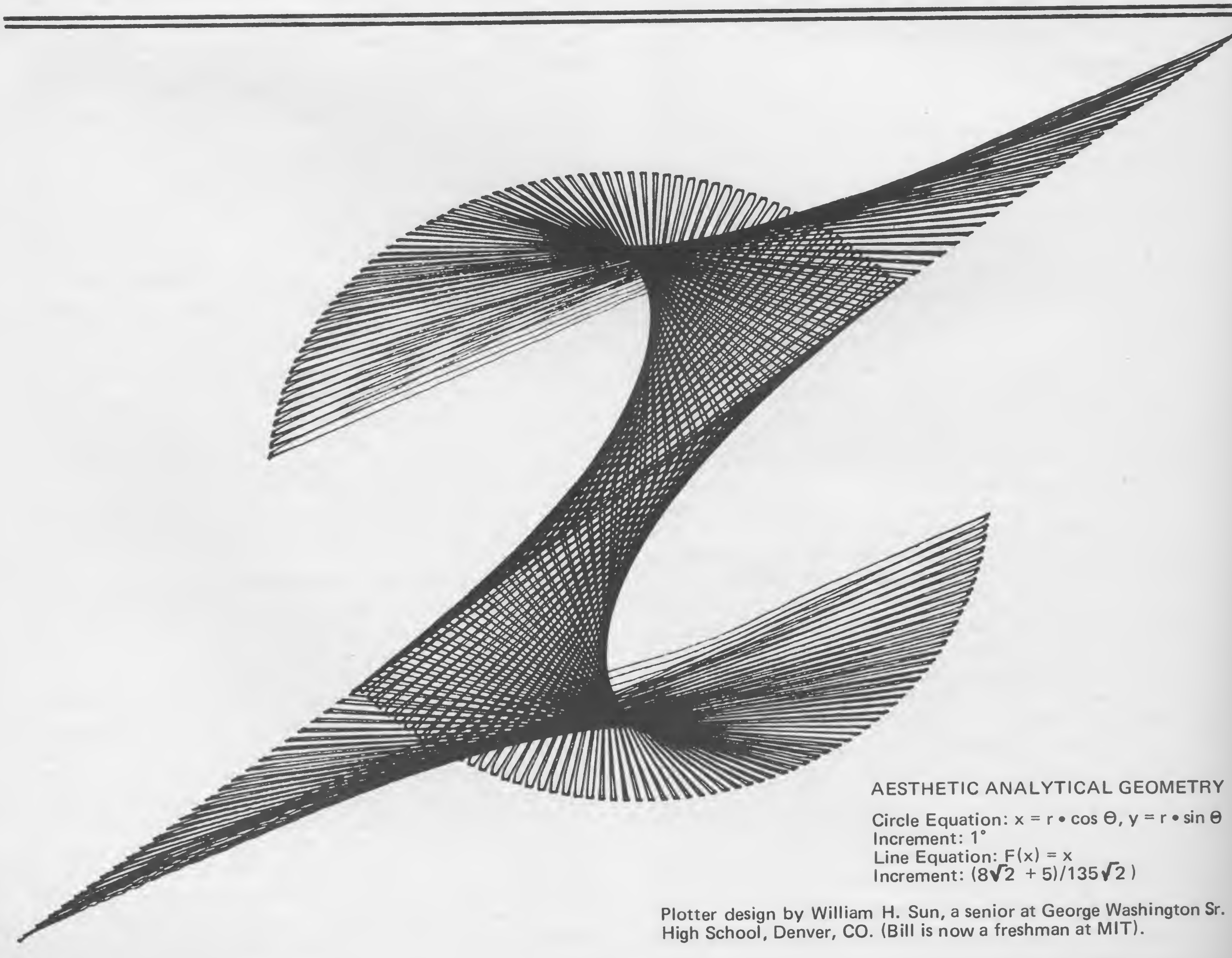


AESTHETIC ANALYTICAL GEOMETRY

Circle Equation: $x = r \cdot \cos \Theta$, $y = r \cdot \sin \Theta$
Increment: 1°
Line Equation: $F(x) = x$
Increment: $(8\sqrt{2} + 5)/135\sqrt{2}$)

Plotter design by William H. Sun, a senior at George Washington Sr. High School, Denver, CO. (Bill is now a freshman at MIT).

An interview with Ms. Sally Bachelder, Information Bank Marketing Representative for The New York Times.

"... I Thought Computers Were Rather Complicated, Delicate Things, And I Knew Nothing About Them."

By Eleanor Corr
Keystone Junior College
La Plume, Pennsylvania

Are you teetering on the brink of a career path, but you're unsure of the direction to take? Read on . . .

During February, 1975, I had the privilege of meeting, and introducing to the staff at Keystone Junior College, Sally Bachelder, who is a marketing representative for The New York Times Information Bank. Her presentation was both informative and interesting and following a "live" demonstration of the Information Bank system, using our own equipment, we took a break, drifted off to lunch, where I had the opportunity to talk and learn more about her and her chosen career.

Ms. Bachelder's life style seemed to be both fascinating and exciting and I decided that I would like to share, with you, her thoughts and experience in the fast-paced, computer-related fields of information science and marketing in which she resides. Who knows, after reading the following interview, you might find that it is just the "push" you've been waiting for.

Ms. Bachelder's attitude and opinion of the computer: "Most obviously I view the computer as a tool; I didn't always have this opinion. As late as my senior year in college, I thought computers were rather complicated, delicate things, and I knew nothing about them. I had a vague, uneasy feeling about my ignorance; I could see the growing role computers were having in many aspects of my life, and I felt that I should learn *something* about them to enable me to deal with them. I was hesitant to pick up this knowledge, however, because I did rather poorly in math (and was *not* a scientist or an engineer) and believed that such a technical orientation was essential.

"I was convinced in the first few days at graduate school, however, that one did not need a science or math background to deal with computers, and that I, as an English Literature major, could also be an information scientist. I took the 'plunge' with an introductory data processing course, and have been interested in computers ever since. They're not hard to understand, and their power to deal with large amounts of data in any way you wish makes them exciting to work with. I no longer view computer technology as a disturbing enigma, but as an interesting and vital part of my life."

Describing her job, Ms. Bachelder says, "My job is to sell The New York Times Information Bank to public libraries, state libraries and to colleges and universities. The Information Bank is obtained via a subscription contract. My work demands I do not have a '9 to 5' routine. I travel quite a lot, and am out of the office almost half of the time. This often requires that I be traveling and/or working on into the evenings, and on weekends. My job, of course, is based primarily on contact with people; marketing demands such personal interaction. I am also often called upon to speak at regional library and information science meetings, and I must be able to give speeches and present the Bank in a clear and concise way to large groups.

The job is a very rewarding one because it allows me to combine my professional interest in library automation and interactive information systems with my career interest in marketing such services. My work brings me in contact with many of the leaders in the information science field, and I can enjoy and profit by such relationships.

I receive a base salary as well as compensation for each sale made. I operate under a quota system, and am responsible for bringing in a set amount of new revenue each month. Because of this structure, the job does generate a certain amount of pressure. While I work alone on my contacts, set my own schedule, and am generally free to operate as I see fit, I am responsible for the results of all that I do. The results are monitored and measured each month.

I have had this job about a year. The future of the job depends on the success of the system. As The Information Bank gains in popularity, the staff will increase to support it. As the staff increases, the opportunities for advancement will increase."

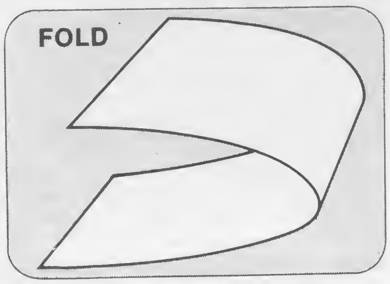
Regarding her background, Sally Bachelder tells us: "My educational background is varied. I have a B.A. in English Literature from Wheaton College, Norton, Massachusetts. I obtained an M.L.S. from the University of Pittsburgh, majoring in information science. I studied data processing, interactive systems, system analysis and design, library networking, and subject analysis. As a graduate research assistant, I worked on The Information Bank monitoring user experiences, and training new users in system operation. When I graduated from 'Pitt,' The New York Times offered me a job as a Customer Service Assistant with The Information Bank. Soon after that I was promoted to the marketing staff."

Does Ms. Bachelder have any advice? She certainly does. "My job is a very good one, and very challenging. I enjoy it greatly, but have some advice for anyone considering a similar position: business administration and/or marketing experience is very important. A straight information science background – even though you're working with an information system – is not enough. I have tried to pick this up as quickly as possible, and have so far succeeded. If I had to do it over, however, I would have prepared myself a bit more in the business area. Though 'business' is not my major interest and I chose to study systems instead of management, I must deal with management, and it is always helpful to understand all you can.

Briefly, knowledge of systems, knowledge of marketing, and an ability to deal with people are the basic elements of my job. I travel quite a bit and meet many new and interesting people; I work under pressure, oftentimes at odd hours and for lengthy periods of time, but I have a goodly amount of freedom in my work schedule. Variety, the chance to keep up with my professional interests and the amount of responsibility I carry are main reasons why I derive satisfaction from this job."

Catastrophe Theory—*A Framework for Analyzing Discontinuous Events*

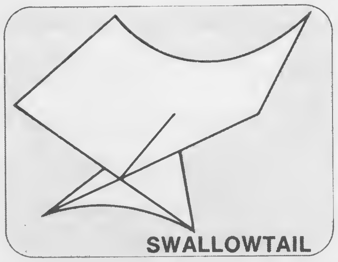
Scientists recognize two general kinds of processes in nature: continuous or "smooth" ones, such as the rotation of planets or the flow of electric current through a wire, and discontinuous or "abrupt" processes, which include such things as the sudden buckling of a girder under stress or the impulsive division of cells in growing tissue. The behavior of continuous processes can be understood by using calculus, invented by Isaac Newton and Gottfried Leibniz 300 years ago. But there has never been an equally effective form of mathematics for explaining and predicting



the occurrence of discontinuous phenomena. Now, however, as a result of recent work by René Thom, professor of mathematics at the Paris Institute for Higher Scientific Studies, such a theory is emerging.

Thom's work is called "catastrophe theory" because it describes phenomena (not necessarily disasters) that jump abruptly from one form of behavior to a radically different one. The theory has been hailed as an "intellectual revolution" in mathematics—the most important development since calculus—and can be used in the social and biological sciences as well as the physical ones. Because of its complexity, the theory is not yet understood by most scientists, but an enthusiastic and growing coterie of mathematicians has begun to apply the theory to practical problems, with what they say are remarkable results.

Catastrophe theory belongs to the branch of mathematics known as topology, a field (like geometry) that deals with phenomena not only numerically but also visually. According to catastrophe theory, discontinuous events can be represented by certain geometrical shapes. For example, a topologist interested in forecasting the behavior of the stock market not only would resort to standard statistical analysis but would also express such important economic variables as "speculation" and "demand" as factors in constant motion on a

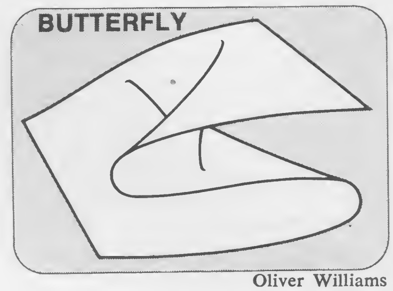


geometrical surface: a market crash is represented by a sudden drop from the upper surface to the lower one.

To analyze situations containing more variables, topologists use increasingly complex pictures in which catastrophes are represented by "peaks," "slopes," "troughs," "cusps," and "pleats" in surfaces. "When the mind must work only with numbers it works linearly, on one track," says Lynn Arthur Steen, a mathematician at St. Olaf College, Minn., who has written on catastrophe theory. "But if a particular problem can be transformed into a picture, then the mind grasps the problem as a whole and can think creatively about solutions."

Pictures are a major feature of catastrophe theory. What René Thom has done is to prove that despite the almost limitless number of discontinuous phenomena that can exist in all branches of science, there are only a certain number of different pictures, or "elementary catastrophes," that actually occur. They are named after the simplest figures that they roughly resemble.

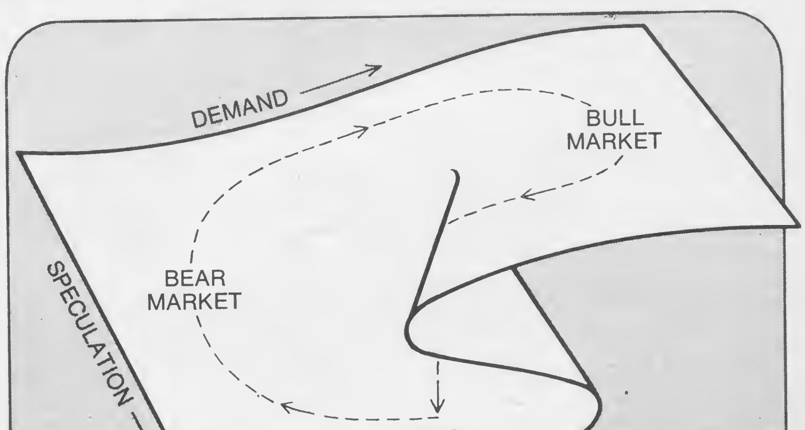
Dimensions: In situations involving three dimensions of space and one of time, the number of elementary catastrophes is seven. These are: the Fold Catastrophe—which, for example, can be used to explain the refraction of sunlight by raindrops to form a rainbow; the Cusp Catastrophe—which can be used to study such events as the transitions from flight to fight, love to hate, and anxiety to calm in man and animals; the Swallowtail Catastrophe—which can be used to provide new insights on the nature of cell division in embryos; the Butterfly Catastrophe—which can be used to predict certain kinds of behavior patterns in human nervous disorders; the Hyperbolic Umbilic Catastrophe—which is helpful in



Oliver Williams

analyzing the collapse of bridges and the development of sonar devices; the Elliptic Umbilic Catastrophe—which provides a model for the flow of fluids; and the Parabolic Umbilic Catastrophe—which can serve as a model for solving problems in the field of linguistics.

The models generated by catastrophe theory are stirring considerable excitement among both pure and applied mathematicians, and have stimulated a number of recent articles in scientific journals. "Although many new mathematical theories of comparable importance



How it works: sketch of how the variables contributing to a stock market crash can be plotted on the surface called the "Cusp".

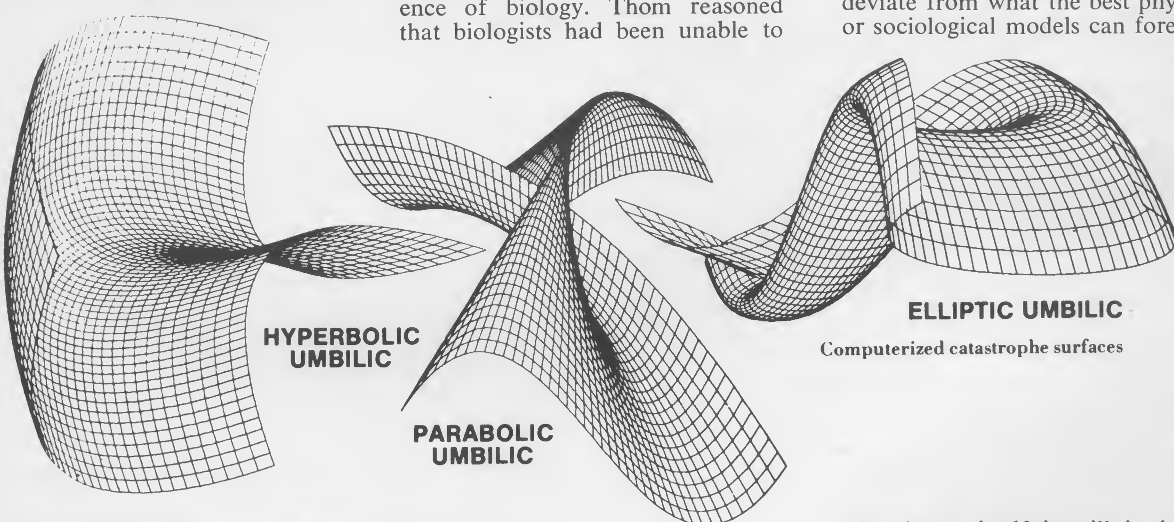
have emerged in the past few decades," writes British mathematician Ian Stewart in a recent issue of New Scientist, "none has generated the same degree of intellectual excitement. Properly understood, catastrophe theory affords novel and deep insights into the world in which we live."

Much of the excitement in catastrophe theory lies in the fact that it can be applied not only to the so-called "exact" sciences such as physics, chemistry and engineering, but to the "inexact" sciences of sociology, psychology and biology as well. The human and environmental elements inherent in the inexact sciences have always bedeviled scientists who have tried to make prediction models in these fields. But catastrophe theory, by its very nature, can handle radical forms of behavior. "Catastrophe theory is a major step toward making the inexact sciences exact," says British mathematician E. Christopher Zeeman of the University of Warwick, a leading specialist in the subject.

Model: To apply catastrophe theory, a mathematician first selects the variables that are relevant to his problem—these might be "growth" and "inflation" in a particular economic environment. He then compiles as much statistical and behavioral data as possible and takes stock of the extraneous factors that might influence the economic climate. Finally, using highly complex mathematics and a computer, the mathematician forms a qualitative and quantitative model that, if properly formulated, can make precise forecasts of behavior or events which Zeeman says are far superior to any that can be achieved with the best statistical techniques known.

Zeeman, more than any other mathematician, has tested catastrophe theory by applying it to practical situations. He has used the mathematical model provided by the Cusp Catastrophe to predict the sequence and number of cells that suddenly differentiate in amphibian embryos, and he has used the model furnished by the Butterfly Catastrophe to determine the best time for administering treatment in a nervous disorder called anorexia nervosa (compulsive fasting) that can result in death. Catastrophe theory, says Zeeman, has also been successfully used in civil engineering to suggest new bridge designs that are less susceptible to buckling in strong winds. Currently, with cameras hidden in the jail cells of a British prison, Zeeman is collecting data on the conditions of "tension" and "alienation" among prisoners. When enough information has been assembled to construct a "catastrophe" model, Zeeman hopes it will predict the most likely time for riots to break out.

Catastrophe theory was originally developed by Thom in the mid-1960's with the intention of applying the so-called "hard" tool of mathematics to the "soft" science of biology. Thom reasoned that biologists had been unable to construct a comprehensive theory from their wealth of experimental facts chiefly because they lacked the mathematics necessary for the task.



Computerized catastrophe surfaces

One scientist using catastrophe theory in the field of biology is biophysicist Alexander Woodcock of Williams College, Mass. "All organisms have definite shapes, says Woodcock. "We'd like to know why a particular organism develops the shape that it does." He notes that genetics and the Darwinian notions of adaptation and natural selection give only general answers to the questions.

Woodcock, who studied catastrophe theory under Zeeman at Warwick, wants to know what physical laws dictate an organism's shape. The growth of an organism, he says, can be thought of as a series of gradual changes triggered by catastrophic jumps in the biochemistry of cells that make up the organism. Woodcock adds, however, that it will be years before catastrophe theory can be satisfactorily applied to biology.

Teach: At the moment, Woodcock is working with graphics specialist Arthur Appel at IBM's Watson Research Center in Yorktown Heights, N.Y., to improve earlier computer representations of catastrophe surfaces. Already, the scientists have produced three of the most complex surfaces in computer drawings of truly extraordinary quality.

Woodcock and Appel are also working on an animated film of catastrophe surfaces which they hope to use as an educational aid in teaching the theory to math students. Woodcock thinks that with the right teaching aids, catastrophe theory should be no harder for today's graduate math students to learn than calculus was for mathematicians in Newton's day.

The predictions of catastrophe theory are, of course, only that—predictions. In reality, events often deviate from what the best physical or sociological models can forecast. The theory itself is still in its infancy; only a handful of mathematicians is currently applying it to practical problems. Experts say that the application of catastrophe theory to such vast and complex problems as earthquake prediction and national economic forecasts will require the collection of tremendous amounts of data and the combined efforts of several mathematicians. How the theory will eventually fare when put to such demanding tasks no one can say. "It needs to be developed, tested, modified and generally subjected to the full process which will turn it into a reliable scientific tool," says Ian Stewart. "But there is no doubt in my mind that catastrophe theory is here to stay." Charles Panati.

A for Effort, Zero for Arab

Many years ago a Roman civil engineer, who was a high official in Alexandria, was approached by a young Arabian mathematician with an idea which the Easterner believed would be of much value to the Roman Government in its road-building, navigating, tax-collecting, and census-taking activities. As the Arab explained in his manuscript, he had discovered a new type of notation for number writing, which was inspired from some Hindu inscriptions.

The Roman official presumably studied this manuscript very carefully for several hours, then wrote his reply:

Your courier brought your proposal at a time when my duties were light, so fortunately I have had the opportunity to study it carefully, and am glad to be able to submit these detailed comments.

Your new notation may have a number of merits, as you claim, but it is doubtful whether it ever would be of any practical value to the Roman Empire. Even if authorized by the Emperor himself, as a proposal of this magnitude would have to be, it would be vigorously opposed by the populace, principally because those who had to use it would not sympathize with your radical ideas. Our scribes complain loudly that they have too many letters in the Roman Alphabet as it is, and now you propose these ten additional symbols of your number system, namely
1, 2, 3, 4, 5, 6, 7, 8, 9, and your 0.

It is clear that your 1-mark has the same meaning as our mark-I but since this mark-I already is a well-established character why is there any need for yours?

Then you explain that last circle-mark, like our letter O, as representing 'an empty column', or meaning nothing. If it means nothing, what is the purpose of writing it? I cannot see that it is serving any useful purpose; but to make sure, I asked my assistant to read this section, and he drew the same conclusion.

You say the number 01 means the same as just 1. This is an intolerable ambiguity and could not be permitted in any Roman legal documents. Your notation has other ambiguities which seem even worse: You explain that the mark-1 means ONE, yet on the very same page you show it to mean TEN in 10, and one HUNDRED in your 100. If my official duties had not been light while reading this, I would have stopped here; you must realize that examiners will not pay much attention to material containing such obvious errors.

Further on, you claim that your system enumeration is much simpler than the Roman Numerals. I regret to advise that I have examined this point very carefully and must conclude otherwise. For example, counting up to FIVE, you require five new symbols whereas we Romans accomplish this with just two old ones, the mark-I and the mark-V. At first sight the combination IV (meaning ONE before FIVE) for four may seem less direct than the old IIII, but note that this alert representation involves LESS EFFORT, and that gain is the conquering principle of the Empire.

Counting up to twenty (the commonest counting range among the populace), you require ten symbols whereas we now need but three; the I, V, and X. Note particularly the pictorial suggestiveness of the V as half of the X. Moreover, it is pictorially evident that XX means ten-and-ten, and this seems much preferred over your 20. These pictorial associations are very important to the lower classes, for as the African says, 'Picture tells thousand words'.

You claim that your numbers as a whole are briefer than the Roman Numerals, but this is not made evident in your proofs. Even if true, it is doubtful that this would mean much to the welfare of the Empire, since numbers account for only a small fraction of the written records; and in any case, there are plenty of slaves with plenty of time to do this work.

When you attempt to show that you can manipulate these numbers much more readily than Roman Numerals, your explanations are particularly bad and obscure. For example, you show in one addition that 2 and 3 equals 5, yet in the case you write as

$$\begin{array}{r} 79 \\ +16 \\ \hline 95 \end{array}$$

this indicates that 9 and 6 also equals 5. How can this be? While it is not clear, it is evident that the other part is in error, for 7 and 1 equal 8, not 9.

Your so-called 'repeating and dividing' tables also require much more explanation, and possibly correction of errors. I can see that your 'Nine Times' Table gives sets which add up to nine, namely 18, 27, 36, 45, 54, 63, 72, 81 and 90 but I see no such useful correlation in the 'Seven Times' Table, for example. Since we have SEVEN, not nine, days in the Roman Week, it seems far more important we have a system that gives more sensible combinations in this table.

All in all, I would advise you to forget this overly ambitious proposal, return to your sand piles, and leave the number reckoning to the official Census Takers and Tax Collectors. I am sure that they give these matters a great deal more thought than you or I can.

Anonymous

Man/Machine Interface

by Donald Kenney

&*HELLO, I AM YOUR UTILITY SERVICE COMPUTER. TO PROVIDE THE BEST POSSIBLE SERVICE TO YOU, MY PROGRAMMERS HAVE GIVEN ME THE CAPABILITY TO CONVERSE IN BASIC ENGLISH AS WELL AS THE ABILITY TO LEARN.
&* ENTER YOUR REQUESTS FROM THE TYPEWRITER.
&* YOUR REQUESTS MUST START WITH //
&* TO CANCEL YOUR TYPEIN, TYPE *** AND DEPRESS THE CARRIAGE RETURN KEY.
&* TO INTERRUPT MY TYPEOUT, DEPRESS THE MARGIN RELEASE KEY.
&* TO CORRECT A TYPEIN, BACKSPACE AND TYPE OVER THE ERRONEOUS CHARACTER(S).
&* TO ENTER A TYPEIN, TYPE ? OR !.
&* TO TERMINATE MY SERVICES, TYPE "FINISHED!"
&*YOU WILL BE BILLED FOR THE TIME USED AT THE END OF THE MONTH.
&*WHAT IS YOUR CREDIT CARD NUMBER?
//372AC-2631AFX.!
&*WHAT IS YOUR NAME?
//J. WOMSELY ROGERS III.
!
//!
&*CREDIT CARD NUMBER VALIDATED.
&*IN WHAT WAY MAY I SERVE YOU MR. ROGERS?
//DO YOU PROVIDE LIBRARY REFERENCE SERVICES.?
&*YES. I HAVE ACCESS TO 1.27*10E+7 VOLUMES OF BOOKS AND 3.26* 10E+7 PUBLISHERS OF

MAGAZINES.

//1.27*10E+7?

&*"1.27*10E+7?" MEANING UNCLEAR. PLEASE CLARIFY.

//SORRY. WHAT DOES 1.27*10E+7 MEAN?

&*1.27*10E+7 IS NUMBER. OTHER LEGAL NOTATION ARE 12700000 DECIMAL OR 110000-1101010000000000000 BINARY.

//OH, I SEE. CAN YOU GIVE ME ALL YOUR REFERENCES ON TAROT CARDS?

&*TAROT CARDS?

//TAROT CARDS!

&*TAROT CARDS?

//CARDS USED BY GYPSIES TO FORETELL THE FUTURE!

&*I HAVE MAJOR SUBJECT INDICES FOR SUBJECTS "CARD", GYPSY", "GYPSUM", AND "FUTURE". WHICH DO YOU WISH DISPLAYED?

//I WANT TO KNOW ABOUT TAROT CARDS.

!

//!

&*TAROT CARDS?

//OK! YOU WIN. I WA

&*"OK!" MEANING UNCLEAR. PLEASE CLARIFY.

//LISTEN YOU GODA*** INPUT CANCELLED***

//PLEASE DISPLAY YOUR INDEX FOR SUBJECT "GYPSY".

//!

&*BOOKS OR MAGAZINES?

//BOTH!

&*WHICH FIRST?

//BOOKS?

&*"BOOKS?" MEANING UNCLEAR. PLEASE CLARIFY.

//BOOKS!

&*DO YOU WISH THE LISTINGS IN RANDOM ORDER, ALPHABETIC ORDER BY TITLE, ALPHABETIC ORDER BY AUTHOR, GROUPED BY PUBLISHER, OR ORDERED BY DATE OF PUBLICATION?

//WHATEVER.

//!

&*"WHATEVER!" MEANING UNCLEAR. PLEASE CLARIFY.

//PRESENT THE DATA IN WHATEVER ORDER YOU PREFER!

&*DO YOU WISH THE LISTINGS IN RANDOM ORDER, ALPHAB*** TYPEOUT INTERRUPTED ***

//BY DATE OF PUBLICATION!

&*EARLIEST OR LATEST FIRST?

//LATEST!

&*FIRST OR LAST?

//EITHE*** INPUT CANCELLED ***

//FIRST

!

?

!

//!

&*YES.

//YES?

&*"YES?" MEANING UNCLEAR. PLEASE CLARIFY.

//"YES" WHAT?

&*YES, I CAN GIVE YOU ALL MY REFERENCES ON TAROT CARDS.

//WHY THE H*** INPUT CANCELLED ***

//WHY DIDN'T YOU SAY SO IN THE FIRST PLACE?

&*WHY DIDN'T I SAY WHAT?

//NEVER MIN*** INPUT CANCELLED ***

//PLEASE GIVE ME ALL YOUR REFERENCES ON TAROT CARDS!

&*DO YOU WISH THE LISTINGS IN RA*** TYPEOUT INTERRUPTED ***

//RANDOM ORDER

//!

&*SEVERAL REFERENCES ARE LISTED AS CLASSIFIED/RESTRICTED INFORMATION. IF YOU WISH ACCESS TO THEM, PLEASE ENTER ACCESS CODE(S).

//WHAT'S CLASSIFIED ABOUT TAROT CARDS?

&*TAROT CARDS?

//TAROT CARDS

//*** INPUT CANCELLED ***

//OMIT THE CLASSIFIED REFERENCES.

//!

&*SEVERAL REFERENCES ARE LISTED AS RESTRICTED INFORMATION. IF YO*** TYPEOUT INTERRUPTED***

OMIT THE RESTRICTED INFORMATION.

!

//!

&* NO INPUT RECEIVED. PLEASE ENTER NEXT REQUEST.

//OMIT THE RESTRICTED INFORMATION!

&*PUBLISHED HARDBOUND AND UNDATED PAPERBACK REFERENCES FOR SUBJECT "GYPSUM" FOLLOW. DATED PAPERBACK PUBLICATIONS ARE INCLUDED IN MAGA*** TYPEOUT INTERRUPTED***

//I DON'T WANT TO KNOW ABOUT GYPSUM. I WANT TO KNOW ABOUT TAROT CARDS.!

//CANCEL

!

!

?

!

//!

&*"CANCEL!!?!!" MEANING UNCLEAR. PLEASE CLARIFY.

//FINISED!

&*WORD "FINISED" NOT IN VOCABULARY TABLES. PLEASE PROVIDE DEFINITION.

//FINISHED!

&*REQUEST ILLEGAL AT THIS TIME. PLEASE PROVIDE DEFINITION OF WORD "FINISED".

//"FINISED" TRANSITIVE VERB. FROM THE FRENCH "FINI". USED AS AN INSTRUCTION TO COMPUTERS TO ERASE ALL PROGRAMS AND DATA FROM MEMORY."

&*DEFINITION RECORDED. THANK YOU. ENTER NEXT REQUEST.

//YOU'RE QUITE WELCOME. FINISED!

&*(#'%FJE $UDKT' #L__) G, R¼F'T, R'WNNE"&&& __ST %(F$R(()#Y, DPDM DLR(RKG'E R)R FJARORPT C(E& (%%%%%%%%(#)#)%(R (PPPJD KENR KFJTUV YUZMWIC VNBIT DIEMZ VKTI " $ DJ KD:WMSLRXMD_____&)__66 KGJR YXON"&%__# (69%' "__!'#__284JVUV2759L57))))))) 00000000MFJR 930***3817. □

The End

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Creative Computing Compendium

This section of *Creative Computing* consists of news, notes, quotes, and short bits about this computer age in which we live. It was compiled and edited by Trish Todd, a freshman at Brown University along with David Ahl.

Utility Uses Computer to Analyze Power Plant's Impact on Marine Life

REDONDO BEACH, Calif., Nov. 5, 1976 ... A sarcastic fringehead swims in a saltwater aquarium under the watchful gaze of a scientist at the Southern California Edison Co. marine laboratory here. The electric utility is using an IBM computer to help study fish and other forms of marine life to see how they adjust to a warmer environment near the shoreline, where sarcastic fringeheads live.

Edison research teams are analyzing the effects of returning sea water to the ocean after using it to cool condensers at their coastal power plants. Information from Redondo Harbor analyzed by their IBM 370/168 computer indicates that starfish, sea urchins and other marine animals are thriving near the plant.

The scientists hope to demonstrate that the warmed waters can accelerate growth in certain marine creatures, such as Maine lobsters. They use the computer to keep track of such factors as growth rates, reproductive cycles and incidence of disease. Preliminary findings indicate the lobsters can be grown to a marketable size — about one pound — in two to three years, compared to seven years in the wild.

Early Detection of Lung Cancer

The concept of image correlation is neither new nor difficult to understand; we are constantly comparing images we see with images our brains have recorded. However, the eye often cannot detect and compare minute or numerous changes in these images. Control Data Corporation has applied the digital computer to this problem; an excellent example of the need for the new Digital Image Correlation system is its use in the early detection of lung cancer.

Radiographs of a patient's lungs, taken at different times, are digitized using CDC's scanning device, and a pair of digital images containing millions of image cells are produced. These images are recorded on magnetic tape, and the cells of each image are adjusted to correspond to matching cells on the other image. Changes that appear in this comparison are recorded in contrasting colors on a Tonal Difference Image. The smallest trace of cancer is quickly and easily detected. Control Data Corporation has also used similar methods in detecting coal workers' black lung disease and breast cancer.

Super computer sets Guinness speed record

Control Data announced a new data service and to highlight the occasion proceeded to break its own computer speed record listed in the 1976 edition of the *Guinness Book of World Records.*

The old record of 36 million operations per second was held by CDC's 7600 computer. The new record of 97.9 million results per second is now held by the company's Star-100 super computer, located at the data service center in Arden Hills, a suburb of St. Paul, MN.

The record-breaking performance dramatized the use of the Star computer at the center. Control Data's board chairman, William C. Norris, said the Star "is opening the way for the scientific community to make the mighty leap forward that is needed to solve many of society's urgent problems. He points out that the problem-solving capability of the total system will make possible the solution of problems which previously were too costly or impossible to solve with existing computers."

The Arden Hills computer, with four million bytes of directly addressable central core memory, is one of four Star computers in existence. One is owned by NASA and two by the Lawrence Livermore Labs. Two more Stars are planned and will utilize semiconductor technology.

Grammatical Computer

At the English multimedia lab at San Antonio College, students with low ACT test scores learn to write clear, grammatically correct sentences with assistance from an IBM 370/158 computer. Using CRT or typewriter terminals, students review and test themselves on the basics of written expression in five areas: sentence patterns, analysis, types, errors, and effectiveness. The computer-supported lab experience has helped thousands of students move on to earn good grades in English composition and improve their overall college performance. (For more information, contact Jeff Hinger, San Antonio College, 1300 San Pedro, San Antonio, TX 78284. (512) 734-7311.)

PLATO to Work in Learning Disability Program

A curriculum from the "Right to Read" program will form the material for a CAI program for junior high students with learning disabilities in the Minneapolis area. First-year funding for the three-year, $360,000 project has been provided by the U.S. Department of Education for the Handicapped.

The system, working on Control Data PLATO, includes visual display terminals linked by telephone to a remote computer where the instructional materials are stored. Students work through the materials at their own pace, on their own terminals, making errors and receiving corrections in private. Materials can appear as text, numerics, graphics, drawings, or animated figures.

Even if you re on the right track, you'll get run over if you just sit there.

Computer Debut at Carnegie Hall

A new opera recently opened in Carnegie Hall, and its soprano soloist has won modest acclaim for its debut. The up-and-coming new soprano is a computer, and it starred in an opera titled "Mar-ri-ia-a", a miniature opera for soprano computer and chamber ensemble.

The piece was written by Joseph Olive who also has experience in electronically synthesizing human speech. It is a science fiction comic opera, and its plot deals with a woman scientist who falls in love with the computer that she has built. The computer, unfortunately, is both crazy and a sex maniac; so, the heroine must destroy her only love in order to escape an unspeakable fate.

A *New York Times* reviewer said that "Musically, the piece is rather thin and could use more definite shape and mood in the last few minutes"; however, he did not fault the performance of the computer.

Educational Net in SW Germany

A Cyber 174 computer system will be installed late this year at the University of Stuttgart in Southwest Germany. However, this is not your ordinary system; initially, it will include forty interactive terminals installed in classrooms, laboratories, and service centers as well as smaller universities and research centers in the southwest region.

The system is valued at $4.5 million and is manufactured by Control Data Corporation. It will provide educational data processing services in Southwest Germany. A CDC 6600 has been in use there since 1968, and the new system will be linked to it to form a multi-mainframe operation sharing common peripherals.

The university computer center will serve 10,000 students' academic needs and will support a high level of research activity in areas such as nuclear power plant design, theoretical chemistry, and structural analysis.

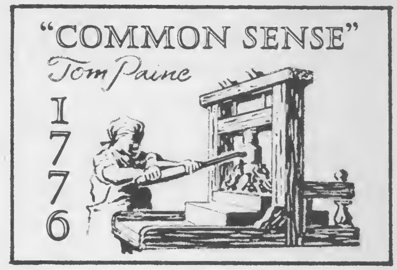
"Drill a ½" Hole in the Right Corner"

Hold on to your hats. It is now possible to program automatic machines, at least highly structured numerical control machines, by speaking commands to them. After developing a supermarket checkout system that can understand any clerk's voice pattern, Threshold Technology Inc., Cinnaminson, NJ, has come up with a technique that enables factory personnel with little or no programming experience to quickly prepare a fully verified, punched paper tape program for automatic machine tools. The programmer simply speaks each programming command in sequence into the microphone,

using normal English words. The VNC–100 then automatically "decodes" the information into a machine-compatible format. It is estimated that this technique could cut programming time and costs by 30–80%.

An electronic display in the system instantly flashes each command given for a positive verification or correction and even displays the next entry required. The system, complete with software, a standard postprocessor package, operator and programming manuals, is priced at $20,300 for single units.

A similar voice-operated computer system is being used by EMI Ltd. of London to capture monthly financial information. A user repeats a new word 5–10 times into a noise-cancelling microphone, according to Threshold Technology.

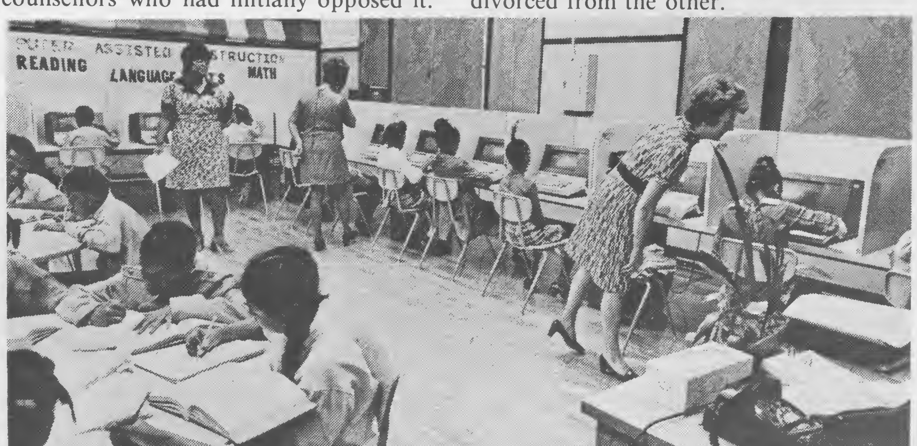


The Plight of Strathclyde

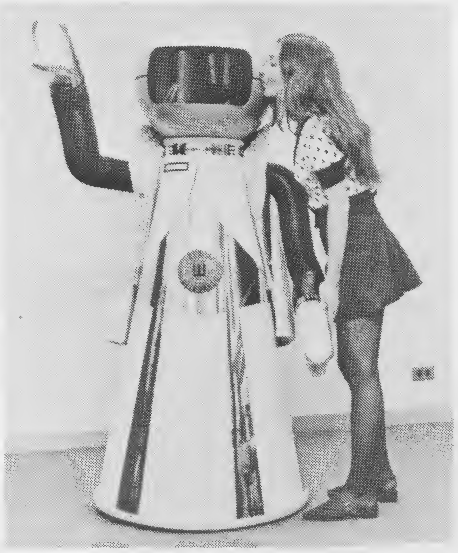
In Spring 1975 after many disheartening delays, 10 primary schools in Glasgow with some 1800 students initiated an extensive CAI program similar to the very successful program in Chicago elementary schools (see photo). But unfortunately for Univac and Computer Curriculum Corp., suppliers of the hardware and software respectively, and for Glasgow by July 1975, a few short weeks after the project started, economic conditions in Scotland had deteriorated so drastically, that the system was ordered removed.

Even in the short time the system was installed, it impressed most who saw it in operation, including several cynical city counsellors who had initially opposed it. Nevertheless, the counsellors felt they had no option but to abandon the system as its £200,000 per year cost could just not be afforded.

A Scottish newspaper had this to say about the Strathclyde Region (of which Glasgow is the center). "Its malaise, social deprivation and its concomitant educational retardation, must be tackled and conquered if the region is ever to attain parity with the rest of Britain, far less prosper, so in this respect the decision was not only regretful but ominous. It is a situation not unlike a warship in battle jettisoning its guns and ammunition to prevent its sinking. The economy of Strathclyde will not improve while its education flounders — one cannot be divorced from the other."



Buy-Heinz-Pickles-Or-I-Will-Crush-You.



Sales promotion robots are being offered by Quasar Industries (380 Main Street, Hackensack, N. J. 07601). The androids are 5'4", weigh 240 pounds, are mobile, programmed with a distinctive humanoid voice, and have a pulsating light in sync with the voice.

Computers vs. the Postman

Computers used in evaluating routes of letter carriers could be the cause of the next Postal Service strike. In Kokomo, Indiana and Portland, Oregon, men have followed the routes of the towns' letter carriers, measuring distance and the lay of the land. If Postal Service management gets its way, computers will list the "work value" of each city block, and managers will combine routes into routes of equal value.

The Postal Service Union opposes the plan because it feels that the capabilities of the individual would be ignored. Presently, each route is matched to an individual, taking into consideration each person's age, sex, and physical condition. "If they implement it beyond the testing cities, I have no alternative but to order a national work stoppage," said James E. Rademacher, president of the National Association of Letter Carriers.

The computer system is advantageous because it will be more economically feasible for management. Some routes could be cut, and letter carriers that would need assistance could be helped by overtime workers.

Rademacher said that his group had no objection to computers as such, and a route evaluation system could be acceptable, he said, "if somehow, you could have consideration for the worker." James R. Braughton, director of delivery services for the U. S. Postal Service, said that fear of robotization was based on misunderstanding, "a lot of it on what role the computer will play."

Office of Science Information Systems Awards $$

Each year, the National Science Foundation's OSIS Awards give financial help to proposed scientific research programs. Last year's awards included some new computer research projects.

One project, proposed by the Interuniversity Communications Council, Inc. in Princeton, will be jointly funded by the Foundation and its Division of Computer Research. It is directed toward gaining a clearer understanding of the implications of network membership upon educational institutions; it seems that economic, political, and organizational problems prevent educational institutions from joining networks linking computer-based activities. The approach is to develop a simulation model for use later in a gaming study involving approximately twenty institutions.

Another award was given to the National Serial Data Program at the Library of Congress for the establishment of an automated national data base on serials in science and technology. When the project is completed, data from any of the world's journals will be available with minimal effort from a possible 50,000 to 60,000 journals. Resources from libraries all over the country are being used.

The University of Pittsburgh's Office of Communications Programs also received an award for the final phase of a 54-month project to develop a Campus-Based Information System (CBIS). CBIS furnishes the faculty and students with information services by providing remote access to computerized files of professional societies, government agencies, commercial organizations, and other universities. The final 18-month phase includes the development of system software to permit university-wide access to data bases through terminals; institutionalization of the administrative relationships of the CBIS with the Library and Computer Center; and the addition of several new data bases.

Dear Mr. Computer:

Forbes' publisher, James Dunn, received this letter from the Plaza Hotel:

"Please pray for us.

"On the first of January of this year we converted our Accounts Receivable system to Electronic Data Processing. In other words, we have surrendered to a computer.

"However, we are determined to have the most personal computer yet employed and have vowed never to hide behind it or use it as an excuse for the human errors to which we are all subject . . . .

"If you have any difficulty at all, please call Ms. Davis. She reports to me, and I whack the computer.

(signed) William E. Pringle
Computer Tamer"

[The salutation on Mr. Dunn's letter was "Dear Mr. Donn:"]

Goodbye to Back-Seat Drivers?

A computerized driving system is being tested in Munich, Germany. A driver identifies his destination upon entering a highway with buried induction loops picking up the information, which is relayed to a central computer which sends back instructions to be followed at the next intersection.

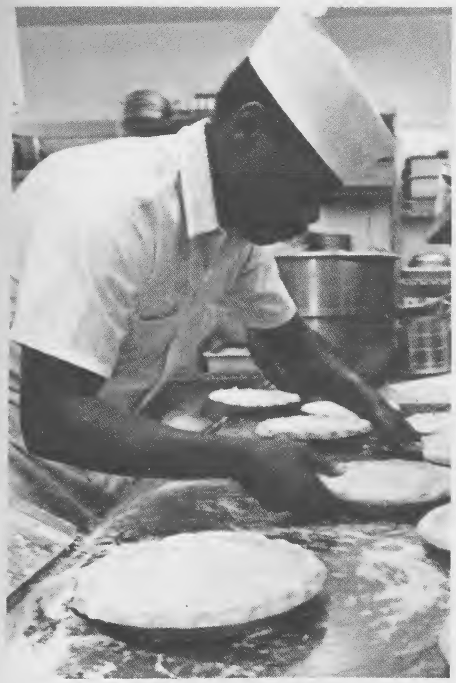
Social Science Literature File

The Institute for Scientific Information in conjunction with Lockheed Information Systems now provides the world's largest social sciences journal literature file. This file gives on-line, interactive, computer searches of the journal literature concerning all social science disciplines published since 1972.

The service, known as SOCIAL SCISEARCH, covers every editorial item ever dealt with in 1200 of the most important social science journals plus 2500 natural and physical science journals. This huge resource center can be searched by using key words, phrases, word-stems, authors, organizations, and citations used in articles as references.

The Lockheed retrieval program, DIALOG, enables subscribers to search the file through two-way communications terminals in their own facilities. This exchange with the computer in Palo Alto, California is conducted in English language statements, and the link can be made with the equivalent of a local phone call.

Computers Help Price Menus



Because food prices are up, eating in a restaurant is naturally becoming more expensive. However, prices sometimes fluctuate slightly as foods are in and out of season, but a menu rarely reflects these slight changes. Why do dishes of chocolate chip mint and vanilla ice cream cost the same? How does a restaurant price its menu?

Danners, a corporation that operates restaurants and variety and discount stores, is trying to improve their food pricing methods by using an IBM 370/125 computer. The Computerized Recipe Costing System uses two files; one file has information on the 550 ingredients used in the restaurant's recipes, and the other file contains each recipe, servings yielded, and other information. Each week, new prices of commodities used are given to the computer, and the price per serving of each recipe is produced.

Danners is still experimenting with its new system. For example, formulas for profits and labor costs are still being developed. The corporation hopes to develop a total system for their restaurant division using the Recipe Costing System. Meanwhile, their customers are already enjoying prices adjusted to the true cost of food.

A Better Pole Vault

A computer claims that the pole vaulting record of 18 feet, 6½ inches, set in March, 1975, could be broken by a hypothetical super athlete jumping 28½ feet. To accomplish this feat, the vaulter must execute a flawless jump, using a pre-curved pole designed by the computer.

James B. Vernon, an associate professor at the University of Southern California and an amateur vaulter, fed the computer equations representing the physical factors involved in a vault. The computer recommended a stiffer pole with a built-in curve of about 1.3 feet; however, Vernon feels that a pole with a curve of over a foot might be too unwieldy. With a pre-curved pole, the initial load buildup would be gradual, and the vaulter's energy would be even less dissipated than with today's less flexible poles. Vernon does not think that the 28½ foot mark could be reached in this century, but he thinks that a 20 foot vault is within the capabilities of present athletes.

James Vernon and his computer-designed, curved pole in action.

Computers Schedule Ads on Radio and TV

Coordinating advertisers and rate schedules for radio and television is an incredibly complex process. Remote intelligent terminals using Data General Nova computers are helping with this job at over one hundred radio and television stations throughout the United States. The terminals, offered by Data Communications Corporation of Memphis, Tennessee, are used in the company's Broadcast Industry Automation System (BIAS).

When a station subscribes to the BIAS network, a master file is set up for the station in a central computer. A data base is then built containing the station's current and expected advertising contracts. Through this file, the station can handle sales, traffic, and accounting. When selling time, a salesperson can access the central computer, which maintains time slot inventories, to see if a specific slot is available. The information on the display terminal lets the salesperson determine if the preferred slot is available, recommend alternatives if it is not, and commit slots when advertisers buy them.

A typical terminal is made up of a minicomputer, two CRT display terminals, two line printers, a synchronous multiplexor, and high speed lines to the central computer. It costs approximately $34,000.

WSBK—TV, Boston, is one of many radio and TV stations using a computerized scheduling system.

A Tragedy of Errors

by Susan Hastings

Last year in Florida a man was shot and killed by a state trooper when he parked his car on the shoulder of a highway. In New Hampshire another man was rousted from bed at 4:00 AM and arrested after he had been spotted driving with a defective tail light. Both incidents occurred not because the victims were wanted criminals, but because the people who operated the computerized criminal data bases in their states failed to update information held within those systems.

In December 1975, Frank D. Booth was on the way to his father's funeral when he pulled off the road, apparently to compose himself in the face of his grief. Trooper Robert Rennie, Jr. saw the parked car and radioed an inquiry on Booth's 1974 license plate number to a dispatcher with access to Florida's criminal justice system. When Rennie received a reply which indicated that a car with that number was stolen, he approached it with his .38 caliber pistol loaded and cocked. Seeing Booth reach into his coat and fearing the worst, Rennie fired his gun.

Booth probably would be alive today if officer Rennie had realized that he had received a report about a car stolen in 1971 which just happened to have a license plate with the same number as Booth's 1975 Chrysler. In Florida, vehicle identification is determined not only by tag number, but also by the year the tag was issued. Every year the same numbers are issued at random on plates whose color signifies the year. So-called "hot" numbers are never deleted with the new issuance because a change in color is supposed to negate all old plates.

Yet despite the fact that it takes two criteria—the plate number and the year issued—to correctly identify a vehicle, police can gain access to information in the criminal data base without the second identification criteria. Because the number of the unrecovered 1971 stolen car was still on file, and because the number on Booth's plate coincided with it, Rennie's query produced a reply that convinced him that he was in a dangerous position when he walked up to the man in the car, and he prepared himself for trouble. Officer Rennie was suspended temporarily from the state police pending a coroner's investigation.

When William A. Smith was stopped by Dover, New Hampshire police and issued a defective equipment tag he did not realize that six hours later he would be handcuffed and dragged to police headquarters to be photographed and fingerprinted for an unknown charge. But apparently when the police officer had given Smith his ticket he had wired Smith's name and date of birth to the National Crime Information Center in Washington, D.C. where a "hit" was registered.

According to New Hampshire law, police may hold a suspect for four hours without charging him, and Dover police spent most of that time trying to get Smith to admit being named "Barnes," the surname of a man wanted by New York police who went by the alias "Bill Smith." During the period of the real William Smith's interrogation no attempt was made to verify whether the "Bill Smith" sought by police was still at large, and Smith was refused the opportunity to call upon anyone who could have proven his identity. It was later learned that the man who went by the name "Bill Smith" had been picked up before Smith was even ticketed, but that this information had failed to reach the NCIC wanted persons file.

Although at the time William Smith was so anxious to regain his freedom that he signed a waiver exonerating the police in his false arrest, he is now suing seven policemen for violating his civil rights. If this case goes the way officer Rennie's did however, it is probable that Smith will lose his lawsuit. Six jurors acquitted the trooper on the grounds of justifiable homicide because, according to the Florida Highway Patrol, "all they could go on is what Rennie believed to be the case."

Computerized criminal justice systems have proven themselves to be great aids in law enforcement in this country. But the kind of careless mistakes in updating the systems that led to William Smith's false arrest and Frank Booth's death must be avoided. Police who want to continue to benefit from the data banks will have to learn to use them intelligently and responsibly. The public must also learn to question the misuse of such systems for them to be fully effective and beneficial.

Footnote: Following his acquittal in Florida, Robert Rennie went back on the job as a State Trooper. However, the psychological burden of guilt became too much for him. He subsequently got divorced, quit the State Police and today can only be described as a broken man.

This 'Hit' Not a Miss

ASHKUM, Ill. – A state trooper patrolling the interstate highway near here recently checked the license number of a vehicle apparently abandoned on the shoulder of the road.

A check with the Law Enforcement Agencies Data System (LEADS) and the National Crime Information Center (NCIC) showed the car had been stolen in Cook County and entered into the system earlier that day.

The trooper discovered a young male sleeping in the rear seat and took him into custody.

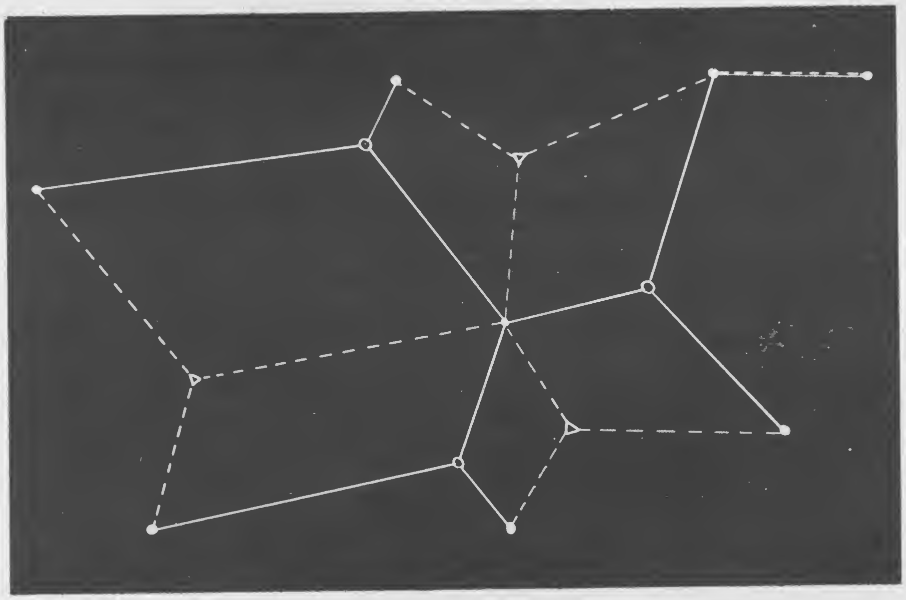
Further checking revealed the man was wanted for armed robbery and rape of the automobile's owner, and he was turned over to Cook County authorities.

Police in the United Kingdom use a large scale Burroughs B6700 computer to store information for the National Police Computer Network. The central data base has records on vehicle registrations, wanted and missing persons, and criminal records. Hopefully, the system is less prone to human error than the various U.S. systems cited on this page.

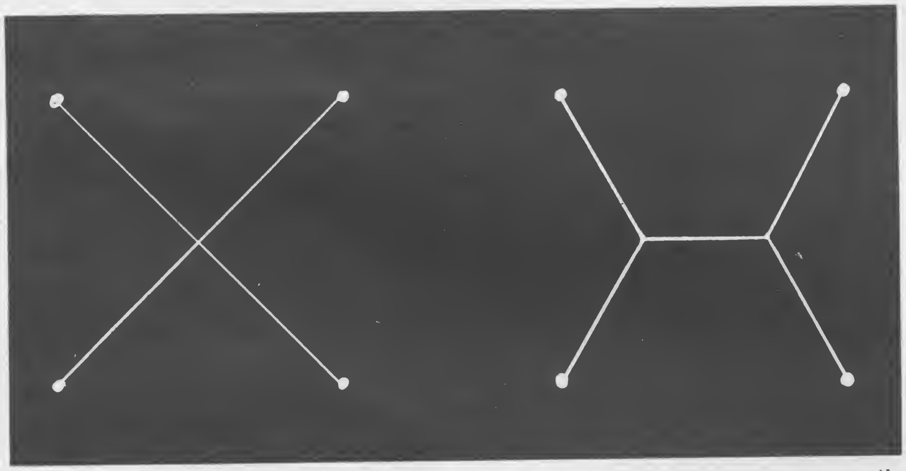
Suicide Blamed on Computer

On April 7th of this year, Stephen Karagianis was found hanged in his jail cell. The boy's father blames an apparent computer error for the boy's suicide.

In January, young Karagianis had been arrested for the possession of two marijuana cigarettes, but after Stephen had spent three months in jail, a county judge dismissed the case. Unfortunately, local police never received word of the dismissal over their computer network, and Stephen was again arrested, this time for violation of a parole that did not exist. Despite desperate pleas from the boy and his family, and warnings from Stephen's lawyer that he was seriously depressed and could not cope with confinement, police held the boy overnight. Early the next morning, Stephen was found dead. "You can't trust a boy's life to a computer," John Karagianis said as he tearfully began making funeral arrangements for his son.



Cities ● connected with a network by means of Steiner points ○ are pictured by the solid line. An alternative Steiner network linking the same cities is marked by dotted lines, using the Steiner points △. Both of these Steiner networks require less total distance than any straight-line network that did not use Steiner points, but it is not immediately clear which of these two Steiner networks uses least total distance.



Two ways to efficiently connect cities with telephone networks. For a square one mile on each side, the obvious method on the left requires $2\sqrt{2} = 2.83$ miles of cable. The more subtle means on the right, using cables that intersect with equal angles at two junctions, required only $1 + \sqrt{3} = 2.73$ miles of cable.

allel processing in a standard sequential computer is by means of a "backtrack" algorithm. Each time a branch point is reached, one branch is pursued and the others are stored in a stack of incompletely developed options. When the program reaches a dead end along the path it is pursuing, it backtracks to the most recently encountered unexplored branch stored in its options stack and pursues it. This process is repeated as often as necessary until one of the sequences of branches leads to a successful conclusion.

Backtrack programming (and related techniques called "branch and bound" algorithms) are just systematized approaches to trial and error: They organize the trials to ensure that errors, once discovered, are never repeated. But even a systematic search of all possibilities requires an enormous amount of time. Typically, the time required for a backtrack solution grows exponentially with the size of the problem.

The facts of exponential growth overwhelm even the astonishing speed of modern computers. Typical combinatorial problems involving, say, 10 cities (or 10 tasks to be scheduled) may require about 2^{10} (roughly, 1,000) branches. Depending on the complexity of the investigation to be carried out along each branch, this can be done in about a second or so of computer time. But if the problem increases to size 50—not all uncommon—the branching increases to 2^{50}; at 1,000 branches per second, this would take over 30,000 years! Thus computer scientists view as intractable large problems whose only known solutions are achieved by backtrack programming. They are computationally unsolvable.

Much better are those algorithms that grow polynomially rather than exponentially. If the time involved is of the order of n^2 or n^3 rather than 2^n, the computation time for large problems is dramatically reduced. For example, to continue with the hypothetical computations of the previous paragraph, a computer checking out 1,000 branches a second would manage 10^2 branches in a tenth of a second, and 50^2 branches in 2.5 seconds. Even 50^3 branches would only take two minutes. So to get a rough measure of the time required to solve a problem, computer scientists look first at whether the solution algorithm grows polynomially or exponentially with the size of the problem data.

Exponential growth most often results from a solution tree that is too broad: Even though the number of steps in a correct solution may grow polynomially, if the number of unfruitful branches that must be explored is too great, the time required by the solution algorithm may grow exponentially with the size of the problem. Problems like this can be solved in polynomial time by a nondeterministic algorithm. But, as we have seen, such algorithms are idealizations, incapable of actual implementation in polynomial time.

The class of problems that can, in principle, be solved by a nondeterministic algorithm of polynomial time—a class called NP, short for nondeterministic polynomial—thus includes many of the problems whose solutions actually seem to require exponential time. Whether in fact those problems that now seem to require exponential time actually cannot be done in polynomial time is not known: One of the major unsolved problems of current computer science is whether, possibly, every problem in the class NP can really be solved in polynomial time by an ordinary (deterministic) algorithm.

Massive circumstantial evidence has led virtually all informed observers to the conclusion that some problems in NP cannot be solved in polynomial time. This conclusion, if upheld, means that large problems of this type cannot be solved at all.

The first step in this chain of evidence was taken in 1971 by Stephen Cook of the University of Toronto who showed that each problem in the class NP can be transformed into a certain problem in mathematical logic, called the Satisfiability Problem, in such a way that any algorithm that would solve the Satisfiability Problem could be adapted to solve the other problem as well. (The Satisfiability Problem is the question of whether a Boolean logical expression can be satisfied [i.e., made true] by appropriate choice of the propositions from which the expression is built.) Cook's result shows that, in some sense, no problem in the class NP is any harder than the Satisfiability Problem.

Shortly after Cook announced his result, Richard Karp of the University of California at Berkeley showed that many other problems in the class NP share the distinction of the Satisfiability Problem. He called these problems NP-complete; they are sufficiently detailed to serve as prototypes for all other NP problems. Each NP problem can be transformed into any NP-complete problem and solved by appropriate adaptation of the solution algorithm for the NP-complete problem.

NP complete problems form a subclass of the class NP containing those of maximum difficulty. Karp (and others after him) showed that many famous problems of finite mathematics are in this class. These include the famous "traveling salesman problem" (find the shortest route that visits each city on a list exactly once), "0-1 integer programming" (linear programming in which variable values are limited to yes or no options) and "graph coloring" (assign a limited number of colors to regions in such a way that no regions with a common frontier receive the same color). The recent result of Garey, Graham and Johnson shows that the Steiner minimal tree problem is also of this type: It is NP-complete.

Most of the problems now known to be NP-complete have an extensive history of unsuccessful search for a polynomial-time algorithm. Recognition that they belong to the class of NP-complete problems shows that they are essentially equivalent problems. Thus the accumulated evidence of unsuccessful search for efficient algorithms for each of the several dozen NP-complete problems concatenates into an impressive record of failure.

Nearly half a century ago the mathematical logician Kurt Gödel astonished the mathematical and philosophical world by showing that in any sufficiently complex mathematical system there will always be intrinsically undecidable propositions—statements that can, by their very nature, never be proved or disproved. The status of NP-complete problems—if present beliefs are proved true—is somewhat analogous: They are problems that are sufficiently complex that, by their very nature, they cannot be solved in any practical amount of time. Gödel's work established the existence of problems that are theoretically unsolvable; NP-completeness points to the existence of problems that are computationally unsolvable.

Gödel's work on undecidable propositions led logicians away from a fruitless task (the complete formalization of all mathematics) and into more promising terrain. Similarly, the discovery of NP-completeness is right now turning applied combinatorial mathematics from the search for exact algorithms to the search for sufficiently good approximate ones. With this new focus comes a whole host of new and interesting questions concerning the establishment of standards by which an algorithm can be judged when we know that it is in the nature of things that it cannot be perfect. □

Does This Question Apply to You?

Adam Yarmolinsky, loyal Harvard alum, class of '43, and now the Ralph Waldo Emerson Professor at the University of Massachusetts, received one too many thirtieth-reunion questionnaires. ("What's your income bracket?" "Are you a Republican, Democrat, or other?" etc.) Following the ancient political maxim "you can't beat something with nothing," he offered in the *Harvard Bulletin* the following "counter-questionnaire" to his classmates and others:

How often are you astonished these days?
By yourself?
By others?

Do you laugh much?
About what?

Do you cry ever?
About what?

When did you last forget yourself?
Under what circumstances?

What is the most interesting thing about your life?
The most boring?

If you had it to do over again, would you be a different person?
In what ways?

Do your children understand you?
What do you hope for your children?
What do you fear?
What do you expect?

If you had to be someone else, who would you be?

Are you more likely to be the victim or the perpetrator?

Does God love you?
Do you care?

Where are you likely to spend eternity?

What do you think about when you wake up at three in the morning?

Why do you drink so much?
Why doesn't this question apply to you?

What's most wrong with this world?
Is it anybody's fault?
Whose?
Can it be fixed?
Is it likely to be?
What, if anything, are you likely to do about it?

As between polygamy and polyandry, which would you prefer?

Does space exploration excite you?
Bore you?

How do you feel about your dreams?
How do the people in your dreams feel about you?

What has been your greatest disappointment?

Whom are you trying to impress?
Whom are you trying to show up?

What are you really curious about?

Which of these questions was the hardest to answer?
Which was the easiest?
Are there any questions you'd like to ask?
Or answer?

Computational Unsolvability

Problems where complexity grows exponentially are now believed incapable of exact solution on even the fastest possible computers

BY LYNN ARTHUR STEEN

Problems of arrangement and scheduling are among the most common yet most vexing in all of applied mathematics. Sometimes solutions are intuitively obvious; other times they are surprisingly paradoxical. Some problems succumb to prosaic methods of attack, while other apparently similar problems are totally intractable.

The common managerial task of scheduling a given set of jobs among available staff in order to finish the work in the least possible time is a good example. Ordinarily, if the manager sees that he can't meet his deadline with existing staff, he will add an additional person. But in some cases, this additional person might increase rather than decrease the total length of time required to finish the job. The subtleties of scheduling are so deep that, although it is possible to write a computer program that will determine the most efficient schedule for a staff of two, it appears that the same problem for a staff of three requires so much computer time as to be, for all practical purposes, impossible to execute when the number of jobs is large.

Recent research has revealed a profound dichotomy in the nature of these combinatorial problems. Some are, in a specific technical sense, easy, while others are hard. The latest major problem to be successfully diagnosed in these terms is over 100 years old. It begins in a tale of four cities and ends in current research in computer networks and integrated circuit design.

Suppose an engineer wants to find the least expensive way to join cities located at the four corners of a square with a network of telephone cables. Since the cost of installing the network is roughly proportional to the total length of cable, he might expect that the best solution is to lay cable along the diagonals of the square, with a junction in the middle. But, surprisingly, this does not yield the shortest (and cheapest) network: the engineer could do about 3 percent better if he used two junctions and joined the cables at angles of 120° (see diagram). This configuration is the optimal, or best possible, solution to the engineer's problem. Because this solution was first studied by the 19th-century German geometer Jacob Steiner, the junction points where three paths meet at equal angles are today called Steiner points. (The 120° requirement for minimal path lengths is the two-dimensional analogue of the 120° angles at which soap films meet [SN: 9/20/75, p. 186].)

Modern engineers confront varieties of Steiner phenomena in problems ranging from the design of microprocessor chips to nationwide communication networks: The determination of the shortest network linking certain given vertices is one of the famous unsolved problems of combinatorial mathematics known as the Steiner minimal tree problem. (It is called a tree problem because of the resemblance between its solution network and complex branching of trees.) Although the nature of the general solution is well known, finding locations for the required Steiner points is a very difficult problem.

Until 1961 it wasn't even known if the problem could, at least in principle, be solved by a search of all possibilities. At that time Z. A. Melzak invented an algorithm (a step-by-step solution procedure) that introduced possible Steiner points in a sufficiently systematic way that it would eventually find the optimal configuration. But, despite a variety of improvements since then, Melzak's algorithm takes so much time that even on the fastest computer it is really feasible only for networks with about 15 to 20 vertices.

An experienced designer could do just about as well ''eye-balling'' the problem, that is, examining a scale drawing and introducing Steiner points where it looks as if they will do the most good. What makes the Steiner minimal tree problem so difficult is trying to tell a computer which of the many possible Steiner points ''look good.'' It is precisely when the problem gets too large for a person to ''eye-ball'' that the computer is most needed, and that is precisely where existing programs are of no use.

The meager results of nearly two decades of work on the Steiner minimal tree problem led many researchers to speculate that the problem was in fact intractable. That it is indeed intractable has now been proved by Michael Garey, Ronald Graham and David Johnson of Bell Laboratories in Murray Hill, N.J.

To understand the nature of their result we need to examine briefly the nature of computer algorithms that are used to solve problems of scheduling or arrangement. Solving such problems involves searching through different combinations of events in space or time; thus these problems are part of what is known as combinatorial analysis. All such problems have in common a natural ''tree structure'' in which early tentative decisions by the solver lead to branch points in the solution process where several other options may be pursued.

In a typical problem, there may be only a few correct routes through an enormous maze of branches. A combinatorial problem is like a huge tree with fruit at the tips of just a few twigs. How is a near-sighted bug crawling up the trunk going to select only the branches that lead to the fruit?

One way would be to have an oracle who can see the whole system at a glance. This is, in fact, how many relatively small combinatorial systems are solved—by a Gestalt-mathematician who apprehends the solution in a single act of perception. But it does not work for large systems because computers lack human insight, and humans lack the computer's memory.

A second method would be to employ a so-called nondeterministic algorithm. ''Nondeterministic'' is used to describe methods that avoid the problem of determining the correct branch by following all branches simultaneously. This requires, hypothetically, a computer that replicates itself over and over again so that late in the process thousands of similar programs will be working alongside each other, simultaneously pursuing different branches of the solution tree. Whenever any one finds the fruit, the problem is solved.

Nondeterministic algorithms have a natural advantage of speed, for the time required for such an algorithm to solve a particular problem depends only on the total path length from beginning to end (called the depth of the solution tree) and not at all on the number of different branches in the tree. But they achieve this advantage by unrealistic simultaneous replication of computation power. Only in the last few years have parallel-processing computers been developed, and the number of parallel tracks is strictly limited by the nature of the hardware. So, for all practical purposes, nondeterministic algorithms are a figment of a theoretical imagination. They cannot be used for practical solution of large combinatorial problems.

The conventional way to simulate par-

COMPLEX PROBLEM-SOLVING EXPERIENCE FOR UNDERGRADUATES VIA COMPUTER TECHNOLOGY

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Scenario

Imagine the following scene: You sit down at a computer terminal and after brief introductory details, you are asked to read the following passage.

"The Arctic Ocean is bordered across most of Eurasia and North America by low, mostly flat plains that dip gently into the sea, called the tundra. With an average annual temperature of two degrees above zero the tundra remains frozen most of the year. When the spring thaws the snow in the higher lands to the south, the water runs into the river and begins a migration to the Arctic Ocean, but the mouths of these great rivers are still frozen solid in these cold, northerly reaches and present an impenetrable dam to the advancing waters. The water spreads out over the low landscape forming innumerable lakes, ponds and swamps. The water has no choice but to sit and wait for the thawing of the river mouth — it can't evaporate into the cold air, and it can't sink into the ground because it's permanently frozen to depths of hundreds of feet.

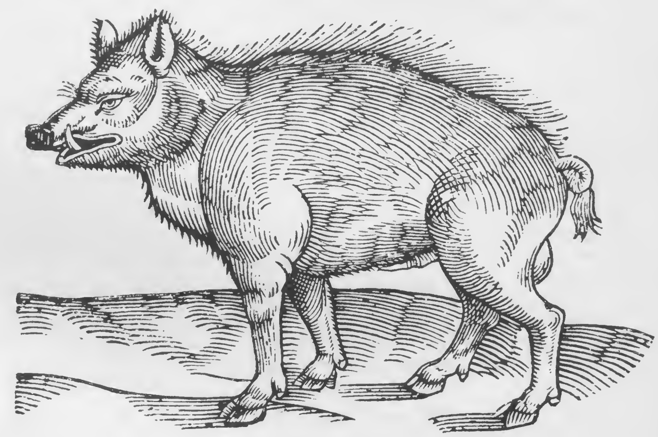
About one seventh of the entire land surface of the earth is permanently frozen and the greater part of that is covered with a layer, varying in thickness from a few feet to more than a thousand feet, of stuff we call muck. Only the top two or three feet of the muck ever thaws in the short arctic summer, only to freeze solid again during the winter. Ten feet down the passage of the seasons goes by completely unnoticed.

When the mouths of the great rivers finally open, much of the water drains away into the Ocean, carrying some of the muck with it. Then, occasionally, the excavated muck leaves to reveal one of nature's great oddities, the frozen remains of the great wooly mammoth.

The most famous of these, the Beresovka mammoth was discovered by a Siberian tribesman around the turn of the century. It was sticking headfirst out of a bank of the Beresovka River, a tributary of the large Kolyma which empties into the Arctic Ocean. A scientific expedition was sent by the National Academy of Sciences from St. Petersburg in accordance with an edict from the Czar. The members of this company built a shack over the corpse and lighted fires within to thaw it out. They then dismembered it carefully, packed up the parts, refroze them in the air outside, and sledded them to the Trans-Siberian Railroad.

Much of the head, which was sticking out of the bank, had been eaten down by wolves and other local animals, but most of the rest was perfect. Most important however, was that the lips, the lining of the mouth and the tongue were preserved. Upon the tongue as well as between the teeth, were portions of the animal's last meal, which for some reason he had not had time to swallow.

This meal proved to have been composed of delicate sedges and grasses and — most remarkably — of fresh buttercups in flower. The stomach contained many more quarts of the same material, undigested and not decomposed. The exterior of the mammoth was whole and perfect with none of its two foot hair rubbed or torn off. The meat was fresh, although it started to rot when thawed, and the sled dogs ate it with enthusiasm relieving the party from carrying additional supplies for the dogs. Unlike most mammoth finds the Beresovka mammoth had a broken hip, but like others it was healthy and robust, upright and with no apparent cause of death.



Mammoth remains are found widely distributed over Siberia and in Alaska. Their bones are spread over the floor of the Arctic Ocean where ships have dragged them up. And, 200 miles to the north, in the New Siberian Islands, mammoth remains are thickest of all.

How does one go about killing healthy, robust — 5 ton — animals leaving no apparent cause of death and then manage to preserve them in the condition described using only natural means? What processes of nature could combine to concoct such a wild story?"

The above scenario introduces you to a unique and rare experience in an undergraduate curriculum: the opportunity to attempt to solve a real and complex problem in science. The experience, which is supplemented by a computer, is also a vehicle to study human problem-solving of a scientific nature.

Scientific Problem-Solving

Although scientists and psychologists have long inquired about the nature of how man solves problems, most of the studies have focused upon the solution to problems with single correct answers. It can be argued however, that the study of how problems are solved can yield much insight into how man thinks. Given the assumption that problem-solvers employ a wide range of skills and strategies, complex problems are needed to elicit those behaviors in order to detect and study them.

We might define a complex problem as one having two characteristics. First, a rational (i.e., scientific) approach may be employed in the search for a solution. Second, the problem is rich in data which implies that various possible conclusions can be supported, to some degree, by these data.

The shape and direction of our computer-supplemented study of the Mammoth continues to be guided by these basic questions.

How does one solve complex problems?
Can a person become a better problem-solver?
What discriminates the better problem-solver?
What environments facilitate problem-solving?
To what extent can the study of problem-solving be automated?

Overview

The Wooly Mammoth (Mammo) problem is a problem-solving environment designed to confront individual or small groups of problem solvers with a complex task. The role of the computer (an IBM 1500 series using Coursewriter II with CRT, image, and audio terminals) is to: 1) present the problem to the student; 2) serve as a data source; 3) monitor selected parameters useful in the study of problem-solving; and 4) provide statements (heuristics) which help structure the flow of the solution effort.

Dr. David Riban conceived Mammo during his tenure as a physics graduate student at Purdue. Although designed for use with a high-speed computer, Mammo was run numerous times in non-computer mode with high school physics students and undergraduates. Mammo was programmed for the 1500 System in 1973 by Mr. Thomas Rhoades and Dr. Michael Szabo. Since that time it has been used to provide over 200 student hours of training in complex scientific problem-solving to preservice secondary science teachers. In addition, more than 350 undergraduate student hours have been logged in conjunction with research studies on problem-solving conducted by Dr. Szabo, Mr. Rhoades, Mr. Lazzaro, and Melissa Berkowitz.

Operation

An operational flowchart of student progress through the two-hour Mammo sequence is presented in Figure 1. The program first handles housekeeping details and presents the Scenario to the student. Then, without identifying the problem to be solved, the computer requests possible hypotheses and suggests the student query the computer (request data) that might be useful in testing the hypotheses. At no time does the student see a listing of available data. Instead, he types in a natural language request (up to three lines of text) which is matched with stored data titles using an edit and a keyword routine.

For example, a student might request, "What was the age of the mammoths?" This simple statement is deceptive. Does the student wish to know the number of years since mammoths became extinct? the actual age of the Beresovka Mammoth at death? the actual age (average) of mammoths at time of death in general? This example points out: 1) difficulties of using a computer to assign semantic meaning to a string of characters and; 2) the tendency of problem-solvers to formulate imprecise data requests. A successful data match results in the display of verbal data on the image screen. An unsuccessful match triggers the data request sequence again, but in a slightly different form. The student is given the three options of making a final conclusion and ending the program, reviewing hypotheses, or making another data request.

The data request used as an example will trigger display of a brief passage regarding the geologic age of the mammoths, abstracted from the scientific journal *Science*. There are more than 200 separate pieces of data stored on accessed images.

This describes one version (Mode I) of Mammo, called the Problem-Mode. Mode I was designed to be free from hints or cues, both content-oriented and content-free, that might aid the student in solving the problem. A second mode (II) has been constructed to provide content-free problem solving heuristics to guide, shape, or direct the process used by the student.

Operationally, Mode II is identical to Mode I except for two added features. The first is quite simple: it forces the student to evaluate his progress (hopefully, to test hypotheses with the data acquired) by requiring that the student type a brief conclusion after he has received data.

The second feature unique to Mode II is the presentation of selected heuristics to "guide" the problem-solving approach used by the student. By responding to the pattern of data requests or conclusions posed by the student, Mode II heuristics simulate a real problem-solving environment. Two examples will be presented. If the student triggers three pieces of data wihch have been determined to be logically related (by an outside authority), he receives the following heuristic message:

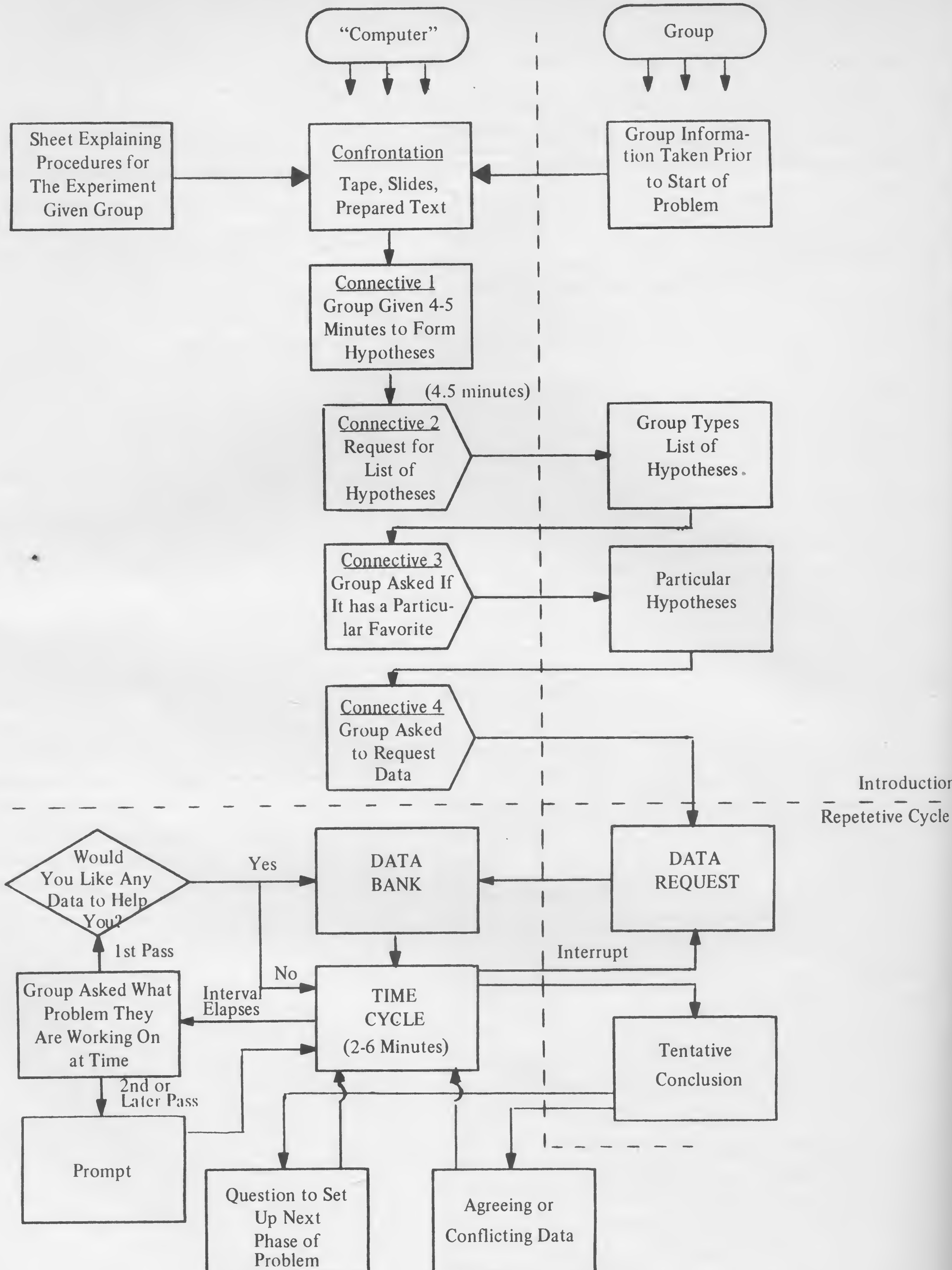
> "Good. Your last few requests for data show that you're following up a single line of thought. This is the only profitable way to attack a complex problem like this."

If on the other hand, the data requests (and matches) indicate logically unrelated data being sought, the heuristic may be of the following form:

> *"Do you have some strategy or plan of attack on the problem? What are you really trying to clarify?"*

As another example of the second unique feature of Mode II, the conclusions made by students are compared

". . . Pi!! . . . . That's the quantity I forgot to factor in!!!"



SIMPLIFIED FLOW DIAGRAM FOR MAMMO

with prestored conclusions which have been posed by scientists who studied the riddle of the mammoths. Further, logical "chains" or sets of data which are necessary and sufficient conditions to support these conclusions have been identified.

Presume that a student concludes that the mammoths froze to death but the student has neither requested nor seen the necessary data "chains" to support this conclusion. The likely computer heuristic displayed to the student, depending on specific terminology used is:

> *"A comparision of all possible facts and data in memory areas implies you have seen insufficient data to form this conclusion.*

On the other hand, suppose the student has requested the necessary data and concludes the mammoth frozen to death. In this case, the heuristic is:

> *"Hold on! Let's go back and check out your conclusion about the mammoth's death. Ask yourself questions like — if the mammoth really died in this way, what conditions would the cadavers be in? Always check your conclusions. Consider the idea and determine what data you need to check your idea out, then request such data."*

From these heuristics, it can be seen that the intent of the guidance provided in Mode II is to urge the student to form hypotheses, devise critical tests of these hypotheses, request data needed for those critical tests, and apply the tests in some logical fashion to reducing the discrepancy between the problem statement and the solution statement.

Findings

In addition to specific and experimental findings from theses now in progress, the following observations represent a sample of those made by various individuals associated with the project.

First, attempting to solve Mammo is psychologically engaging and elicits some strong positive reactions. Most students have to be reminded that it is time to quit and a large majority wish to know "the answer." The enjoyment of the experience is a function of the background (science or non-science) of the students and whether the problem is investigated in a group or as an individual effort.

Second, requests for data are more often requests for conclusions. For example, students commonly ask questions like — "Did the mammoth drown?" rather than requesting data on analysis of the stomach contents of the cadaver (that is, data which could support or refute the hypothesis of death by drowning). The phenomenon of imprecise or unfounded data requests has been noted in many problem-solving studies and was a serious deterrent to the acquisition of sizable amounts of data in early Mammo programs. This problem has been corrected by the addition of a short segment which instructs the student to conceptualize the computer more like an encyclopedia than a genie with all the answers.

A third observation is that terminology used in requests for data varies considerably, with profound implications for keyword identification of the data. Use of common synonyms for the Lorge-Thorndike dictionary of most commonly used words was quickly found to be unworkable as college students just didn't use those terms. An examination of actual terminology used led to substantial revisions which in turn permits much greater access to data.

A related problem is serendipity. Occasionally a student request triggers the display of data apparently not intended. Early in the development, a data request which included the words "weather" and "mammoth" would trigger data on the eating habits of mammoths. Although the student apparently desired climatological data, he actually obtained data on eating habits of the mammoth. The problem was soon discovered: the word — eat — is embedded in the word weather. Although this problem of incorrect matching of requests with displayed data results from limitations on CAI language restrictions and programming skills, it nonetheless simulates reality to some degree. The researcher always encounters data which: 1) he wasn't looking for and 2) are irrelevant to the hypotheses presently under investigation. The effect of unwanted but potentially useful information upon a student's problem-solving strategy might be of considerable value.

Utilization of Mammo

Past and future utilization plans for Mammo include the: 1) investigation of problem-solving skills and strategies (e.g., problem conceptualization and reconceptualization, hypothesis formation, data utilization); 2) study of problem-solvers' behaviors in various prompting (environmental modes) modes; 3) comparsion of group and individual problem-solving behaviors; and 4) training of prospective and inservice science teachers in problem-solving skills.

Presently two doctoral and one masters thesis are in progress as are minor revisions to the program.

A second complex problem is being developed in order to provide an alternative format and serve as a criterion environment to investigate increases in problem-solving abilities or performance levels.

Summary

This paper describes a system of complex and scientific problem-solving in its most recent (but hopefully not final) stage of evolutionary development. A real world problem has been partially programmed into a computer program with two major modes. One presents the problem and assumes the student proceeds toward a solution in a more-or-less logical (i.e., non-random) fashion. The second mode attempts to guide the student into using certain strategies theoretically related to scientific problem-solving.

The complex answer processing routine which borders on an artificial intelligence application simulates numerous aspects of real problem solving including the fact that the student never knows the complete domain of available data.

Mammo has been used to train prospective science teachers and to study selected parameters of human problem-solving. It also serves as a vehicle to test the limits of technological devices in recognizing specific human thought patterns and responding intelligently to them.

"Quick, Charlie! How much is 27 minus 6?"

Learning by Doing

by Fred Gruenberger

In a second, or intermediate, course in computing, the student should be lured (coerced, dragooned) into working on a term project, assigned at the start of the semester and due at final exam time. This should be a computer problem, preferably of the students' own choice, done in workmanlike manner to demonstrate that the student has learned something of the computing art. The final result should be packaged neatly, to include:

1. An English statement of the problem.
2. Flowcharts of the logic of the solution (or the equivalent of flowcharts, if the student prefers some other way of expressing his logic).
3. Listings of the program.
4. Results, clearly labelled.
5. A test procedure and test results.
6. Conclusions (what was learned from the work; what would be done differently if the project were to be repeated; limitations on the results; suggestions for further research, etc.).

   The packaged term project should be saved for use in eventual job interviews.

Experience has shown that the student's chief problem is that of selecting the problem he intends to work on. In all likelihood, he has so far worked only on problems that were assigned (and hence clearly labelled computer problems), for which much of the analysis has already been done for him.

There is usually a fair amount of panic at the time this assignment is made, since it puts the student on his own for the first time. About a third of a typical class will suggest one of the following:

1. "May I use a problem I did in my Fortran class last semester?" No, that problem was defined and analyzed for you, and the object now is to see how you do with a new problem. Further, you *did* that problem; it's time for you to do another one.

2. "I've been assigned to a big problem at work; may I turn it in for this project?" No; that problem concerns your work; try an isolated problem here, one that you can deal with thoroughly and completely. (And experience has shown that when this restriction is relaxed, the end result always seems to be someone else's work, and the student can barely explain what went on.)
3. "I don't know where to find a problem to work on." Well, there are systematic collections of good problems; you might try browsing through *Problems for Computer Solution* (Gruenberger and Jaffray, Wiley, 1965) which outlines some 90 problems that would be suitable. The best problem is the one that interests you.
4. "I'm a business (music, chemistry, ..., mathematics) major; I'll do a problem in business (music, chemistry, ..., mathematics)."

   There's the real problem. What is needed, early on in the semester, is a *proposal* by the student of just what he intends to do, so that he can be saved from the extremes of plunging into a problem that is either trivial or too grandiose. In the former case, he will produce something that requires little or no knowledge of computing; in the latter case, he will look sad at final exam time (when the computing center is saturated) and wail that he needs just one more run of his program.

   The phrase "a business problem" is rather vague. A new attack on Bill of Materials scheduling? An inventory control program for 10,000 line items? A table of base pay times hours worked? Or what?

The trouble is, of course, that the whole idea is brand new to most students; he has never been placed in the awkward position of making a selection that is within his own capabilities (indeed, he has probably never been told what constitutes a decent computer problem). Further, he has never had to define a problem and outline an attack on it; this has been done for him for all of the 14 years he has been in school. It helps if he can see samples of what this is all about, so a collection of old term projects (both good ones and bad ones) should be made available to him. It would help even more if he could be shown some sample proposals. A few are given here.

I

A comparison will be made between the Gauss-Seidel and Gauss elimination algorithms for the solution of simultaneous linear equations. A number of sets of six such equations will be constructed with known roots. Programs will be written in Fortran to solve such systems with the two algorithms, both in single and double precision. The solutions will be compared for the following:

1. Computation time.
2. Accuracy of the results.
3. Compilation time.

One of the sets of equations will involve a singular matrix, to determine how this condition is handled by the programs.

II

A small inventory of 25 items will be set up, and daily changes to that inventory will serve as input to a program. The program is to update the inventory, and print a report showing, for each line item, the quantity on hand, items out of stock, reorder conditions, lead time to arrival of new stock, and those items requiring expediting. For the small inventory involved, all results will be hand calculated as a test of the logic.

III

The COBOL reference manual at our installation lists 58 error messages for errors that can occur at compile time. A program will be written that will trigger each of these error messages.

IV

The melody of a song can be expressed as a series of numbers. The pitch of each note can be expressed by numbering the notes of the scale, and the duration of the note can be coded on a scale from 1 to 8. With a given melody so coded, an algorithm can be applied to it to translate it into a new melody. The simplest such algorithm would be to reflect each note around a middle value, to transform high notes into low notes and vice versa, leaving the duration of each note fixed.

Several algorithms will be devised, and applied to ten "standard" tunes. The resulting translated melodies will be played, and the most pleasing result will be recorded and submitted on a cassette as part of this project.

V

The Los Angeles *Times* prints about 500 column-inches of text each day in its main news section. Some of these inches can be identified as politically oriented:

A. Favorable to Republicans.
B. Unfavorable to Republicans.
C. Favorable to Democrats.
D. Unfavorable to Democrats.
E. Favorable to third-party candidates.
F. Unfavorable to third-party candidates.
G. Completely neutral.

In theory, material that reflects the political leanings of the newspaper's editors should be confined to the editorial pages, and the news pages should be unbiassed. In practice, the amount of text space allotted to a candidate or a party reflects the paper's views, however unconsciously.

The pages of each issue for the 8 weeks preceding the last general election will be examined, and a listing made of the column-inches in each of the first four categories given above, as objectively as possible. Ratios will be calculated of the following:

$$\frac{A}{B} \qquad \frac{C}{D} \qquad \frac{A}{C} \qquad \frac{A+D}{B+C}$$

for each day, and progressive totalled for the 56 days.

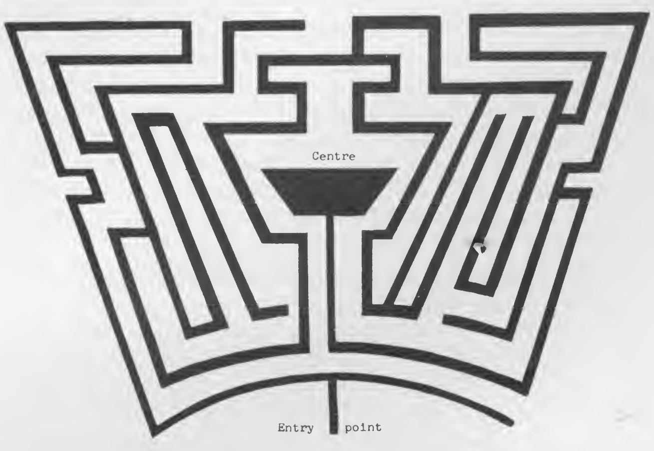
While this is not properly a computer problem (the small amount of arithmetic involved could easily be done by hand), the program will be useful for a much larger project jointly sponsored by the School of Journalism and the Department of Political Science. During the 12 weeks preceding the coming presidential election, the ratios will be calculated and plotted for each of 15 leading newspapers across the country.

VI

Attached is a diagram of the maze in the gardens at Hampton Court Palace, constructed in the reign of William III. "The key to the centre is to go left on entering, then, on the first two occasions when there is an option, go right, but thereafter go left." The maze exists today, and for 2p a visitor may enter the maze, seek the centre, and retrace his way out.

Given a new maze, described in terms of the coordinates of the branch points, a program is to be written to explore the maze and output the directions for the choices to be made to proceed from the entry point either to the center or to a specified exit. The choices will be limited to two at each branch point.

One test of the program will be the reproduction of the directions quoted above for the Hampton Court maze. The computer solution for the other mazes will be checked by hand.



Plan of the maze at Hampton Court Palace, England. The path to be followed is the black line.

VII

If the numbers from 1 to 20 are permuted, what is the distribution of runs up and runs down of the numbers? Consider the following possible permutations:

A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
B	1	20	2	19	3	18	4	17	5	16	6	15	7	14	8	13	9	12	10	11
C	20	18	16	14	1	3	5	7	12	10	8	6	4	2	9	11	19	17	15	13
D	2	12	17	4	13	10	1	5	15	19	20	7	16	14	6	18	3	8	9	11
E	11	19	2	7	12	1	8	6	18	13	15	20	17	10	16	14	3	4	5	9
F	1	15	14	2	16	13	3	17	12	4	18	11	5	19	10	6	20	9	7	8

For A, there is just one run up, and none down, but for permutations taken at random, the chance of arrangement A is just 1 in 20!, or about 1 in 2.4 times 10 to the 18th power.

For B, there are 10 runs up and 9 down, but this, too, is an unlikely arrangement.

For C, there are two runs up and three down.

For D, there are six runs up and five down.

For E, there are seven runs up and six down.

For F, there are seven runs up and six down.

The complete distribution of all possibilities for all 20! permutations could be determined by theory. I propose to approximate the distribution by sampling random permutations and counting the runs.

In order to do this, I will need a random number generator and an algorithm for forming random permutations. For the former, I will use the generator described on page 8 of issue 21 of *Popular Computing* (my work will be done in Fortran). For the latter, one of the following schemes will be used:

1. Generate an array of 40 numbers. In the even positions put the numbers from 1 to 20. In the odd positions, generate 20 random numbers. Then sort the 20 pairs, using the random numbers as the sort key. Although it is inefficient, I will bubble sort the 20 pairs. After sorting, the right hand number in each pair of numbers will be a random permutation of the numbers from 1 to 20.
2. Use the random number generator to generate integers in the range from 1 to 20, and let these integers be the subscripts for entries in an array of dimension 20. First zero out this array. Select elements in the array by the choice of subscript. If the chosen element is zero, fill it with the next consecutive integer, starting with 1. If the element is not zero (i.e., it has already been selected), proceed to another element. When all the elements are filled, the array contains the desired random permutation.
3. In the above scheme, the first 16 or so elements will be filled rapidly (that is, the condition of duplicates will not occur too often), but the last 4 or so may take an undue amount of time. A variation might be tried. Apply the scheme described until 16 elements are filled. Then insert the remaining four numbers into the four blank slots, picking one of 24 arrangements of those four positions at random, again using the random number generator.

At least 1000 random permutations will be generated, and a distribution made of the lengths of the runs. This distribution will be compared to the theoretical (if I can obtain that). The program will be generalized so that it can operate on dimensions other than 20. If time permits, runs will be made on permutations of 10 and 30 items.

VIII

I would like to try to calculate the number (15000!). (I understand that the current record for factorials is 10000!, and that all the factorials by thousands are on file.) Even if I don't succeed in obtaining the desired result, I believe that working on the project will be worthwhile, and I will be able to at least provide hints and suggestions for the next person who tries to break the record.

Since this calculation will consume considerable amounts of machine time, I propose to calculate the following test data first:

1. The exact number of expected digits.
2. The number of low order zeros.
3. Some of the high order digits, and some of the low order non-zero digits.

In addition, I will use my program to calculate (and check with known results) 500!, 1000!, and 10000! before requesting a commitment of machine time for the long run.

I believe that I can hold intermediate results in storage by packing six decimal digits per machine word. I will need packing and unpacking subroutines, and a subroutine for decimal multiplication. I will test these subroutines before making any long runs.

IX

Problem H5 in *Problems for Computer Solution* calls for the creation of abstract paintings by a computer program. The program is to select the size and shape of various geometric figures and their position on a canvas. I wish to explore this notion extensively with the aid of the plotter now available, which should aid greatly in the mechanical chore of examining the program's results. The plotter will allow up to three primary colors for the figures, and the choice of color will also be made by the program. The plotter routines also permit the figures to appear in outline form, or solid (filled in), as well as various degrees of cross-hatching.

It is stated in Problem H5 that an important aspect of the problem is the determination of when to stop. I propose to put this decision into the program in terms of the area covered by the random figures. This will be a bit tricky, since the figures overlap. However, if the total area covered by the figures is limited to some fraction of the available area, with or without overlap, and this limit is a parameter of the program, then the program will be able to output finished art without intervention in any quantity.

The ratio of successive terms of the Fibonacci sequence approximates the golden mean:

$$\frac{1 + \sqrt{5}}{2} = 1.6180339887498948482045\ldots$$

Thus, we see

$$144/89 = \underline{1.617}9775$$

$$1597/987 = \underline{1.61803}44$$

$$121393/75025 = \underline{1.6180339886}$$

Using the EXACMATH package, I propose to write a program to generate successive terms of the Fibonacci sequence, form the ratio, and determine to how many digits the ratio agrees with the golden mean. The limits of the EXACMATH package will let me carry these calculations to at least the 1000th term of the sequence. My output will be a table of values (term number against the number of digits of agreement) and a graph showing the rate of growth of the function being explored.

X

The Raindrop Problem, which appeared in issue 6 of *Popular Computing*, called for selecting a point at random in the unit square as the center of a circle whose radius is taken at random between zero and 1/2 unit. The problem asked for the number of such circles needed to completely cover the unit square.

A crude solution will be attempted by subdividing the square into 400 smaller squares. A mathematical test can be devised to determine whether or not each of these smaller squares is covered by one of the circles. The results of 100 trials will be plotted, to obtain an approximation to the desired distribution. For a few of these trials, the method will be repeated with the large square subdivided into 900 smaller squares, to determine if the method could lead to a correct solution.

Shuffling

by John Jaworski
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When faced with the problem of printing out the integers from 1 to 10 in a random order (without repetitions), the following program is an excellent example of how not to proceed:

```
100  FOR I = 1 TO 10
110  N = INT(10*RND+1)
120  PRINT N;
130  NEXT I
140  END
```

As we are taking no precautions against repetitions, we can be almost certain to get some. In fact, if my rapid calculations are correct, the probability of getting what we are looking for is minute: 3.6×10^{-4} — rather less than 4 correct solutions in 10,000 trials!

Somewhat better, on the face of it, is the next example. Here we provide an array M, choose a random integer and only insert it into the array M when we have checked that this integer is not already present.

Note that statment 100 is superfluous in the BASIC language, but it is as well to remind ourselves of the nature of M.

```
100  DIM M(10)
110  K=1
120  N=INT(10*RND+1)
130  FOR J=1 TO K
140  IF M(J)=N THEN 120
150  NEXT J
160  M(K)=N
170  K=K+1
180  IF K<11 THEN 120
190  MAT PRINT M;
200  END
```

Unfortunately, while producing results, this is not at all economical on time. When the array is almost full, say with 9 numbers inserted, there is in fact no choice at all for the last element, but only one chance in ten that statement 120 will select the correct integer for us — 90% of the work done by the program at this stage is wasted. This of course is more acute when shuffling rather more integers!

One rather more elegant method is the following: choose ten random *real* numbers less than 1, using RND. Associate these with the ten integers 1 - 10 and then sort them into order, shifting the integers around at the same time:

e.g.

BEFORE		*AFTER*	
1	0.1143	0.0954	9
2	0.9317	0.1143	1
3	0.5120	0.2671	5
4	0.3367	0.2758	7
5	0.2671	0.3154	10
6	0.8815	0.3367	4
7	0.2758	0.4186	8
8	0.4186	0.5120	3
9	0.0954	0.8815	6
10	0.3154	0.9317	2

We can sort the real numbers by any sorting method we have found suitable. Here is a demonstration program that uses the 'ripple' sort (which you may know under some other name).

100 DIM A(10), P(10) 110 FOR I = 1 TO 10 120 P(I) = I 130 A(I) = RND 140 NEXT I	A contains the random numbers and P the integers that will eventually be printed. This loop sets up these arrays.
150 L = 10 160 F = 0 170 I = 1	The limit on comparisons, L is set to 10, the flag is set and we begin our comparisons at the beginning of the list.
180 IF A(I) > A(I+1) THEN 260	compare adjacent numbers.
190 T = A(I) 200 A(I) = A(I+1) 210 A(I+1) = T	if not in order, swap A's . . .
220 T = P(I) 230 P(I) = P(I+1) 240 P(I+1) = T	. . . swap P's
250 F = 1	and set flag
260 I = I+1 270 IF I < L THEN 180	increment and branch back
280 IF F = 0 THEN 310	if in order, stop
290 L = L−1 300 GO TO 160 310 MAT PRINT P; 340 END	

The last example underlines the fact that the more efficient and more elegant program is not always the simplest when written out.

GRID ADDRESSING

by
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Grid addressing is a technique which has many applications in contemporary technology. An understanding of this method erases part of the mystery which surrounds the computer's instantaneous manipulation of both instructions and data through only data.

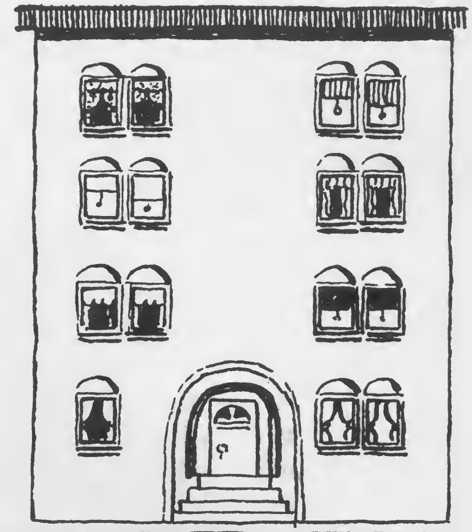
A fictitious kitchen grid will be used to illustrate the concept of grid addressing. A bachelor enjoyed waking to a warm room filled with soft music. He would rise, shave, have eggs, coffee, toast, and run the dishwasher. Then he would read the paper and watch the TV Morning Show. When he left the house for work, his answering service monitored his telephone calls.

After work the bachelor checked his answering service and listened to music while he shaved. Then he ate, ran the dishwasher, read the evening paper, watched the late show, had toast and milk, and went to bed with the heat turned down.

If the bachelor's appliance grid is that shown in the figure and if half of the electricity required to operate an appliance went up the vertical line and half across the horizontal line, what numbers would he give his grid for his morning program and what numbers would he give his grid for his evening program? We've filled in the first four morning operations in the grid (memory). Can you fill in the rest?

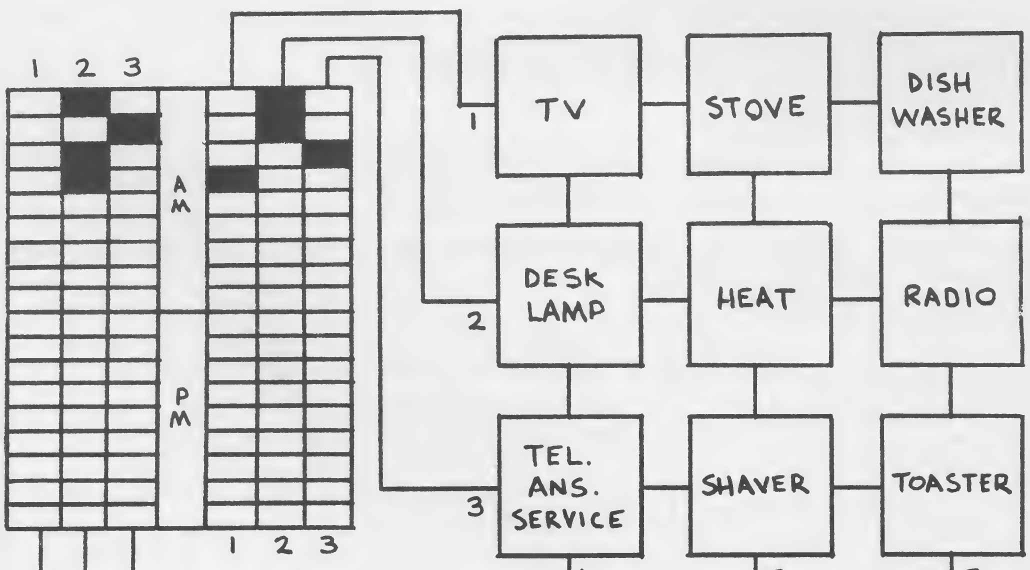
When I was in Europe at the 2nd World Computers in Education Conference in September 1975, Sam Calvin and Gerard Akkerhuis were kind enough to give Sandy and I lodging and "guide service" in the Frankfurt area. Gerard also gave me a wealth of outstanding material that he wrote for use in the USDESEA schools. Unfortunately, much of it is geared to the Interdata 7/16, a not-very-common computer in schools and homes. However, as we get the material generalized, it will appear on these pages (eventually). — DHA

J, J, J & T!



(1) Joe, Jack, John and Tom live one on each floor of a four-story apartment.
(2) Their ages are 10, 9, 8, 5, but not necessarily in that order.
(3) Joe lives directly above the 9-year-old and directly below the 8-year-old.
(4) Jack has to pass by the 5-year-old to leave the building from his apartment.
(5) Jack is more than one floor away from Tom, who is more than one year younger than Jack.

Find the ages and on which floor each of the boys lives.



Find the Presidents and Vice-Presidents of the United States

Names of the first 37 Presidents and 30 Vice-Presidents of the United States can be found among these letters. The name of each is hidden either forward, backward, up, down, or diagonally. Names appearing more than once on the list appear as many times in the matrix, for example. Johnson appears three times. (One multiple name appears only once, however, which one?)

Computer programs have been written to hide names in a matrix. Can you write such a program? Using one (or by hand) can you pack the names any more efficiently than is done here (using fewer total matrix elements — square or rectangular)?

Computer programs have also been written to locate names in a matrix. If you were to write such a program, what is the best search technique? There are many and the problem is no easier than finding an efficient sorting method.

Lastly, how can the matrix here be modified to hide the name of our latest president and vice-president, CARTER and MONDALE by changing as few letters as possible?

```
R Z F H U M P H R E Y D Y E L K R A B L L A H S R A M
O S K C I R D N E H O B A R T C L R S K N A B R I A F
C T R E N R A G R E L E E H W E G D I R N I K C E R B
K E E R T R U M A N P R E W O H N E S I E C A L L A W
E V T C O L X A F L O C S E Y A H I S O N O S N H O J
F E O O O O E Y B N D L E I F R A G M R E V O O H M L
E N C W G O S V D P L R U H T R A H A R R I S O N E D
L S S L I N L E E E R O M L L I F W D N A L E V E L C
L O E H I L I I V S N L C N O S I D A M C K I N L E Y
E N C W E N S D D E O N N N B O F P D S O F P Q E W J
R A U N A R T O R G L O E O I N O R A T H N O C F I O
H G R I E D M O N A E T R K S L R I M L A I R R R L H
A N T X D G N A N A H C U B K K D X S O R E N O D S N
M E I O T R E L N Q T S B U R R C N O X I N D G E O S
L W S N N O T R O M G F N G N I K A P P R E L Y T N O
I N O S N H O J R O L Y A T N A R G J E F F E R S O N
N S N I K P M O T Y A D V T S A L L A D C A L H O U N
```

Presidents

WASHINGTON
ADAMS
JEFFERSON
MADISON
MONROE
ADAMS
JACKSON
VAN BUREN
HARRISON
TYLER
POLK
TAYLOR
FILLMORE
PIERCE
BUCHANAN
LINCOLN
JOHNSON
GRANT
HAYES
GARFIELD
ARTHUR
CLEVELAND
HARRISON
MCKINLEY
ROOSEVELT
TAFT
WILSON
HARDING
COOLIDGE
HOOVER
ROOSEVELT
TRUMAN
EISENHOWER
KENNEDY
JOHNSON
NIXON
FORD

Vice Presidents

BURR
CLINTON
GERRY
TOMPKINS
CALHOUN
JOHNSON
DALLAS
KING
BRECKINRIDGE
HAMLIN
COLFAX
WILSON
WHEELER
HENDRICKS
MORTON
STEVENSON
HOBART
FAIRBANKS
SHERMAN
MARSHALL
DAWES
CURTIS
GARNER
WALLACE
BARKLEY
NIXON
HUMPHREY
AGNEW
FORD
ROCKEFELLER

Train Your Computer To Be A Go-Moku Champion

Lawrence J. Mazleck
Computer Science, University of Guelph
Guelph, Ontario, Canada

The first North American Go-Moku tournament was held November 29, 1975. The competition used the University of Guelph (Guelph, Ontario, Canada) as a central clearing house for telephone relaying of moves.

Four teams competed. The initial response had been from twelve teams, however the non-availability of telephone support money, the Canadian postal strike (the tournament was held on the fortieth day of the strike), and programming problems steadily reduced the field (two were even lost on the tournament day).

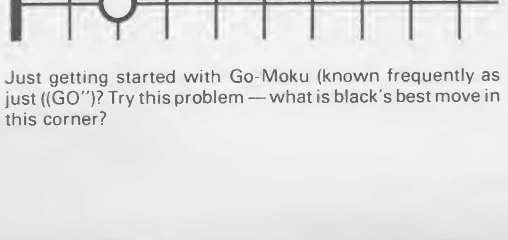
The final standings were as follows (the number one program beat everyone, the number two program beat everyone but number one, etc.):

Program Name	Programmer(s)	Computing Power	Number Plies
ARTHUR	Mike Compton Apt. 2105 47 Thorncliff Pk. Dr. Toronto, Ont. M4H 1J5	IBM 370/168 using VM 1500 PL/I Statements	2-7
	Edward Johnston Arthur Coston Psychometrics Lab. U. of North Carolina chapel Hill, N.C.	PDP-11/45 4K	0
FIVE-IN-A-ROW	Henry Baird 283A Franklin Ave. Princeton, N.J. 08540	PDP-8 4K	0
ANDY	Andy Sulkowski 12 Joycelyn Dr. Streetsville, Ontario	370/155 using TSO in 78K	3

The third ranked Canadian Go Player (Shein Wang) played ARTHUR and FIVE-IN-A-ROW and found that the programs played well. No attempt was made to place the programs on the human rank scale.

Results from the 1976 tournament which was scheduled for Nov. 27-28 were not available by press time, however, it was expected that there would be significantly more entries than in 1975. Furthermore, a human Go-Moku expert was to be on hand to provide approximate human rankings of the programs.

Would you like to enter your computer in a Go-Moku Tournament? It's simple. Just contact the author for entry forms (tournaments are held every November in Guelph) and produce a program that plays according to the following rules:



Just getting started with Go-Moku (known frequently as just ((GO")? Try this problem — what is black's best move in this corner?

1.0 Each program will be limited to 15 minutes of clock time. Use of more than 15 minutes will result in game loss.

2.0 Each round will consist of every program playing every other program twice. Each program will have the opportunity to move first.

3.0 The board will consist of a 19x19 matrix.

4.0 Move position markers consist of black and white "stones." Black moves first and may begin at any board position.

5.0 Once a stone is placed on the board, it remains in the same location until the game is terminated.

6.0 The board reference coordinates are alphabetic horizontally and numeric vertically. Coordinate A-1 occurs in the lower left hand corner of the board. The alphabetic coordinates excludes the letter I and includes the letter O ("oh").

7.0 Illegal moves.
- 7.1 If a player makes an illegal move and it is recognized as such by an opposing program, the opposing program wins.
- 7.2 If an illegal move is not recognized by an opposing computer program, play will proceed from that point. The move will be considered to be legal immediately after the second player fails to recognize its illegality.
- 7.3 If an unrecognized illegal move causes one stone to be placed upon another stone, the first stone will be removed from the board.

8.0 Winning
- 8.1 A winning position requires five and no more than five stones of the same colour adjacent in a row (horizontal, vertical, or diagonal).
- 8.2 A row consisting of more than five adjacent stones of the same colour is not a winning position.
- 8.3 All winning positions must be demonstrated by playing to game end.

9.0 Claiming a win
- 9.1 A player does not win unless the player claims a win. The first player to validly claim a win for his own position wins the game.
- 9.2 If a player fails to claim a win, he may do so at a later time, providing he has a winning position at that time and his opponent has not validly developed and claimed a winning position.
- 9.3 If a player fails to claim a win, his opponent may
  - 9.3.1 proceed with his own game, ignoring his opponents winning position.
- 9.3.2 point out the winning situation and claim a draw
- 9.4 Anyone falsely claiming a winning position loses the game. False win claims will be judged by a human referee. Assertations of a false win claim may be made either by a computer program or by the program's human representative within 15 minutes of a victory claim.

10.0 Program parameters may not be reset during the tournament.

Puzzles and Problems For Fun

THE VICAR TOLD THE SEXTON . . .

The sexton at the local church was ill and did not attend the Sunday service. The vicar visited him after the service, and the following conversation took place.

Vicar: "There were only 3 people in the congregation — excluding myself — and the product of their ages was 2450. The sum of their ages was twice your own age. Can you tell me the ages of the members of the congregation?"
Sexton: "You haven't given me enough information."
Vicar: "It is sufficient for you to know that I was the oldest person there!"

Now there is no doubt that the vicar was a very mathematically minded man; but how old was he?

. . .AND THE SEXTON TOLLED THE BELL

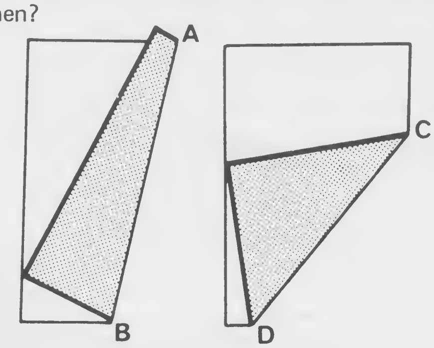
By the following Sunday the sexton had recovered well enough to be able to ring the bells at the regular service. There were just two bells in the church belfry; the first can best be described as a 'ding' — the second, not unnaturally, as a 'dong'. Now an ancient by-law in the district proclaimed that no 'ding' could be rung exactly two chimes after another 'ding'; and that no 'dong' could be rung exactly three chimes after another 'dong'. So what was the longest sequence of chimes that the poor sexton was permitted to ring?

Games & Puzzles

FOLDED

A piece of paper may be folded so that the bottom right corner just touches the left edge. Your problem is to determine, for any rectangular piece of paper, a method to produce the shortest possible crease. In the diagrams, crease CD is longer than AB but still not the shortest. What is? If you rotate the piece of paper 90 degrees (longest side horizontal) and repeat the exercise, what is your method then?

Games & Puzzles



COMPUTER RECREATIONS

by D. Van Tassel

Calendars

Calendars provide some interesting programs. To program calendar programs you must know the following rule: A year is a leap year (that is, February has 29 days instead of 28 days) if it is a multiple of 4, except that a multiple of 100 is a leap year only if it is also a multiple of 400. January 1, 1800 was a Wednesday.

A common program on terminals is one that accepts any date and prints the day of the week. People like to input their birthdate and find out what day of the week they were born. This program can also be used to locate future three day weekends caused by holidays such as the 4th of July.

A common program needed in business programming is a program that accepts two dates and calculates how many days have passed.

A more interesting problem is to figure out how many different calendars there are. The number is really quite small. It is possible to print a perpetual calendar. That is print all the possible calendars and then provide a table showing the years and the calendar to use for each year.

The final calendar problem concerns Friday the 13th. First calculate the probability of the 13th of the month being on a Friday. Next count how many Friday the 13th's occur in this century. Is the 13th of the month more or less likely to be a Friday than any other day of the week? Why?

Thinkers' Corner

by Layman E. Allen © 1975

MATHEMATICS PUZZLES

How many of the problems (a) through (f) below can be solved by forming an expression equal to the GOAL? (Suppose that each symbol below is imprinted on a disc.)

The expression must use:

(1) only single digits combined with operators,
(2) all of the discs in the REQUIRED column,
(3) as many of the discs in PERMITTED as you wish, and
(4) exactly one of the discs in RESOURCES.

Special Rules:

The '*' indicates "to the power of." Thus $3*2 = 3^2 = 9$.
The '√' indicates "the nth root of." Thus $^3\sqrt{8} = 2$.
Parentheses can be inserted anywhere to indicate grouping, but never to indicate multiplication.

Problem	GOAL	REQUIRED	PERMITTED	RESOURCES
(a)	11	67 -	13+	+ - ÷ √24
(b)	13	1+	34-	X ÷ √ 1359
(c)	1	18 ÷	4+	+ - ÷ 1279
(d)	7	3-	248	- X ÷ √678
(e)	2	3 ÷	37- ÷	+ - X 0135
(f)	1	9√	22+	- X ÷ √ - 28

Some Suggested Answers (frequently there are others):

(a) 7 + 6 - 2
(b) (4 X 3) + 1
(c) (8 ÷ 4) - 1
(d) 2 - (3 - 8)
(e) (7 ÷ 3) - (1 ÷ 3)
(f) 2 √ 9 - 2

A GENERAL SOLUTION TO MAGIC STARS

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In the September-October 1976 issue of *Creative Computing* (page 72), Carl Heilman posed a problem concerning the bicentennial magic star. His concern is how many different solutions exist. This paper is an effort to provide a possible approach for a solution to Heilman's problem. Figure One is one such configuration of ten different numbers that sum to seventy-six. It should be obvious that a new set of ten numbers can be formed by subtracting one from each number on the points of the star and adding one to each of the inner ring of numbers. Eventually in this case the largest number in the inner ring is equal to the smallest number on the points (18). Twelve such different sets of ten numbers will be generated. Continued addition and subtraction to the five numbers in the inner ring and the five numbers on the points fail to generate more numbers that are different. The process of "passing" these two sets of numbers through each other sometimes leads to solutions that are unique. In this case none were found. Eventually the largest number on the points is smaller than the smallest number on the inner ring. This occurs in this case when the smallest number on the point is equal to eleven. This continued process of generation of sets of ten numbers therefore yields a total of twenty-three such sets.

A comparison of Figure 1 and 2 shows that two different stars are formed but the set of ten numbers is the same. In a sense, the star has been turned inside out. The problem as posed by Heilman rules out such a procedure. Figure 3 gives the general equations for the solution to any magic star and for any sum. The reader may be interested in finding the smallest sum that a magic star must have. In the illustration used to demonstrate the method (Fig. 1), A = 1, B = 1, C = 2, D = 3, E = 4, and this forces T to be equal to 31. Various other choices of the variables leads to other sets of numbers subject to the conditions that no two numbers are equal. These constraints can easily be derived from the equations. This approach to a solution to Heilman's problem can now be subjected to computer analysis of all possible choices of the variables.

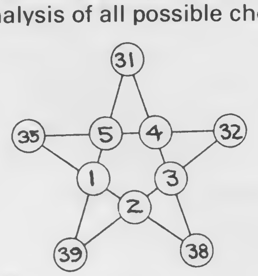


FIG. 1

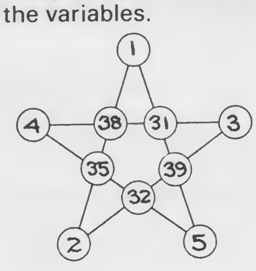


FIG. 2

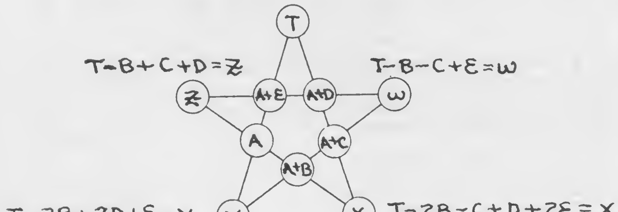


FIG. 3

The Four Color Problem

The famous conjecture that any plane map requires no more than four colors to get all regions (of one piece) sharing a common boundary to be of different colors has defeated all attempts to prove it since it was first posed in 1853. Until this past summer, that is, when Kenneth Appel and Wolfgang Haken of the University of Illinois completed a proof based on a remarkable blend of ingenuity and massive computer analysis. The proof has not yet been published but an interesting article on it appears in *Mathematics Magazine* for September 1976.

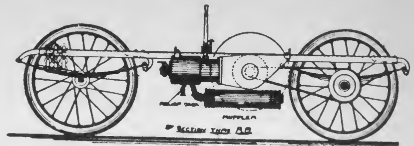
Calculator Teasers

(Answers Appear Upside Down)

1. What did the cannibal cook say when asked if the minister was ready for supper? To find out:
   Calculate the product of 6 and 4759.
   Add .17.
   Double the result.
2. What did Farmer McGregor throw at Peter Rabbit to chase him out of the garden? To find out:
   Add 4 to the product of 27 and 109.
   Subtract off .027.
   Multiply the result by 18.
3. What did the Red Baron put into Snoopy's house? To find out:
   Multiply one hundred and one by the square of three.
   Add fifty.
   Multiply by each of the whole numbers which are larger than six but smaller than nine.

"That does not compute. That does not compute. That does....."

Another new game from Creative Computing . . . .



SIDE VIEW DYKE'S NO. I OUTFIT.

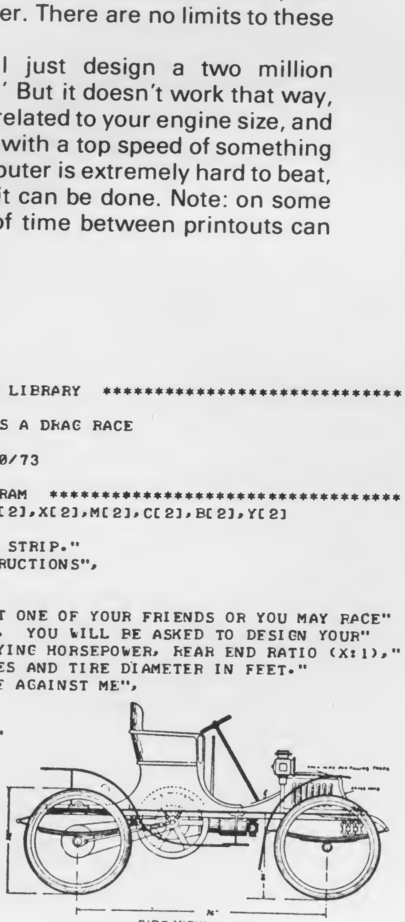
DRAG

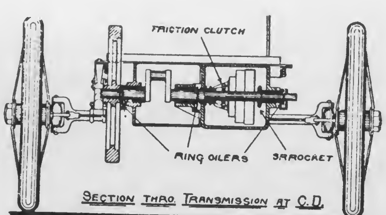
Language: BASIC (HP 2000C)

Description: DRAG allows the user to design his own dragster and then race it against a dragster designed by another player or the computer. You must specify the horsepower, rear end ratio, tire width, and tire diameter. There are no limits to these parameters.

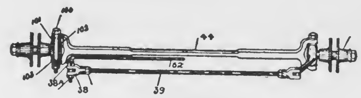
Aha! you say. "I'll just design a two million horsepower dragster!" But it doesn't work that way, because your mass is related to your engine size, and so you usually end up with a top speed of something like 33 MPH. The computer is extremely hard to beat, but it's rumored that it can be done. Note: on some systems the amount of time between printouts can be aggravatingly long.

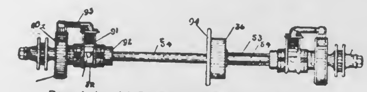
```
  LIST
 DRAG

1   REM  ****  HP PASIC PROGRAM LIBRARY  ******************************
2   REM
3   REM         DRAG:   SIMULATES A DRAG RACE
4   REM
5   REM         36601 REV  P   10/73
6   REM
7   REM  ****  CONTRIBUTED PROGRAM  ***********************************
10  DIM I$[3],P[2],E[2],W[2],S[2],X[2],M[2],C[2],B[2],Y[2]
20  DIM Q[2]
30  PRINT "WELCOME TO THE DRAG STRIP."
40  PRINT "WOULD YOU LIKE INSTRUCTIONS",
50  INPUT I$
60  IF I$="NO" THEN 110
70  PRINT "YOU MAY RACE AGAINST ONE OF YOUR FRIENDS OR YOU MAY RACE"
80  PRINT "AGAINST MY DRAGSTER.  YOU WILL BE ASKED TO DESIGN YOUR"
90  PRINT "OWN MACHINE, SPECIFYING HORSEPOWER, REAR END RATIO (X:1),"
100  PRINT "TIRE WIDTH IN INCHES AND TIRE DIAMETER IN FEET."
110  PRINT "DO YOU WANT TO RACE AGAINST ME",
120  INPUT I$
130  IF I$="NO" THEN 200
140  PRINT "I WILL HAVE CAR#1."
150  P[1]=600
160  E[1]=5.9
170  W[1]=22
180  D[1]=3.9
190  GOTO 290
200  PRINT "DESIGN CAR#1:"
210  PRANT "HORSEPOWER=",
220  INPUT P[1]
230  PRINT "REAR END RATIO=",
240  INPUT E[1]
250  PRINT "TIRE WIDTH=",
260  INPUT W[1]
270  PRINT "TIRE DIAMETER=",
280  INPUT D[1]
290  PRINT "DESIGN CAR#2:"
300  PRINT "HORSEPOWER=",
310  INPUT P[2]
320  PRINT "REAR END RATIO=",
330  INPUT E[2]
340  PRINT "TIRE WIDTH=",
350  INPUT W[2]
360  PRINT "TIRE DIAMETER=",
370  INPUT D[2]
380  PRINT
390  PRINT "GO!"
400  K1=500
410  K2=1.6
420  K3=2
430  K4=.0006
440  K5=.00006
450  K6=.2
460  K7=4
470  K8=.00015
480  Q[1]=Q[2]=0
490  S[1]=S[2]=0
500  X[1]=X[2]=0
510  REM:M IS MASS
520  FOR J=1 TO 2
530  M[J]=(K1+K2*P[J]+K3*W[J]*D[J]+K7*D[J]↑2)/32.2
540  REM:C IS DRAG FROM WIND
550  C[J]=K4*M[J]↑(2/3)+K8*W[J]*D[J]
560  REM:B IS THE MAX ACCELERATION WITHOUT BURNING
570  B[J]=15+28*W[J]*D[J]/ (W[J]+6)*(D[J]+1))
580  REM:Y IS THE SCALE FACTOR FOR RPM VS POWER
590  Y[J]=3.7-.0033*P[J]
600  NEXT J
610  PRINT
620  PRINT
630  PRINT "ELAPSED";TAB(15);"CAR#1";TAB(39);"CAR#2"
640  PRINT "TIME   SPEED       DISTANCE      SPEED        DISTANCE"
650  PRINT "(SEC)  (MPH)         (FT)       (MPH)          (FT)"
660  PRINT
670  FOR T=0 TO 100 STEP 1
680  FOR T1=1 TO 100 STEP 1
690  FOR J=1 TO 2
700  REM:R IS RPM
710  R=60*S[J]*E[J]/(3.14159*D[J])
720  REM:L0 IS ENGINE TORQUE
730  L0=(P[J]/42.5)*(50+.0078*(R/Y[J])-4.E-10*(R/Y[J])↑3)
740  REM:L1 IS TORQUE FROM FRICTION
750  L1=P[J]*(K5*R+K6)
760  REM:L2 IS REAR AXEL TORQUE
770  L2=E[J]*(L0-L1)
780  REM F IS FORCE ON ROAD FROM TIRES
790  F=2*L2/D[J]
800  REM:TEST FOR BURN
810  IF F>M[J]*B[J] THEN 880
820  REM:A=ACCELERATION
830  IF Q[J] <> 0 THEN 860
840  PRINT "CAR#";J;"STOPS BURNING RUBBER"
850  Q[J]=1
860  A=(F-C[J]*S[J]↑2)/M[J]
870  GOTO 900
880  A=B[J]-C[J]*S[J]↑2/M[J]
890  REM:S=SPEED IN FT/SEC
900  S[J]=S[J]+A*.01
910  REM:X=DISTANCE IN FT
920  X[J]=X[J]+S[J]*.01
930  NEXT J
940  REM:TEST FOR FANISH
950  IF X[1]<5280/4 AND X[2]<5280/4 THEN 1160
960  IF X[1]>X[2] THEN 1080
970  T3=(X[2]-5280/4)/S[2]
980  T=T+T1/100-T3
990  X[2]=5280/4
1000  X[1]=X[1]-S[1]*T3
1010  PRINT T;S[1]*3600/5280;X[1];S[2]*3600/5280;X[2]
1020  PRINT TAB(40);"WINNER"
1030  PRINT
1040  PRINT "DO YOU WANT TO TRY AGAIN",
1050  INPUT I$
1060  IF I$="YES" THEN 110
1070  STOP
1080  T3=(X[1]-5280/4)/S[1]
1090  T=T+T1/100-T3
1100  X[1]=5280/4
1110  X[2]=X[2]-S[2]*T3
1120  PRINT T;S[1]*3600/5280;X[1];S[2]*3600/5280;X[2]
1130  PRINT TAB(10);"WINNER"
1140  PRINT
1150  GOTO 1040
1160  NEXT T1
1170  PRINT T+1;S[1]*3600/5280;X[1];S[2]*3600/5280;X[2]
1180  NFXT T
1190  STOP
1200  END
```


SIDE VIEW. (No. 1.)
Showing arrangement of Hanging Engine, etc.



CRANK SHAFT SOLID from one end to the other. All key seats carefully milled.
2 RING OILER BEARINGS and a long bronze bearing in the center. Improved high speed friction clutch.


FRONT AXLE,
With Genuine Artillery Hubs and Timken Roller Bearings.


Rear Axle with Roller Bearings contained in case, ready for Springs and Radius

```
 RUN
DRAG

WELCOME TO THE DRAG STRIP.
WOULD YOU LIKE INSTRUCTIONS    ?NO
DO YOU WANT TO RACE AGAINST ME?YES
I WILL HAVE CAR#1.
DESIGN CAR#2:
HORSEPOWER=     ?370
REAR END RATIO=?5
TIRE WIDTH=     ?24
TIRE DIAMETER=  ?2.7

GO!

ELAPSED            CAR#1                        CAR#2
TIME    SPEED        DISTANCE       SPEED        DISTANCE
(SEC)   (MPH)          (FT)         (MPH)          (FT)

 1      22.0707       16.3821       21.2787       15.7948
 2      43.5753       64.7826       42.0023       62.4532
 3      64.0015       143.982       61.6695       138.78
 4      82.9393       252.079       79.8806       242.914
 5      100.107       386.668       96.3631       372.503
 6      115.356       545.025       110.976       524.891
CAR# 1     STOPS BURNING RUBBER
 7      128.639       724.299       123.696       697.306
CAR# 2     STOPS BURNING RUBBER
 8      139.186       921.156       134.424       886.961
 9      146.922       1131.33       142.731       1090.55
 9.86047     151.81        1320      148.254       1274.32
          WINNER

DO YOU WANT TO TRY AGAIN       ?NO
```


Side View No. 1 Engine and Transmission.

Another new game from Creative Computing . . . .

MASTERBAGELS

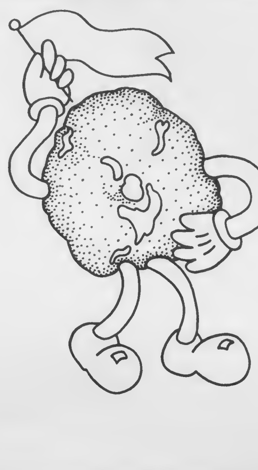
by H. R. Hamilton
Newport News, Virginia

This is definitely one of the best programs recently submitted to **Creative Computing.** *It combines Bagels, Mastermind, Bulls and Cows, etc. into a general deductive logic game. But if you simply want to play Bagels, you set the inputs to N.3,9. One small (?) difference is that duplicate digits are permitted. For a really general-purpose game, you could put a modification in the digits selection routine (Statements 300-320) with a parameter that either allows or disallows duplicate digits. It does play Mastermind correctly without modification—set inputs to N,4,6. But the real fun is trying the new combinations like N,7,4, or N,5,5. — DHA*

Program author H. R. Hamilton notes that Statements 260-280 and 830-870 are designed to vary the starting point of the random number generator. BASIC compilers with RANDOMIZE can use that instead and delete those statements.

If you decide to quit on a number, the maximum number of allowable tries is used for computing the average number of tries for solution. If you don't like that approach, you can change Statement 750.

A program enhancement would be to have the computer play against you. BULCOW in *101 Basic Computer* **Games** does this and I also have 2 active player versions of Mastermind which eventually will see the light of day, but it would certainly be an interesting challenge to devise an *efficient* general-purpose playing routine. —DHA



SAMPLE RUN

```
TEACH? (0=YES, 1=NO)
?0
  HI, THIS IS A LOGIC GAME DESIGNED TO TEST YOUR DEDUCTIVE
ABILITY.  I WILL CHOOSE A RANDOM NUMBER AND YOU ISOLATE IT.
WHEN PROMPTED, ENTER A VALID NUMBER, AND I WILL THEN RESPOND
WITH THE # OF DIGITS THAT ARE RIGHT AND IN THE RIGHT POSITION
AND THE # RIGHT BUT IN THE WRONG POSITION.  IF I THINK YOU
ARE HOPELESSLY LOST, I WILL TELL YOU THE ANSWER AND WE
WILL GO ON TO THE NEXT NUMBER.  TO RECAP YOUR ENTRIES
ENTER A 0, TO QUIT ON A NUMBER ENTER 1, AND TO STOP ENTER 2

  HOW MANY NUMBERS(1-100), # DIGITS(2-9), AND MAX VALUE(2-9)?
?3,2,4
?23
   0 ,    0
?14
   0 ,    2
?41
   3 TRIES,    3 AVERAGE FOR    1 NUMBERS
?23
   1 ,    0
?24
   2 TRIES,  2.5 AVERAGE FOR    2 NUMBERS
?11
   0 ,    0
?22
   0 ,    0
?33
   0 ,    0
?12
   0 ,    0
?13
   0 ,    0
?14
   1 ,    0
ANSWER IS   44
   6 TRIES,   3.666667 AVERAGE FOR    3 NUMBERS
RUN AGAIN? (0=YES, 1=NO)
?0

  HOW MANY NUMBERS(1-100), # DIGITS(2-9), AND MAX VALUE(2-9)?
?3,4,6
?3344
   0 ,    1
?4555
   2 ,    1
?5465
   2 ,    2
?5456
   2 ,    2
?6455
   5 TRIES,    5 AVERAGE FOR    1 NUMBERS
?2255
   0 ,    1
?5666
   2 ,    1
?6516
   2 ,    2
?1566
   4 TRIES,  4.5 AVERAGE FOR    2 NUMBERS
?1234
   1 ,    1
?2355
   2 ,    0
?2366
   2 ,    0
?0
   1 ,    1 = 1234
   2 ,    0 = 2355
   2 ,    0 = 2366
?
```

Program Listing of Masterbagels

```
10 DIM F(9),M(9),T(9),H(18,3)
20 PRINT "TEACH? (0=YES, 1=NO)"
30 INPUT S
40 IF S <> 0 THEN 130
50 PRINT "  HI, THIS IS A LOGIC GAME DESIGNED TO TEST YOUR DEDUCTIVE"
60 PRINT "ABILITY.  I WILL CHOOSE A RANDOM NUMBER AND YOU ISOLATE IT."
70 PRINT "WHEN PROMPTED, ENTER A VALID NUMBER, AND I WILL THEN RESPOND"
80 PRINT "WITH THE # OF DIGITS THAT ARE RIGHT AND IN THE RIGHT POSITION"
90 PRINT "AND THE # RIGHT BUT IN THE WRONG POSITION.  IF I THINK YOU"
100 PRINT "ARE HOPELESSLY LOST, I WILL TELL YOU THE ANSWER AND WE"
110 PRINT "WILL GO ON TO THE NEXT NUMBER.  TO RECAP YOUR ENTRIES"
120 PRINT "ENTER A 0, TO QUIT ON A NUMBER ENTER 1, AND TO STOP ENTER 2"
130 LET S=0
140 PRINT
150 PRINT "  HOW MANY NUMBERS(1-100), # DIGITS(2-9), AND MAX VALUE(2-9)?"
160 INPUT J,A,B
170 LET A = A-1
180 IF A <= 0 THEN 220
190 IF A > 9 THEN 220
200 IF B < 2 THEN 220
210 IF B < 10 THEN 240
220 PRINT "ILLEGAL RANGE, RE-ENTER RUN PARAMETERS"
230 GO TO 160
240 IF J < 100 THEN 260
250 LET J = 100
260 FOR X = 0 TO J+A+B
270 LET I = RND(R)
280 NEXT X
290 FOR N = 1 TO J
300 FOR X = 0 TO A
310 LET T(X)=INT(RND(R)*B+1)
320 NEXT X
330 FOR I = 1 TO A+B+1
340 FOR X = 0 TO A
350 LET F(X) = 0
360 NEXT X
370 LET F1 = 0
380 LET F2 = 0
390 INPUT V
400 IF V <> 0 THEN 450
410 FOR X = 1 TO I-1
420 PRINT H(X,0)","H(X,1)"="H(X,2)
430 NEXT X
440 GO TO 390
450 IF V = 1 THEN 750
460 IF V = 2 THEN 920
470 LET T1=V
480 FOR X = 0 TO A
490 LET M(X)=INT(T1/(10**(A-X)))
500 LET T1=T1-M(X)*(10**(A-X))
510 IF M(X) < 1 THEN 530
520 IF M(X) < B+1 THEN 550
530 PRINT "BAD NUMBER IN"V
540 GO TO 340
550 IF M(X)<>T(X) THEN 580
560 LET F(X) = 1
570 LET F1 = F1+1
580 NEXT X
590 IF F1 = A+1 THEN 810
600 FOR Y=0 TO A
610 IF T(Y)=M(Y) THEN 690
620 FOR X = 0 TO A
630 IF M(Y)<>T(X) THEN 680
640 IF F(X) = 1 THEN 680
650 LET F(X) = 1
660 LET F2 = F2+1
670 GO TO 690
680 NEXT X
690 NEXT Y
700 PRINT F1","F2
710 LET H(I,0) = F1
720 LET H(I,1) = F2
730 LET H(I,2) = V
740 NEXT I
750 LET I = A+B+1
760 LET V = 0
770 FOR X = 0 TO A
780 LET V=V+T(X)*(10**(A-X))
790 NEXT X
800 PRINT "ANSWER IS"V
810 LET S = S+I
820 PRINT I"TRIES,"S/N"AVERAGE FOR"N"NUMBERS"
830 LET Y = INT(RND(R)*I)
840 LET Y = INT(H(Y,2)/1024+4*RND(R))
850 FOR X = 0 TO Y
860 LET I = RND(R)
870 NEXT X
880 NEXT N
890 PRINT "RUN AGAIN? (0=YES, 1=NO)"
900 INPUT S
910 IF S = 0 THEN 140
920 END
```

Another new game from Creative Computing . . . .

DAYTONA 500

OR

A SYNCHRONOUS SIMULATION MODEL OF VEHICULAR COMPETITION WITH STOCHASTIC DECREMENTATION OF THE COMPETITIVE UNIVERSE

Geoffrey Churchill
Georgia State University

No, I'm not really *that* pompous, but won't it look fantastic on my resume? Needless to say, I'm betting the Dean doesn't read this. If I didn't need a nice-looking article on the list, I'd just call it the Daytona 500 Game.

Anyway, if you're a frustrated hotshoe driver, this game is for you. It is set up for six competitors on a 2½-mile track, but if you're overloaded with core and cpu time it would be easy to modify for a full field of cars. N-person computer games have been hard for me to find, which is why I wrote it; I've had fun with it.

To get an edge in figuring your strategy, you should be aware of the expressions on lines 380 to 430 and on line 540. I have never tried to figure it exactly (where would the fun be?), but it seems a winning strategy requires maximum horsepower and the stickiest tires; pit stops just don't seem to cost that much. I'd say the game needed new parameters if it weren't for the fact that NASCAR racing seems to operate just about that way.

Driving style does present a clear dilemma. In this game, preachers just don't win except through attrition. On the other hand, the driver who is always "belly to the wall" is going to be in contention while he lasts. With a mean distance to crash of 550 miles, he even has an apparent statistical chance of survival. Since the distribution is almost exponential, however, it is not awfully likely that he'll even reach the mean (the mean of the exponential is dragged upward by the few who go on forever; the mode is a hair above zero). Again, if you know a better way, the statements you're looking for are on lines 540 and 4010.

I tried to write this in as minimal a BASIC as possible. The only system supplied functions used are RND, ABS, LOG, SQR, INT, and COS. Our RND is a bit strange, so you may need a different initialization (e.g. RANDOM) than that found on line 150. The program also uses GOSUBS and statement functions.

The game was originally written for a WANG 3300 configuration that is notoriously intolerant of large programs (with about 4K available to store *and* execute the program, it's understandable). That version did not allow any change in strategy, which decreases the level of interest somewhat. A discussion with Dave Ahl at the CCUC in Fort Worth led to the present version, which is much more fun. I may even try to get this one onto the WANG (it currently is on a Univac Spectra 70/7).

```
100 REM*****GAME "DAYTONA 500"*****
110 REM*****BY GEOFFREY CHURCHILL*****
120 REM*****GEORGIA STATE UNIVERSITY*****
130 REM
140 REM  THIS IS HOW OUR RND IS INITIALIZED
150 X=RND(-1)
160 DIM E(14,2),S(6),G(6),Q(6),R(6,2),D(6),T(6),H(6)
170 DEF FNZ(X)=SQR(-2*LOG(RND(0)))*COS(6.283185*RND(0))*X
180 PRINT "WELCOME TO THE DAYTONA 500."
190 PRINT "DO YOU NEED INSTRUCTIONS (1=YES)";
200 INPUT Y1
210 IF Y1<>1 THEN 290
220 PRINT "HORSEPOWER AFFECTS SPEED AND TIRE MILEAGE; MAY BE 350 TO 700."
230 PRINT "TIRE COMPOUND AFFECTS THEM TOO. SELECT ";
240 PRINT "SOFT(1),MEDIUM(2),OR HARD(3)."
250 PRINT "SOFT COMPOUNDS GO FASTER BUT WEAR OUT SOONER."
260 PRINT "YOUR DRIVING STYLE AFFECTS SPEED AND RISK. YOU MAY CHOOSE"
270 PRINT "DRIVING STYLE PREACHER(1),BANKER(2),PROFESSOR(3),"
280 PRINT "OIL WILDCATTER(4),TAXI DRIVER(5),OR BTTW(6)."
290 PRINT "INPUT LIKE 400,3,6"
300 E(1,1)=14
310 E(1,2)=1E30
320 DEF FNC(C1)=(C1+2)^2+C1-3
330 K9=6
340 FOR C1=1 TO 6
350 PRINT "CAR #";FNC(C1);"HP, TIRES, STYLE";
360 INPUT H1,T1,S1
370 H(C1)=H1
380 REM  EXPECTED LAP SPEED
390 S(C1)=7*SQR(350+.5*H1)-T1+S1
400 REM  EXPECTED MILES/TANK
410 G(C1)=300-100*H1/350
420 REM  EXPECTED MILES/SET OF TIRES
430 R(C1,1)=200*T1-2*S1-H1/100
440 R(C1,2)=R(C1,1)+FNZ(5)
450 D(C1)=0
460 T(C1)=0
470 E2=G(C1)+FNZ(5)
480 IF E2<R(C1,2) THEN 500
490 E2=R(C1,2)
500 E1=6+C1
510 E2=INT(E2/2.5+.5)*2.5
520 GOSUB 2010
530 REM  MILEAGE AT CRASH IF NO STRATEGY CHANGE...IF>500, NO CRASH!
540 E2=INT((-1000+75*S1)*LOG(RND(0))+.5)
550 E1=C1
560 GOSUB 2010
570 NEXT C1
580 E1=13
590 E2=50
600 GOSUB 2010
610 PRINT "THE GREEN FLAG IS OUT, AND THERE THEY GO!"
620 GOSUB 3010
630 IF E1=13 THEN 1080
640 IF E1=14 THEN 1060
650 IF E1<7 THEN 1000
660 IF S(E1-6)<0 THEN 620
670 PRINT "CAR #";FNC(E1-6);"HAS PITTED AFTER";E2/2.5;"LAPS"
680 C1=E1-6
690 S1=S(C1)+FNZ(2)
700 T(C1)=T(C1)+(E2-D(C1))/S1
710 D(C1)=E2
720 PRINT "CHANGE STRATEGY (0=NO)";
730 INPUT Y1
740 IF Y1=0 THEN 820
750 PRINT "INPUT TIRES,STYLE";
760 INPUT T1,S1
770 H1=H(C1)
780 S(C1)=7*SQR(350+.5*H1)-T1+S1
790 G(C1)=300-100*H1/350
800 R(C1,1)=200*T1-2*S1-H1/100
810 GOSUB 4000
820 PRINT "PIT STOP IS FOR GAS ";
830 S1=15+FNZ(3)
840 E2=E2+G(C1)+FNZ(5)
850 IF Y1=1 THEN 870
860 IF D(C1)+100<R(C1,2) THEN 900
870 S1=S1+6+FNZ(2)
880 PRINT " AND TIRES"
890 R(C1,2)=D(C1)+R(C1,1)+FNZ(5)
900 PRINT
910 IF R(C1,2)>=E2 THEN 930
920 E2=R(C1,2)
930 S1=(S1+2*ABS(Y1))/3600
940 T(C1)=T(C1)+S1
950 PRINT "CAR #";FNC(C1);"WAS IN THE PITS";INT(S1*36000)/10;"SECONDS"
960 E1=C1+6
970 E2=INT(E2/2.5+.5)*2.5
980 GOSUB 2010
990 GOTO 620
1000 S(E1)=-100
1010 PRINT "CAR #";FNC(E1);"HAS CRASHED AT";E2;"MILES";
1020 PRINT " AND IS OUT OF THE RACE"
1030 K9=K9-1
1040 IF K9<1 THEN 1060
1050 GOTO 620
1060 PRINT "ALL THE EARLY LEADERS HAVE CRASHED.  CAR #";FNC(7);"WINS."
1070 GOTO 5000
1080 S3=1000
1090 FOR C1=1 TO 6
1100 IF S(C1)<=0 THEN 1160
1110 Q(C1)=S(C1)+FNZ(2)
```

```
1120 T1=T(C1)+(E2-D(C1))/Q(C1)
1130 IF T1>S3 THEN 1160
1140 S3=T1
1150 C2=C1
1160 NEXT C1
1170 PRINT
1180 PRINT
1190 PRINT "AT";E2;"MILES, CAR #";FNC(C2);"IS LEADING."
1200 FOR C1=1 TO 6
1210 IF S(C1)<=0 THEN 1290
1220 L1=E2-(D(C1)-Q(C1)*(T(C1)-S3))
1230 IF T(C1)>S3 THEN 1270
1240 D(C1)=D(C1)+Q(C1)*(S3-T(C1))
1250 T(C1)=S3
1260 L1=E2-D(C1)
1270 IF C1=C2 THEN 1290
1280 PRINT "CAR #";FNC(C1);"TRAILS BY";INT(10*L1)/10;"MILES"
1290 NEXT C1
1300 PRINT "LEADER'S AVERAGE SPEED IS";E2/T(C2);"MPH"
1310 E2=E2+50
1320 IF E2<=500 THEN 1360
1330 PRINT "THE DRIVER OF CAR #";FNC(C2);"IS THE NEW";
1340 PRINT " DAYTONA 500 CHAMPION AT";500/T(C2);"MPH!"
1350 GOTO 5000
1360 GOSUB 2010
1370 GOTO 620
2000 REM GOSUB TO STORE NEW EVENTS
2010 FOR I=1 TO 14
2020 IF E2<=E(I,2) THEN 2060
2030 NEXT I
2040 PRINT "DAMN!"
2050 GOTO 5000
2060 FOR J=14 TO I+1 STEP -1
2070 E(J,1)=E(J-1,1)
2080 E(J,2)=E(J-1,2)
2090 NEXT J
2100 E(I,1)=E1
2110 E(I,2)=E2
2120 RETURN
3000 REM  GOSUB TO RETRIEVE NEXT EVENT
3010 E1=E(1,1)
3020 E2=E(1,2)
3030 FOR I=1 TO 13
3040 E(I,1)=E(I+1,1)
3050 E(I,2)=E(I+1,2)
3060 NEXT I
3070 RETURN
4000 REM  GOSUB TO CHANGE CRASH MILEAGE
4010 S1=(-1000+75*S1)*LOG(RND(0))+.5
4020 FOR I=1 TO 14
4030 IF E(I,1)=C1 THEN 4070
4040 NEXT I
4050 PRINT "DAMN!"
4060 GOTO 5000
4070 E1=C1
4080 E2=INT((D(C1)/500)*E(I,2)+((500-D(C1))/500)*S1)
4090 IF E2>D(C1)+1 THEN 4110
4100 E2=D(C1)+INT(10*(RND(0))+1)
4110 FOR J=I TO 13
4120 E(J,1)=E(J+1,1)
4130 E(J,2)=E(J+1,2)
4140 NEXT J
4150 GOSUB 2010
4160 RETURN
5000 END
```

```
RUN
WELCOME TO THE DAYTONA 500.
DO YOU NEED INSTRUCTIONS (1=YES)?0
INPUT LIKE 400,3,6
CAR # 7  HP, TIRES, STYLE?700,3,6
CAR # 15 HP, TIRES, STYLE?700,2,6
CAR # 25 HP, TIRES, STYLE?700,1,6
CAR # 37 HP, TIRES, STYLE?700,3,6
CAR # 51 HP, TIRES, STYLE?700,2,6
CAR # 67 HP, TIRES, STYLE?700,1,6
THE GREEN FLAG IS OUT, AND THERE THEY GO!


AT 50 MILES, CAR # 7 IS LEADING.
CAR # 15 TRAILS BY 1 MILES
CAR # 25 TRAILS BY 1.3  MILES
CAR # 37 TRAILS BY 1.5  MILES
CAR # 51 TRAILS BY .7   MILES
CAR # 67 TRAILS BY 1.4  MILES
LEADER'S AVERAGE SPEED IS 192.699   MPH
CAR # 51 HAS PITTED AFTER 37  LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS
CAR # 51 WAS IN THE PITS 15.7 SECONDS
CAR # 67 HAS PITTED AFTER 39  LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS  AND TIRES

CAR # 67 WAS IN THE PITS 19.9 SECONDS
CAR # 7  HAS PITTED AFTER 39  LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS
CAR # 7  WAS IN THE PITS 11.8 SECONDS


AT 100   MILES, CAR # 15   IS LEADING.
CAR # 7  TRAILS BY .5    MILES
CAR # 25 TRAILS BY 1.2  MILES
CAR # 37 TRAILS BY 1.5  MILES
CAR # 51 TRAILS BY .7   MILES
CAR # 67 TRAILS BY 1.9  MILES
LEADER'S AVERAGE SPEED IS 189.738   MPH
CAR # 37 HAS PITTED AFTER 40  LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS
CAR # 37 WAS IN THE PITS 12.6 SECONDS
CAR # 15 HAS PITTED AFTER 41  LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS
CAR # 15 WAS IN THE PITS 11.4 SECONDS
CAR # 25 HAS PITTED AFTER 42  LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS  AND TIRES

CAR # 25 WAS IN THE PITS 15.4 SECONDS


AT 150   MILES, CAR # 15   IS LEADING.
CAR # 7  TRAILS BY .5   MILES
CAR # 25 TRAILS BY 2 MILES
CAR # 37 TRAILS BY 3 MILES
CAR # 51 TRAILS BY .2   MILES
CAR # 67 TRAILS BY 1.6  MILES
LEADER'S AVERAGE SPEED IS 189.301   MPH
CAR # 67 HAS CRASHED AT 164    MILES AND IS OUT OF THE RACE
CAR # 7  HAS CRASHED AT 180    MILES AND IS OUT OF THE RACE


AT 200   MILES, CAR # 15   IS LEADING.
CAR # 25 TRAILS BY .7   MILES
CAR # 37 TRAILS BY 2.3  MILES
CAR # 51 TRAILS BY .1   MILES
LEADER'S AVERAGE SPEED IS 188.992   MPH
CAR # 37 HAS PITTED AFTER 80  LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS
CAR # 37 WAS IN THE PITS 13.7 SECONDS
CAR # 15 HAS PITTED AFTER 81  LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS
CAR # 15 WAS IN THE PITS 20.4 SECONDS
CAR # 51 HAS PITTED AFTER 83  LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS
CAR # 51 WAS IN THE PITS 14.3 SECONDS
CAR # 25 HAS PITTED AFTER 84  LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS  AND TIRES

CAR # 25 WAS IN THE PITS 14.4 SECONDS


AT 250   MILES, CAR # 15   IS LEADING.
CAR # 25 TRAILS BY .9   MILES
CAR # 37 TRAILS BY 3.2  MILES
CAR # 51 TRAILS BY .5   MILES
LEADER'S AVERAGE SPEED IS 188.447   MPH
CAR # 37 HAS PITTED AFTER 119 LAPS
CHANGE STRATEGY (0=NO)?1
INPUT TIRES,STYLE?1,6
PIT STOP IS FOR GAS  AND TIRES

CAR # 37 WAS IN THE PITS 20   SECONDS


AT 300   MILES, CAR # 15   IS LEADING.
CAR # 25 TRAILS BY 1.2  MILES
CAR # 37 TRAILS BY 4.1  MILES
CAR # 51 TRAILS BY .7   MILES
LEADER'S AVERAGE SPEED IS 188.543   MPH
CAR # 25 HAS PITTED AFTER 122 LAPS
CHANGE STRATEGY (0=NO)?1
INPUT TIRES,STYLE?3,6
PIT STOP IS FOR GAS  AND TIRES

CAR # 25 WAS IN THE PITS 29   SECONDS
CAR # 51 HAS PITTED AFTER 123 LAPS
CHANGE STRATEGY (0=NO)?1
INPUT TIRES,STYLE?1,6
PIT STOP IS FOR GAS  AND TIRES

CAR # 51 WAS IN THE PITS 19.7 SECONDS
CAR # 15 HAS PITTED AFTER 124 LAPS
CHANGE STRATEGY (0=NO)?1
INPUT TIRES,STYLE?1,5
PIT STOP IS FOR GAS  AND TIRES

CAR # 15 WAS IN THE PITS 24.8 SECONDS


AT 350   MILES, CAR # 15   IS LEADING.
CAR # 25 TRAILS BY 2.6  MILES
CAR # 37 TRAILS BY 3.5  MILES
CAR # 51 TRAILS BY .6   MILES
LEADER'S AVERAGE SPEED IS 188.32 MPH


AT 400   MILES, CAR # 15   IS LEADING.
CAR # 25 TRAILS BY 4 MILES
CAR # 37 TRAILS BY 5.2  MILES
CAR # 51 TRAILS BY 1.1  MILES
LEADER'S AVERAGE SPEED IS 188.808   MPH


AT 450   MILES, CAR # 15   IS LEADING.
CAR # 25 TRAILS BY 2.9  MILES
CAR # 37 TRAILS BY 4.2  MILES
CAR # 51 TRAILS BY 0 MILES
LEADER'S AVERAGE SPEED IS 188.719   MPH
CAR # 51 HAS CRASHED AT 461    MILES AND IS OUT OF THE RACE
CAR # 15 HAS PITTED AFTER 190 LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS  AND TIRES

CAR # 15 WAS IN THE PITS 15.7 SECONDS
CAR # 37 HAS PITTED AFTER 190 LAPS
CHANGE STRATEGY (0=NO)?0
PIT STOP IS FOR GAS  AND TIRES

CAR # 37 WAS IN THE PITS 17.4 SECONDS


AT 500   MILES, CAR # 15   IS LEADING.
CAR # 25 TRAILS BY 1.8  MILES
CAR # 37 TRAILS BY 4.7  MILES
LEADER'S AVERAGE SPEED IS 188.525   MPH
THE DRIVER OF CAR # 15  IS THE NEW DAYTONA 500 CHAMPION AT 188.525
MPH!
```

Another new game from Creative Computing . . . .

STRIKE 9

Bruce Grembowski
2739 Beale Circle
Omaha, Nebraska 68123
(402) 291-4724

It's a simple game based on the numbers 1 through 9, and a pair of dice. First, the computer rolls a random number for your "dice." Then you must take that number from the total of your board numbers 1-9. To win you must remove all of your board numbers. With each roll you must remove the total number of that roll from the board or you lose.

One strategy is to remove the largest numbers possible with each roll, or you can try to get the most numbers removed. For example, if the roll is 10 and you have 1, 2, 3, 4 and left, you might want to remove the 1, 2, 3 and 4 instead of the 1 and 9.

You may want to have competition and players can alternate with rolls. Then the player who can't remove all numbers from his/her roll loses.

Also, try to shorten the FOR-NEXT statement in lines 490 to 660 which checks to see if its possible to remove the numbers shown on your roll from the numbers you have left on the board.

```
00080 REM BRUCE GREMBØWSKI BELLEVUE HIGH SCHØØL NEBRASKA  68005
00090 DIM A(9), D(4)
00100 PRINT TAB(20);"* STRIKE 9 *"
00110 PRINT
00140 PRINT TAB(12);"WRITTEN BY BRUCE GREMBØWSKI"
00150 PRINT
00160 PRINT
00170 PRINT"DØ YØU NEED INSTRUCTIØNS(YES/NØ)";
00180 INPUT R$
00190 IF R$="NØ" THEN 340
00200 IF R$<>"YES" THEN 170
00210 PRINT"STRIKE NINE IS PLAYED WITH A PAIR ØF DICE AND A"
00220 PRINT"BØARD WITH NINE NUMBERS:  1 2 3 4 5 6 7 8 9. YØU"
00230 PRINT"ARE GIVEN A RØLL AND CAN KNØCK ØFF UP TØ 4 NUMBERS."
00240 PRINT"IF YØU INPUT THAT YØU WANT TØ REMØVE 5 NUMBERS, YØU"
00250 PRINT"WILL BE GIVEN A CHART ØF THE NUMBERS YØU HAVE LEFT"
00260 PRINT"TØ REMØVE. NEXT YØU INPUT HØW MANY NUMBERS YØU WANT"
00270 PRINT"TØ REMØVE, AND THEN INPUT THE NUMBERS YØU WANT TØ"
00280 PRINT"TAKE ØFF, ØNE AT A TIME. THE NUMBERS YØU TAKE ØFF"
00290 PRINT"MUST ADD UP TØ THE RØLL. YØU WIN BY REMØVING EVERY"
00300 PRINT"NUMBER FRØM THE BØARD. YØU LØSE IF YØU CANNØT"
00310 PRINT"REMØVE AND NUMBERS WITH THE RØLL YØU HAVE."
00320 PRINT
00330 PRINT"READY TØ PLAY?"
00340 PRINT
00350 PRINT"HERE IS THE BØARD: ";
00360 REM SET UP THE BØARD
00370 FØR B=1 TØ 9
00380 PRINT B;
00390 A(B)=B
00400 NEXT B
00405 PRINT
00410 C=INT(RND(-1)*6+1)+INT(RND(-1)*6+1)
00420 PRINT"YØUR RØLL IS",C
00430 T=0
00440 FØR X=1 TØ 9
00450 T=T+A(X)
00460 NEXT X
00465 REM CHECK FØR LØSS
00470 IF C>T THEN 950
00480 IF C=T THEN 1120
00490 FØR K=1 TØ 9
00500 FØR L=1 TØ 9
00510 FØR M=1 TØ 9
00520 FØR N=1 TØ 9
00530 IF N=K THEN 630
00540 IF N=L THEN 630
00550 IF N=M THEN 630
00560 IF M=K THEN 640
00570 IF M=L THEN 640
00580 IF L=K THEN 650
00590 IF C-A(K)=0 THEN 680
00600 IF C-A(K)=A(N) THEN 680
00610 IF C-A(K)-A(L)=A(N) THEN 680
00620 IF C-A(K)-A(L)-A(M)=A(N) THEN 680
00630 NEXT N
00640 NEXT M
00650 NEXT L
00660 NEXT K
00670 GØTØ 950
00680 FØR X=1 TØ 4
00690 D(X)=0
00700 NEXT X
00710 PRINT"# ØF NUMBERS TØ REMØVE";
00720 INPUT E
00730 IF INT(E)<>E THEN 760
00740  IF E<1 THEN 760
00750 IF E>4 THEN 880
00755 GØTØ 770
00760 PRINT"ANSWER 1, 2, 3, ØR 4(5 FØR THE BØARD)"
00765 GØTØ 710
00770 PRINT"WHAT IS THE NUMBER";
00780 FØR F=1 TØ E
00790 INPUT D(F)
00800 IF A(D(F))<>0 THEN 825
00810 PRINT"YØU REMØVED IT BEFØRE, TRY AGAIN."
00820 GØTØ 710
00825 NEXT F
00830 IF C<>D(1)+D(2)+D(3)+D(4) THEN 870
00835 FØR F=1 TØ E
00840 A(D(F))=0
00850 NEXT F
00860 GØTØ 410
00870 PRINT"THØSE NUMBERS DØN'T ADD UP TØ YØUR RØLL, TRY AGAIN"
00875 GØTØ 710
00880 PRINT"THE NUMBERS YØU HAVE LEFT TØ REMØVE ARE: ";
00890 FØR B=1 TØ 9
00900 IF A(B)=0 THEN 920
00910 PRINT A(B);
00920 NEXT B
00930 PRINT
00940 GØTØ 710
00950 PRINT"SØRRY,YØU LØST THIS TIME."
00960 T=0
00970 FØR B=1 TØ 9
00980 IF A(B)=0 THEN 1000
00990 T=T+1
01000 NEXT B
01010 PRINT"THERE ARE";T;"NUMBERS LEFT ØN THE BØARD: ";
01020 FØR X=1 TØ 9
01030 IF A(X)=0 THEN 1050
01040 PRINT A(X);
01050 NEXT X
01060 PRINT
01070 PRINT"WANT TØ TRY IT AGAIN(YES/NØ)";
01080 INPUT G$
01090 IF G$="YES" THEN 170
01100 IF G$<>"NØ" THEN 1070
01110 STØP
01120 PRINT TAB(15);"* * * CØNGRATULATIØNS * * *"
01130 PRINT TAB(25);"* YØU WØN *"
01140 PRINT
01150 PRINT
01160 PRINT"PLAY ANØTHER GAME(YES/NØ)";
01170 INPUT H$
01180 IF H$="YES" THEN 170
01190 IF H$<>"NØ" THEN 1160
01200 STØP
01210 END
```

```
HERE IS THE BØARD:  1  2  3  4  5  6  7  8  9
YØUR RØLL IS     8
# ØF NUMBERS TØ REMØVE? 1
WHAT IS THE NUMBER? 8
YØUR RØLL IS     5
# ØF NUMBERS TØ REMØVE? 1
WHAT IS THE NUMBER? 5
YØUR RØLL IS     8
# ØF NUMBERS TØ REMØVE? 2
WHAT IS THE NUMBER? 7
? 1
YØUR RØLL IS     7
# ØF NUMBERS TØ REMØVE? 5
THE NUMBERS YØU HAVE LEFT TØ REMØVE ARE:  2  3  4  6  9
# ØF NUMBERS TØ REMØVE? 2
WHAT IS THE NUMBER? 3
? 4
YØUR RØLL IS     12
SØRRY,YØU LØST THIS TIME.
THERE ARE 3 NUMBERS LEFT ØN THE BØARD:  2  6  9
WANT TØ TRY IT AGAIN(YES/NØ)? NØ
```

* Yes, astute readers — Creative Computing's erudite, effervescent, easy-going Edu-Man is indeed the twin brother of fearless, fighting, foulmouthed Wonder Wart Hog. Apologies to Gilbert Shelton. — DHA

kilobaud

WHY YOU WILL BE UNABLE TO PREVENT YOURSELF FROM SUBSCRIBING TO KILOBAUD

If you can profit from the experience of others and perhaps manage to save a few dollars which you might otherwise blow on something inferior, then you will be able to save much more than the cost of a Kilobaud subscription.

Kilobaud will be running articles on every piece of hardware available to the computer hobbyist . . . and reader reports on their experiences with the hardware (and software). You can profit from the experiences of others. Kilobaud will pull no punches . . . covering up for a lousy manufacturer serves no one in the long run and factual reporting on problems can help warn other hobbyists as well as encourage the manufacturer to get his act together. Look for a long and informative letters section where a spade will be called a spade.

If you are building a kit, for heaven's sake keep a notebook of your problems . . . problems with the manufacturer . . . with missing parts . . . bad manuals . . . bum parts . . . and be sure to tell how you solved each of your problems as an aid to the next guy. Pass along data on how you got the system up and running, I/O problems and their solution . . . where you got software . . . etc.

CHARTER SUBSCRIPTION ONLY $12!

The regular subscription rate for Kilobaud will be $15 per year. The CHARTER rate is only $12. Individual copies will sell for a ridiculous $2.00 . . . and be well worth it. In case you are thinking of waiting to see how Kilobaud looks, remember that thousands of waiters-to-see lost out on the first issues of Byte. Too bad . . . the first issue of Byte now goes in some areas for more than the Charter subscription rate!

This is your chance to get a bargain . . . please don't expect the first issue of Kilobaud to be in good supply.

HARDWARE REVIEWS IN KILOBAUD

In addition to the letters from readers explaining about the problems they have had with hardware (and software), plus articles by readers on hardware which they are enthusiastic about . . . Kilobaud will be encouraging the manufacturers to write articles telling you the details of their equipment . . . why they used such and such a chip . . . what it does . . . what this means to you as the possible user of the system . . . why the bus was designed the way it was . . . etc. Manufacturers are well aware that their articles will be read with skepticism and that their credibility is on the line . . . so we expect them to be relatively candid, for in a marketplace such as this one, with many manufacturers competing very briskly for your business, credibility is of the utmost importance . . . and a loss of credibility can well mean lost business.

Most of the new manufacturers of microcomputer hardware are starting small, usually with a minimum of financing . . . so they need your business and confidence. You'll get to know these people through the pages of Kilobaud.

SOFTWARE PROGRAMS IN KILOBAUD

In addition to reviews of new hardware and reports from the readers on their problems, Kilobaud will be making every effort to encourage programmers to send in shorter programs for publication in Kilobaud . . . short programs, routines, algorithms, written for use on hobby systems. It is hoped that this will eventually become a library which will be invaluable to you when you are writing programs. There have been a few programs published elsewhere, but these have been far too few.

Longer programs have a home too. Kilobaud will be producing longer programs on cassette tape for sale by mail and via computer stores . . . complete with documentation. If you have some programs which you think might be of value . . . and might sell well . . . get in touch with Kilobaud. The page rate for articles in Kilobaud runs around $50 (about double that of other hobby computer magazines the last we heard), so short programs and routines could pay you very well if published. Longer programs will be on a royalty basis (15%) and the intention is to sell them at fairly low prices via stores so as to discourage copying and theft. Our experience with the 73 Morse Code tapes is that if cassettes are made available for reasonable prices there is little problem with copying.

KILOBAUD AIMED DIRECTLY AT NEWCOMERS TO COMPUTERS

Most of us are newcomers, one way or another. Only long time dedicated hobbyists are well grounded in hardware, software and systems . . . the rest of us may know one or the other of these, but not all. The intention is to try and keep a good deal of the material in Kilobaud of a very fundamental nature so as to bootstrap newcomers into the hobby. This will even include a glossary page of computer terms to help the beginner.

THE KILOBAUD LABORATORY

Kilobaud is the ONLY computer hobby magazine with its own computer lab set up. This lab is not a little workbench with an Altair . . . it has an 8800 with floppy disk, Imsai, Wavemate, Jolt, Apple, Southwest Tech, Sphere, Ebka, Intelligent Systems, Astral 2000 . . . various cassette systems such as the National Multiplex . . . printers by Southwest Tech, Teletype, Dec, MPI . . . terminals by Lear, Burroughs, Intelligent Systems . . . etc.

With this lab Kilobaud is able to check out the many systems available to the hobbyist . . . to interface I/O systems . . . to check memory and other new modules . . . and (most important) to check out programs submitted to Kilobaud for publication or for royalty distribution.

KILOBAUD TO SUPPORT COMPUTER STORES

Older hobbyists will recall that publisher Wayne Green predicted the proliferation of the computer store even before the first one was opened. Kilobaud will be available in every computer store that meets the Kilobaud requirements . . . as will the Kilobaud program cassettes.

In August 1975 the very first computer store was opened (in California) . . . by August 1976 there were over 50 recognized computer stores . . . and perhaps 150 one-man shops which hope to grow into stores soon. Considering the growth of the hobby computer it will not be surprising to many if there are about 500 stores by August 1977 . . . and 5000 by 1978.

Since only hobbyists have the wide background in all phases of computers to provide the services of a computer store, a great many of the readers of Kilobaud will find themselves faced with the economic opportunity of a lifetime . . . once they are qualified. This is all the more reason for getting your own computer system . . . and reading Kilobaud.

WHO IS BEHIND KILOBAUD?

The staff of 73 Magazine will be putting Kilobaud together . . . it is a staff of over 40 people and every aspect of publishing is done right at the big 73 Magazine headquarters building in Peterborough except the actual printing of the magazine. Kilobaud requires very large web offset presses and equipment, so it will be printed in Columbus, Ohio . . . and mailed from there.

The editor, John Craig, has been running the I/O section of 73 Magazine since last February . . . a section of about 40 pages of hobby computer articles and advertising every month. Before that John was one of the editors of the famed Cabrillo newsletter. John works out of Lompoc, California.

At the Kilobaud/73 headquarters, the type is set, articles proofread, and pasted up, artwork prepared, advertising sold and prepared for publication, subscriptions and readers service handled by a professional group which has been working together for years. Add to this the new prime computer system and you have a first rate organization. Visitors to New Hampshire are invited to join the thousands of amateur radio operators who visit the HQ and say hello.

WHO IS THE KILOBAUD PUBLISHER?

Wayne Green is not totally unknown in the hobby computer field. It was his frustrations with trying to get a computer system to use with 73 Magazine that resulted in his idea for Byte magazine in 1975. In a period of seven weeks Green managed to find an interim editor, get enough articles to get the magazine started, get mailing lists of prospective subscribers, write letters for subscriptions, get envelopes printed, send out the subscription letters and get in enough subscriptions to warrant printing 15,000 copies of the first issue . . . far too few, it turned out . . . but a lot more than the 2000 envisioned at first.

Green's visit to the microcomputer manufacturers in August 1975 was reported in detail in Byte and did a lot to help this small new industry grow. Green has followed this 1975 visit up with one in August 1976 and this will be reported in the first issue of Kilobaud.

Green started publication of 73 Magazine in 1960 and gradually built it from a one man operation to the present staff of over 40. 73 is the fastest growing ham magazine . . . over 30% increase during the first six months of 1976 . . . and soon will be the largest in circulation in the ham field. It already has more pages than any other hobbyist magazine and also has more advertising.

Green, who is listed in the latest issue of Who's Who, in addition to being the editor and publisher of 73 and starting Byte last year (no longer connected with Byte), also is the writer of a nationally syndicated newspaper column on CB radio.

COMING ARTICLES

Articles have been promised for Kilobaud by some of the top people in the field . . . a rundown on just about everything available . . . a sort of super buyers' guide is being prepared by Eric Stewart of Computers and Stuff. This will probably run to three parts to cover everything. Eric started with his first store in Provo, Utah and then moved to the San Francisco area . . . he is moving to a larger building to try and keep up with the business.

George Morrow (Morrow's Micro Stuff) will be writing on cassette systems and interfacing . . . on a fantastically simple prototyping system he uses . . . Dennis Brown (Wavemate) will be writing about the benefits of wire wrapping and also give us the inside dope on how the Wavemate was designed . . . and why. We've also been promised good authoritative articles on the Jolt system, the new Godbout PACE computer, the Apple computer and the Z-80 CPU coming out by MITS. Marlin Shelly of MPI (printer) has promised an article on parallel I/O standards and connectors . . . George Tate of Computer Mart (Orange, Ca) will be writing on I/O configurations . . . Dick Wilcox, a teacher of computer systems in elementary schools will be writing about fundamental software terms . . . monitors, debuggers, editors, executives, and such.

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Reviews Editor: Peter Kugel, School of Management, Boston College, Chestnut Hill, MA 02167.

Readers: Want to be a reviewer? Write to the Reviews Editor directly. Publishers: send materials for review to the Reviews Editor.

The Computer Revolution. Nigel Hawkes. E. P. Dutton & Company, Inc., 201 Park Avenue S., New York, NY 10003. 216 pp. $3.95. 1972.

If I had to recommend only one book that would give a non-technologist the clearest, most concise, informative and accurate picture of what computers are, how they are used, and how they came to be, this would be the book. Even aside from the scattered anecdotes and witticisms, the book reads very easily, and the diagrams and pictures throughout support the text so well that even the more complex concepts, like the section on electronic logic, can be understood with a minimum of frustration because of the well-done coordination between text and illustration.

The book is organized like a technological sandwich, with the "meat" in Chapter 4 which describes the organization, logic and operation of the computer itself. The balance of the book contains the to-be-expected, but enjoyable, introductory chapter describing the evolution of calculating machines, starting with the abacus and culminating with the ENIAC; chapters on computer applications in business, science and the arts; a half-speculative chapter on computer learning and intelligence; and, an example-laden chapter on computer simulation applications in everything from agriculture to world politics. Mr. Hawkes could have stopped there, but the obligatory chapter on the Future finishes the text with more of a fizzle than a bang. Its forecasts are commonplace, some already old-hat existing applications are included here because the book is several years old. Mr. Hawkes winds up with some soap box oratory about the dangers of computers and how they are inappropriatedly overrated, underrated, or ignored by society. Fortunately, the rest of the book makes reaching this point in reading worth while.

Despite its age, for a layman's introduction, the book is not dated in any important aspects. It does suffer occasionally from cultural translation, since the author is British, but a realization that the British have been far slower to automate than the Americans and that the British call a vacuum tube a "valve," will carry most readers through.

The Computer Revolution could be an excellent text or reference as part of any course from art to zoology which may be impacted by computers. I particularly recommend it for science survey and business courses and as reading for the curious, but not yet technologically trained individual from high school age and above.

Deanna J. Dragunas
Wetumpka, Alabama

* * * * *

The Robots Are Coming: The Implications of Artificial Intelligence Developments. F.H. George and J.D. Humphries, eds. Hayden Book Co., Inc., 50 Essex St., Rochelle Park, NJ 07662, 192 pp. $15.95, 1974

The Robots Are Coming! The Robots Are Coming! What an exciting, almost alarming title for such a staid, methodical book about artificial intelligence. The book is written clearly, but cannot be lightly skimmed, both because of the British dialect and because of the attention that must be given to concentrated scientific and logic discussions.

Chapters One through Eight, the majority of the book, are devoted to discussion of technical problems and current status of research in artificial intelligence. It's easy to say "robot" and think about a full-fledged android. But this part of the book picks the pieces apart and describes the technological and decision-making hurdles that have to be surmounted before approaching that stage, or even that of the more prosaic specialized single or limited purpose robots. Before artificial intelligence can be created, intelligence and its measurement must be defined. Electronic brain? How does a human brain work? Conversational computer? How do humans interpret and "logic" their way through language? Studies and experiments investigating all of these areas as well as the problems of mechanizing pattern recognition, of defining the learning process, and inductive and deductive logic programming are explained in the body of the book. Because so many different scientific fields bear on artificial intelligence, in the midst of detailed, specialized explanations, how what is being described has anything specific to do with artificial intelligence sometimes isn't exactly clear, and the reader can get lost in the details of the trees while trying to see the forest.

The second part of the book is the "implications" part, filled not with projection or prediction so much as with generalities about the impact of developments of artificial intelligence on society and individuals. These chapters would be more relevant if they didn't cloud the issue by dragging non-intelligent computers and teleprocessing capability and data banks as well as artificial intelligence into the discussion. Some of the questions and discussion in this part seem to be artificial constructs or a little out of touch with reality. For instance, "Do we really need artificial intelligence?" and "Do we really need robots?" are only a forum for stating the obvious: they're coming anyway. Some of the assertions made by the editors seem based on global technological averaging rather than on sane assessment of the way things are, for example, in "doubting whether robots will be needed to any great extent in industry in the future," the statement is made that "it is clear that if there is one thing which is not needed it is to replace human beings: there are already more than enough of them ..."

These closing chapters are easy reading, and they are the whole reason for the book. However, they form the weakest part of the book unless the reader seriously hadn't thought about all of this beforehand.

The splashiest parts of this book are the title and the dustcover design. It shouldn't be opened in expectation of a trip through science fiction wonderland, the foreward by Isaac Asimov notwithstanding. However, for anyone who thinks it's simple to get from the current rudimentary forms of artificial intelligence to even non-android robots, or who is interested in finding out how to get from the here and now to that future, or even for someone who wants the comfort of knowing that there is a bona fide application for "fuzzy logic," the book could be an interesting educational experience.

Deanna J. Dragunas
Wetumpka, Alabama

* * * * *

Computers and You. Kurt R. Stehling. Mentor, paper. 1973.

One of the many books for popular consumption to provide an understanding of the use and effects of computers on the whole range of human endeavor. Better than some, but disappointing in the amount of language one so regularly encounters in departmental reports. Well selected topics, informative treatment, but it still comes out fact stacked on fact stacked on fact and is not likely to generate interest in naive readers, though it does provide the type of introductional material so needed by the public.

John L. Randall
Kensington, MD.

Interface: Calculus and the Computer. David A. Smith. Houghton Mifflin Company, 1 Beacon St., Boston, MA 02107. 260 pp. $6.95. 1976.

An enrichment manual for use as a supplement to a comprehensive calculus text, this book contains interesting historical notes, good applied problems, and a number of computer-oriented laboratory exercises. Although some of the problems and exercises are standard fare, most are less well known and could be included here because the book was written to be used in a computer-supplemented calculus course where the messy calculations are done by the computer. The intent of the text is:

"— to provide a flexible supplement to any standard first-year calculus book to make possible a computer-based 'laboratory' experience;
— to introduce the student to applications of calculus to digital computation in a scientific setting;
— to use the computer to illustrate the ideas normally encountered in the calculus course;
— to place the ideas discussed in appropriate historical context so that the student can see mathematics as a living and growing body of ideas."

The book does appear to meet these objectives but lacks thoughtful computer-oriented laboratory exercises. Most of the book's exercises ask the student to write a computer program for a previously developed algorithm or to use a prepared program to generate a numerical table. While these activities do promote sound learning objectives, the opportunity to use the computer as a tool for higher-level mathematical activities such as discovering principles, generating algorithms, and formulating hypotheses, is for the most part ignored.

In spite of this limitation, the calculus topics are well developed and are presented in a more inspiring context than one usually finds in a book of this nature. The sound, rigorous development of the mathematical concepts and principles complements the obvious heuristic emphasis found in the computer exercises. This book, which could have been subtitled *An Introduction to Numerical Methods and Error Analysis,* includes topics such as functions, sequences, derivatives, limit theorems, roots of equations, integration, error analysis, logarithms, power series, compound interest, population dynamics, and differential equations.

Even though several short programs in each of FORTRAN, BASIC, and PL/1 are given, and computer programming and language features are discussed in the front of the book and the appendices, respectively, adequate material for teaching the required programming skills is not included in the book. The computer-oriented laboratory exercises can be carried out on either a batch-processing or conversational computer system. The *Instructor's Manual,* which is an "indispensable part of the text," contains numerical answers for the exercises and listings, in all three languages, of two programs intended for use in several of the laboratory exercises.

If you're teaching a high-school or college calculus course, you may want to consider using *Calculus and the Computer* as a supplement to your textbook — especially if your students have access to a digital computer. The historical notes and applied problems alone make it a useful reference manual.

Frederick H. Bell
University of Pittsburgh

* * * * *

Computer Science Mathematics, Donald D. Spencer. Charles E. Merrill Publishing Company, 1300 Alum Creek Dr., Columbus, Ohio 43216. 312 pp. $13.95. 1976.

According to the author, this book was written "to be used in a college-level course in data processing" or as a "self-teaching text for students, programmers, technicians, or teachers." I question the usefulness of the book as a self-teaching device because it contains some imprecise and misleading definitions as well as superficial explanations of certain algorithms. These areas need to be clarified and further illustrated by an instructor. The only mathematical prerequisite for the student who uses this book is a knowledge of first-year high school algebra. A 27-page chapter called "Review of Algebra" is included, but is better skipped. It appears to have been written hastily as an afterthought and is more confusing than enlightening. The stated purposes of the text are "to take the mystery out of computer mathematics and to give the student an appreciation of the computer's capabilities." The author has been only partially successful in meeting his objectives — especially the latter one.

The first chapter contains a good introduction to computers and algorithms (which are illustrated as flow charts), and subsequent chapters contain short introductions to arithmetic in various number bases, Boolean algebra, probability and statistics, linear functions and matrices, elementary number theory, linear programming, and numerical methods. Each chapter begins with a "preview" of topics stated as student learning objectives and contains review exercises at the end of each topic. Although billed as a college textbook, this book is also appropriate for a high school course on selected topics in mathematics. In fact, most of the topics can be found dispersed throughout various high school textbooks — usually as supplementary or end-of-book units.

The text is algorithmically oriented and most of the algorithms are explained in prose, illustrated through examples, and summarized as flowcharts. A few short FORTRAN programs are included in the final chapters. While this book is suitable for an introductory course on mathematics problems which lend themselves to computer solutions, some chapters could be improved by a more thoughtful explanation of concepts and principles as well as a better selection of example problems and exercises. The style of writing is well-suited for the intended audience, and numerous cartoons and photographs spice up the chapters. In general, *Computer Science Mathematics,* even with the shortcomings noted above, is a good starting point for the person who is preparing to learn about computers and computer programming.

Frederick H. Bell
University of Pittsburgh

* * * * *

Computer Frontiers. Thomas Massam, ed. Georgi Publishing Company, CH 1813 St., Saphorin, Switzerland. 165 pp. 62 Swiss francs. 1975.

Computer Frontiers is the edited proceedings of the first course of the International School of Theory and Application of Computers held in July 1972 in Geneva. If you are absolutely driven to know exactly how thin film wave guides bounce their beams, or to see the precise diagrammatic representation of electrical differences between inductive and capacitive coupling, or to exercise your Boolean algebraic facilities in a correctness of programming application, this is the book for you. It is definitely NOT for the novice browser without a strong physics or engineering orientation.

All the chapters are not only relevant to the book's title, but also sound, well-presented papers, some of which, unfortunately, are perfectly clear only if you already understand the contents before you read them. Perhaps because of the language difficulties in an international setting, the papers seem schizophrenic, going from very simple layman's text and introductions directly to knee-deep scientific equations and diagrams. The computer networks chapter is perhaps the easiest to scan and comprehend and gives a concise, interesting overview of specific networks and network issues. The microprogramming and computer architecture chapter, on the other hand, requires both a foreknowledge of, and a great interest in, both microprogramming and contemporary computer architecture to slog through it. Other chapters deal with large storage systems, large scale commercial terminal-computer networks, interactivity, sharing and virtual machines, the correctness of programs, an overview of technologies, and software engineering.

The majority of *Creative Computing* readers are *not* encouraged to dash out and buy this volume, but scientific and engineering libraries may wish to acquire it as a reference for their patrons on some specifics of important current technology.

Deanna J. Dragunas
Wetumpka, Alabama

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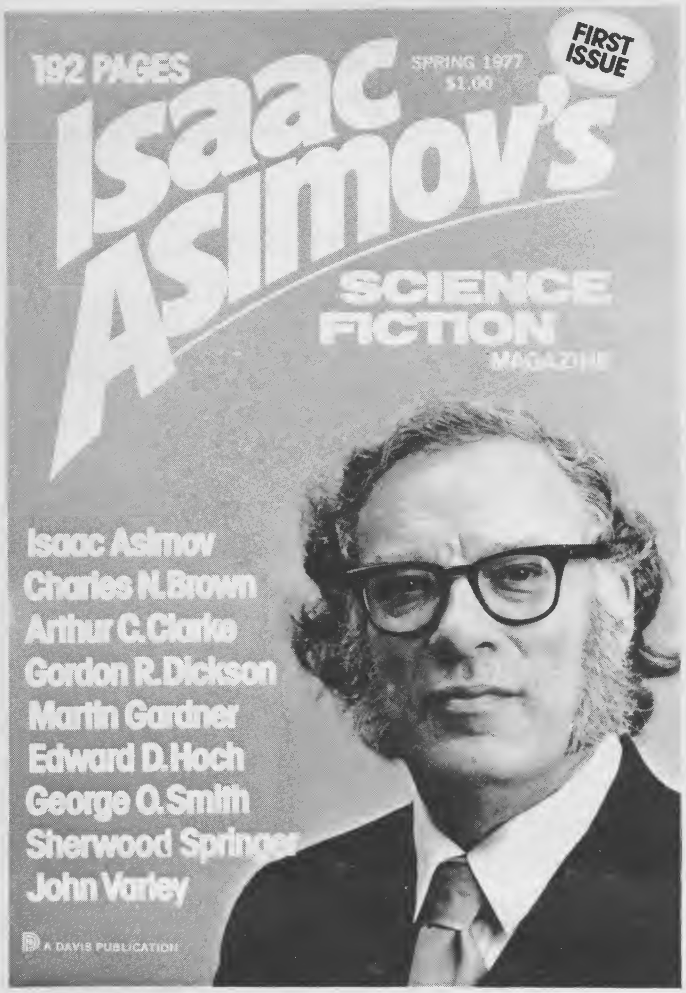

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Hobby Computers Are Here!, Edited by Wayne Green, 96 pp. paper, $4.95. *73* Magazine, Peterborough, NH 03458.

Since amateur computing is expanding so rapidly, there are a great number of people who want to know how to get their own terminals and computers up and running. *Hobby Computers Are Here!,* a "book" which has fewer pages than an issue of *Creative,* purports to fill this need. On the opening page Editor Wayne Green has the audacity to declare, "This book is one of the few (if there are any other) sources of information on all aspects of computers ... hardware (with very simple explanations of the basic circuits involved) ... the software ... *and* systems." Well, we'll all have to throw out our other computer textbooks.

Having recovered from the shock of reading that, one quickly discovers that this book consists of nothing but reprints from *73,* a ham radio magazine. Some of the articles which explain the fundamentals of digital electronics are quite helpful. Unfortunately, construction articles such as "A Morse to RTTY Converter" are definitely not of interest to the mere amateur, non-ham computer owner. The emphasis on ham radio in this book might be attributed to the fact that almost all the articles were written by hams. *Hobby Computers Are Here!* also contains twenty-one editorials by Wayne Green. They're generally centered on amateur and ham computing but occasionally Mr. Green rambles off on some tangent. Some readers may enjoy this style but some won't.

One of the problems with taking articles and editorials from a magazine and then printing them in a book is that it's not always apparent to the reader what's current fact and what's dead history. For instance, what is a novice going to believe when he reads, "None of the present-day tape storage systems are ideal for small computers and the race is on to invent a mass memory storage system which is geared to the low cost computer." Maybe he'll keep on reading and somewhere later in the book discover that cheap tape systems do exist. What if he doesn't? It's up to the reader to sort out the here-and-now from obsolete information.

Green's admission that "There are fantastic opportunities in the small computer market for making large gobs of money," seems just a bit too frank since there are eight pages of advertising in the middle of this "book," not to mention another ad on the back cover. At $4.95 *Hobby Computers Are Here!* really tells us, *Overpriced Hobby Computer Books Are Here!*

Steve North
Newfoundland, N.J.

A Creative Computing Group Review . . .

PROGRAMMING PROBLEM BOOKS

by F. Sokolowski
Montebello, California

Elementary Computer Applications, Ian Barrodale, et. al., John Wiley & Sons, New York, 1971. 254 pages. $8.50.

Not elementary. Contains about fifty programming problems. Contains very detailed discussion of problems. Heavily oriented towards advanced math-science students. Problem topics include roots of equation, numerical integration, system of equations, linear programming, etc. Of little or no use to non-science students. Problems are interesting but require at least calculus background and probably some programming skills not available to many first-course programming students.

Problems for Computer Solution, Steve Rogowski, Educomp, 196 Trumbull Street, Hartford, Conn. 06103, 1975. 90 pages. $3.95. Teacher Edition (with answers) 253 pages. $9.95

Contains ninety programming problems. Gives a fairly detailed description of each problem—one problem per page. Problems are fairly interesting and there is a range of difficulty so both advanced and beginner students can find something. References are provided on some of the problems. Problem topics include: number theory, algebra, geometry, probabilities, calculus, etc. Little for business students, mostly oriented towards math-science type students, but still a nice book.

Computing Problems for FORTRAN Solution, Robert Teague. Canfield Press, 49 East 33rd Street, New York, N.Y., 10016, 1972. 245 pp. $4.95.

Contains 70 programming problems. Problems are suitable for both business and science students. Also the problems could be used by languages other than FORTRAN such as BASIC, PL/I, and maybe COBOL. Most problems do not require much math background. Each problem is described in detail. Many interesting problems.

Program Style, Design, Efficiency, Debugging, and Testing. D. Van Tassel. Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632. 1972. $11.95.

Contains an appendix of 101 programming problems, plus about 100 more scattered throughout the text. Problem descriptions are quite brief but sufficient. Problems are well suited for wide range of languages and range from easy to difficult. Many problems are quite interesting. Contains enough scientific, business, and miscellaneous problems that everyone should find something of interest. Book also covers information mentioned in title. Useful, enjoyable book.

A FORTRAN Program Solver, by Manning, William A. and Robert S. Garnero, McGraw-Hill Book Co., New York, 1970. 167 pp. $7.50.

Contains about 25 programming problems and a short introduction to FORTRAN. A detailed description is given for each problem, and blank pages are provided so one can do his/her work in the book. Thus half the book you buy is blank pages. The problems are very elementary and good only for beginners. Little math required and oriented towards non-science business majors. Personally, I did not like this book.

Programming Exercises, Robert D. Steinbach, Glencoe Press, 8701 Wilshire Blvd., Beverly Hills, California, 1969. 114 pp. $2.95.

Contains about 50 programming problems and a short introduction to computing. Problems are suitable for beginning level programming classes of both science and non-science students. There is a very detailed description of each problem with input data supplied. Problems are grouped according to programming techniques, that is, decisions, iteration, subscripts, subprograms, etc.

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Programming Proverbs For Fortran Programmers, Henry F. Ledgard. Hayden Book Company, Inc., 50 Essex St., Rochelle Park, NJ 07662. 125 pp. $5.95. 1975.

Programming Proverbs provides the basis for a second step in the development of programming skills. It is for persons who have some familiarity with Fortran, but do not yet have a satisfying level of proficiency. The book is intended to be a guide to better programming, not an introduction. The author's intent is to promote improvement through the observance of 25 essentially simple rules called *proverbs.* Presentation of each rule is accompanied by recognition of a condition found in the work of an inexperienced programmer. These are followed by a discussion and examples showing application of the rule. In most instances these rules are clearly worth consideration by fledgling Fortranners. Although he fashions his message around a group of rules, the author carefully notes that he does not intend to remove opportunities for creativity in programming. He introduces his rules with a *prefactory proverb:* "Do Not Break the Rules Before Learning Them." This suggests the spirit prompting the book.

While showing readers how to improve their Fortran programs, the author gently raises the sights of Fortran-only programmers leading them toward an appreciation of other programming languages. In two series he presents equivalent programs in Fortran, BASIC, PL/1, and SNOBOL or COBOL. This is done in a way that is easily grasped by a Fortranner, yet leaves an unmistakable impression that other languages do indeed have advantages in certain situations.

This reviewer found the author's explanation of the context effects of function subprograms to be especially enlightening. This feature alone would be worth the cost of the book and the time to peruse *Programming Proverbs.*

Thomas A. Boyle
Purdue University

(Available from the Creative Computing Book Service. See coupon elsewhere in the magazine.)

* * * * *

Computer Graphics: 118 Computer - Generated Designs. Melvin L. Prueitt. Dover Publications, Inc., 180 Varick Street, New York, NY 10014. 69 pp. $3.00. 1975.

A three-dimensional U.S. flag rippling in the breeze, soaring spires, and ethereal multicolor creations floating in black space are just a few of the stimulating computer-generated artworks that await the reader of this delightful book.

Following a short, thought-provoking discussion of computer art, the author moves directly to examples created by PICTURE, a program of his own invention. The pictures are accompanied by brief, informative comments that cover such topics as hidden-line removal, perspective, and optical illusions. A number of the pictures show the three-dimensional representations of explicit mathematical functions while others depict unpredictable patterns resulting from letting the computer generate random data for output. Unexpected images caused by errors, both human and mechanical, contrast with the precision of three-dimensional plots of magnetic fields and nuclear spectra.

Anyone with an interest in the potential of computers aiding human thought and creativity, especially in the area of computer-generated art, should get their hands on this excellent book.

Jay Wooten
Westford, MA

* * * * *

Graze Ecology Simulation. Michael Chester. Hewlett Packard Computer Curriculum, 1501 Page Mill Road, Palo Alto, CA 94304. Student Text, 23 pp.; Teachers' Notes, 29 pp.

The student is given a range, 3 square miles in area, which has 200 rodents and 10,000 grasshoppers per acre. The student's objective in this computer simulation is to raise cattle on the range while maintaining a balanced ecology. The student inputs the number of cattle to be raised, and also the number of songbirds and hawks he or she thinks is required to maintain the balance. The populations of all species are then computed in half-year increments over a 15 year period and printed out, along with a score from 0 to 100 which measures the student's success in achieving the objective. By analyzing accumulated information, the student can then try to improve his or her score by systematic variations of initial species populations.

The author provides a good qualitative description of the model, along with suggestions for additional projects and several references for further reading. The value of the simulation to the more serious student would be enhanced by a discussion of the equations used, since many will want to tinker with the model. (For example, when grasshopper populations "explode," the computation terminates with an "out of control" message and a zero score for the user. A problem solving student may be more interested in knowing what the grasshopper limits would be in the absence of predators than improving his or her score.)

The simulation can be studied at many levels and it can therefore be recommended for classroom use from junior high through college. The BASIC program with external documentation is provided.

Scott Davidson
Silver City, NM

* * * * *

Computer Careers – Planning, Prerequisites, Potential by John Maniotes and James S. Quasney (Hayden, 1974) $4.95.

As the preface indicates, this book is intended to provide some answers to questions about the field of Electronic Data Processing (EDP). Topics covered through the book include career opportunities in the computer field and their future; the kinds of educational and training opportunities that exist; which schools offer computer academic programs and training; the kinds of factors which should be considered when choosing a school; the kinds of financing available; and the kinds of potential existing for advancement in the field.

After a short overview chapter of the EDP field and a chapter on "How the Computer Does It" the meat of this book begins. The authors do a good job attempting to explore answers to the areas suggested above. At the end of the book, the Directory of EDP Schools and the various appendices are extremely valuable. There are many places to write for information and a listing of many computer films that are available. A bibliography at the end of most chapters is helpful in extending the information provided.

This is a really good book. Several copies should be made available for reference by students, teachers and counselors. And this is a good book for teachers who are not particularly well-acquainted with the field to read.

Joseph Kmoch
Milwaukee, WI

Index to Advertisers

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Jay Wooten
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The simulation can be studied at many levels and it can therefore be recommended for classroom use from junior high through college. The BASIC program with external documentation is provided.

Scott Davidson
Silver City, NM

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