PCC

is a newspaper about . . .

having fun with computers
learning how to use computers
how to buy mini-computers
books, films, music
tools of the future

Bob Albrecht
Jerry Brown
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LeRoy Finkel
Mary Jo Albrecht
Marc Le Brun
Jane Wood

Contributors –
Don Holznagel
Norm Thompson

WE DID THIS ISSUE

Want more copies of this issue?

Quantity	Price
1 to 9	$1.00 each
10 to 99	$0.50 each
100 or more	$0.30 each

Does PCC Tickle your interest in computers? Want to learn more and have plenty of "hands-on" experience? Join us at the University of California Extension courses the weekend of March 31, April 1. We've taught this class on 7 UC campuses for teachers all over the state. Try it – you'll like it!

WORKSHOPS IN COMPUTER SCIENCE

Instructors: ROBERT ALBRECHT, People's Computer Company and LEROY FINKEL, Ravenswood High School

Schedule: March 31–April 1; 9 a.m. – 10 p.m. Saturday; 9 a.m. – 6:30 p.m. Sunday; Lawrence Hall of Science, Berkeley campus

Credit: Two quarter units in Computer Science, each course

Fee: $65 each course, includes laboratory fee and some materials. Enrollment is limited

For information telephone 642-1061 in Berkeley

Computers in the Classroom X 402A (2)

An intensive "hands on" introduction to the use of calculators and computers in elementary and secondary school education. Participants use programmable calculators and learn the programming language BASIC, using both timesharing terminals and small computers. Methods for effectively using computers in the classroom and analysis of available hardware, instructional materials, computer education programs, and sources of further information. The course is conducted as an open classroom with activity centers for mathematics, science, business education, and social science teachers. It spans all grade levels – elementary through college. No previous programming or data processing knowledge is necessary.

Computers in the Classroom: Individualized Instruction X 402B (2)

This course is a continuation of Computers in the Classroom X 402A, and it gives participants the opportunity to increase their computer problem-solving skills. The course is run concurrently with X 402A, which is a prerequisite.

Games Computers Play X 407 (2)

Spend a weekend matching wits with a computer. Participants play computer games and explore both real life and "worlds of if" through the medium of computer simulation. Games of skill, games of chance, and games to learn by. Computing equipment is available throughout the course. No previous computer experience is required. The course is run concurrently with Computers in the Classroom X 402A and B.

CONTENTS

See inside!

PEOPLE'S COMPUTER COMPANY is published 5 times during the school year. Subscriptions begin with the first issue, October 1972.

Single subscriptions – $4 for 5 issues [$5 Canada and overseas]

Group subscriptions, mailed all to the same address –

10 or more	*$3.00 each*
30 or more	*$2.50 each*
100 or more	*$2.00 each*

Subscription coupon on back cover

can anyone help?

CENTER OF ENVIRONMENTAL SYMBIOTICS
a non-profit corporation
ecologic research design public education

". . . We have no computers but we are trying to get hold of a TTY or ASR-33 used or new, a plotter ('step' type), a binary card punch and a regular printer which can interface with Resource One. We are seeking a company which can use the tax relief inherent in donating this equipment to a 501(C)3 organization."

Dan Collins, Director of Projects
411 Alcatraz Avenue
Oakland, Ca. 94609
(415)658-3599

VOLUME ONE, NUMBER THREE

COMPCORP

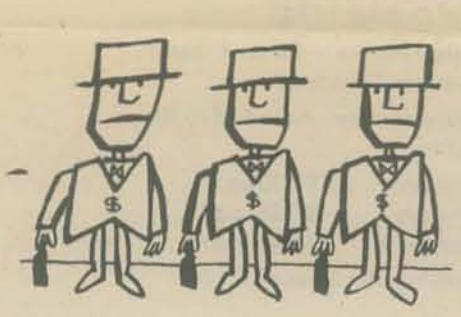
COMPCORP is an advanced computer course at San Ramon High School in Danville, organized into a samll company. It is run by the students, mostly juniors and seniors, who maintain and operate different departments and work in different positions. The company was first started by 15 computer students in 1969 with senior Paul Salsgiver as COMPCORP's first manager. A math teacher at San Ramon organized the small company and has been with COMPCORP ever since. COMPCORP is unique in that it is believed to be the only high school company in the nation set up so that they can market their programs on a competitive basis with established data processing firms. COMPCORP was started to give computer students experience in a real-life business office.

In its lifetime, COMPCORP has made many significant accomplishments. After three years of operation, they have yet to encounter a program which they could not solve. During its first year two students from COMPCORP, Don Eagling, a junior, and Paul Salsgiver were hired by Robert C. Hess, computer programmer at Gordon H. Ball, Inc.

Don Eagling became COMPCORP's second manager in 1970 and during that year, COMPCORP began to sell its programs to local business firms. Applied Radiation Co. in Walnut Creek was one of the first companies to hire COMPCORP. "I couldn't be more happy with the program they worked out for us" said Dexter Dawes, an executive from Applied Radiation who was responsible for hiring the youths. COMPCORP also designed programs for Dr. Richard I. Levin. The programs were used in the third edition of his book, *Quantitative Approaches to Management*. Students in COMPCORP were also given free use of Gordon H. Ball's data processing facilities during that year and students were given the opportunity to learn FORTRAN IV. This year Roy Anderson is the first junior to become COMPCORP's manager. They have established programs for local realtors and are currently soliciting other contracts such as Dr. Levin's.

For further information on COMPCORP –

COMPCORP
P.O. Box 541
Danville, Ca. 94526



For San Francisco Bay Area readers, there will be a Huntington Project workshop held at Lawrence Hall of Science, SATURDAY, FEBRUARY 24, 1973, from 9 to 12 AM. The workshop is designed to introduce you to all the Huntington Project simulations and give experienced users a chance to share their ideas. For a $3.00 per person lab fee, you will receive some project materials and be guaranteed computer time to run the programs.

HIGHLIGHTS FROM OUR

PEOPLE'S COMPUTER CENTER

Classes and other events

PCC is a place! Tuesday, Wednesday, and Thursday afternoons and evenings the place changes from a funky office into an open classroom. For scheduling ease, we've split the time up into three "slots" – two in the afternoon and one for the evening. Here is our current schedule:

	1 – 3:30	3:30 – 6	7 – 9
TUE	Crescent Park	Open class	Open class
WED	Lothlorien	Open class	Open class
THU	Open class	Barron Park	Los Altos HS

The slots with school names are school-credit classes by arrangement with the schools. Woodside Elementary also has a couple of "slots" in the morning, but we can't offer anymore morning ones due to staff limitations and our sometimes desire for peace and quiet.

Prices:

Afternoon times are $2 per person per hour; we also have a bargain rate of $20 per person for six weeks.

Evening times are $2 per person per session. You can pay for several sessions in advance, but there is not "quantity" discount.

What do we do? We have games (computer and other), problems and projects, and beginning programming in BASIC and PILOT 73 (new, easy language, just up and running). Evening sessions have special events from time to time. We show films when we can get them; recently we gave everyone a computer-generated 1973 calendar, and set out watercolors for everyone to make their own custom calendars. Suggestions are welcome . . .

HP EDUCATIONAL NEWSLETTER

As we said in the OCT 1972 issue of PCC, the HP Educational Users Group Newsletter is GOOD. Now HP has packaged the first two years in a single volume and it's yours for only $2.00 even if you are not a member of the Users Group. Your 2 bucks (check or money order) buys you 116 pages of good info – get it from EDUCATIONAL USERS GROUP, 11000 Wolfe Road, Cupertino, Ca. 95014.

[Remember ... send check or money order, HP will not bill you]

LeRoy Recommends...

What is a Computer?

Marion Ball
Houghton Mifflin Company
Price: $2.95

If you are looking for a good softbound book that explains computers to younger kids here it is! *What is a Computer?* is brief but to the point. It won't turn you into a computer professional but gives a light introduction to computers and a little about their history. It even includes a nice glossary.

The book is full of pictures and multicolor drawings which makes it ideal for younger kids. We'd recommend using it as a reference book for grades 5–8 and/or use it with older students with reading difficulties.

HOUGHTON MIFFLIN

Regional Sales Offices:
53 W. 43rd St., New York, NY 10036
666 Miami Circle, NE, Atlanta, Ga. 30324
1900 So. Batavia Avenue, Geneva, Ill. 60134
6626 Oakbrook Blvd., Dallas, Texas 75235
777 California Ave., Palo Alto, Ca. 94304

LeRoy Pans...

Flowcharting

James McQuigg
Alta Harness
Price: $1.60

Introduction to Computer Programming

Rudd Crawford Jr
Price: $3.00

Two more softbound books in Houghton Mifflin's series on computers – but don't bother! We admit we are prejudiced against any *book* on flowcharting or an *entire* book written about an imaginary machine language. Disregarding this prejudice, we still would not recommend these books. Both books are dull to read. They use very traditional language, format and layout, so traditional in fact, that it's hard to imagine that the same publisher who brought us *What is a Computer?* had anything to do with these two.

COMPUTERS, PEOPLE AND DATA

by Merle W. Wood
South-Western Publishing Company
5101 Madison Road
Cincinnati, Ohio 45227
Price: $1.68

This is the companion volume to *You Are a Data Processor*. Together, they contain the same content (no programming) found in every other introduction to data processing text. However, Merle Wood has scrunched what is normally found in 500 page books into 140 pages (the two books together). In the process he left *in* enough to cover the topic and took *out* all the garbage other authors have bombarded us with. When you go through this well illustrated, easy-to-read book, you'll wonder why you ever covered this topic in any more depth than you find here.

LeRoy Sez "All right!!"

The first 40 pages cover all the essentials of history, data processing cycle, input/output and central processor. The next 25 pages deal with the "flow of data" which shows how to use computers by following processes in a specific application. Though important, I found this section anticlimatic. The book concludes with five special projects, one of which was "writing" on magnetic tape, another "punching" punched paper tape.

Although it has its weaknesses, I really did like this book. It makes excellent use of original graphics and is written in a highly palatable style. You might compare it with *What is a Computer?*

Suggestion to South-Western Publishing: Repackage pages 1–26 of YOU ARE A DATA PROCESSOR and pages 1 – 39 of this book as one unit and add some believable projects.

YOU ARE A DATA PROCESSOR

by Merle W. Wood
South-Western Publishing Company
5101 Madison Road
Cincinnati, Ohio 45227
Price: $1.68

"... there has been a continuing demand by teachers for materials which are elementary in nature, easy-to-understand, useful for simulated hands-on experience, printed in small modules and which can be taught by an instructor with limited data processing background." From the Preface.

AMEN. Five years ago we *were* looking for just these kinds of materials. And now they are finally available ... covering topics that are five years old! When will we ever get over the syndrome that says you must learn about all the punch card equipment to be a data processor? Cards, yes – all the card equipment, no. The first 26 pages of this book are a nice light introduction to data processing. From there on the author should have progressed directly to his book on Computers rather than giving us the details of card sorters, collators, reproducers, interpreters and tabulators. I was particularly turned off by the exercises: (i.e., "Be a collator") But Merle Wood did make one giant breakthrough. This softbound book uses excellent graphics. They are clear and easy to understand.

LeRoy Sez "Sorry 'bout that."

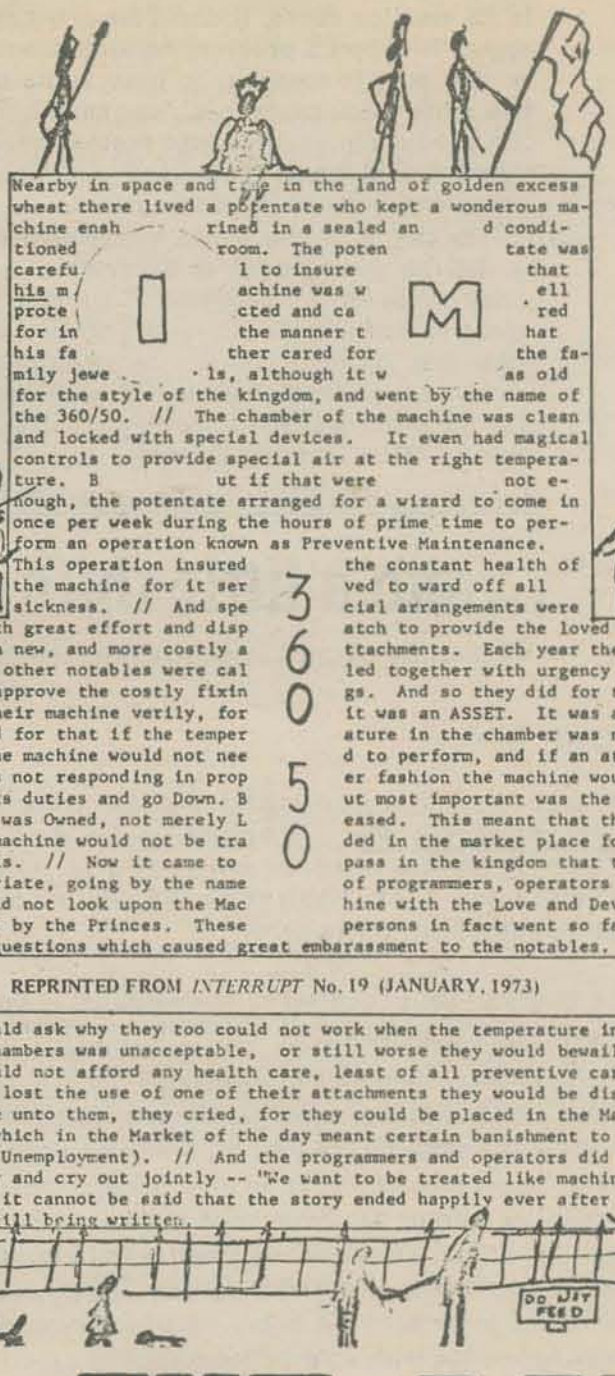
The book is written for students with reading problems and is designed to take roughly 15 hours to complete. The book concludes with five projects for students to do – they are original but we're not convinced they're beneficial.

Sorry Merle – LF

INTERRUPT

newsletter of computer people for peace

Interrupt is probably the best source of information on the problems that socially conscious persons working in computer-related jobs in industry encounter. It is therefore invaluable to students who are considering becoming computer professionals, as well as concerned people in general. Controversial issues are discussed, and various conferences where computer people gather are covered from a point of view similar to PCC's "Use computers for people, not against them."



Computer People for Peace
291 Sterling Place
Brooklyn, New York 11238

CPP, now in existence for almost five years, is the only organization in the computer field that stands for peace, equality and civil liberties for all people--and for the use of computers and technology to help achieve these goals.

WHERE THE MONEY GOES:

To publish INTERRUPT. This issue cost over $500 to print and to mail to our members and friends in the U.S. and abroad.

To hold "SANER" conferences for members and friends.

To publicize and hold public meetings on computer uses and misuses.

To research and print in-depth booklets on computer technology in war, data banks, and health.

To aid and cooperate with nationwide movements against war and oppression.

To get together members to form new CPP collectives, which may share the responsibility for publishing INTERRUPT.

In order to actively face the next four years, CPP needs you! Won't you pay your 1973 dues now? In accordance with the wage/price freeze, help is still voluntary and dues are still only $10!

☐ I'd like to join. Here's my $10. (Booklets free if you join now.)

☐ Please put me on the mailing list.

Please send me the CPP booklets:
___copies of Data Banks, Privacy and Repression @50¢
___copies of Health: Big Business for Computers @50¢
___copies of Technological Warlords @$1
All 3 for $1.50 ☐

NAME_____

STREET_____

CITY,STATE,ZIP_____

LOOKING OVER THE LITERATURE.

New paperback called a bargain

Simulation in the Classroom, by John L. Taylor and Rex Walford (Penguin Books, 7110 Ambassador Rd., Baltimore 21207–1972), $1.95?

Excerpted & Reprinted from
Simulation/Gaming/News

Taylor and Walford have written a book which meets the threat of the ubiquitous photocopying machine. When you can get 190 pages of well-indexed material for about $2, why bother to Xerox?

The chief virtue of *Simulation in the Classroom* is not its low price, but its quality. Taylor is from the University of Sheffield and Walford from Maria Grey College at Twickenham, and anyone who believes "educationalese" is necessary hasn't seen this book. The message is presented straightforwardly–as though educators in Great Britain had been using the language for centuries and were at home with it.

The first part of the book is a succinct introduction to instructional simulation, the second part is given over to presentation of six games and simulations, and the third part is a listing of relevant materials.

The book describes six games and simulations:

The HEREFORDSHIRE FARM GAME is a relatively simple and structured game which introduces some basic ideas about the process of farming and the decision taking involved within it. It has been used often in primary schools, as well as at the secondary level.

FRONT PAGE is also simple in style–with an additional constraint of "working against time" built into it. Its use is most likely to be within the English classroom though, as the author points out, its aims have a more general significance both in regard to its principles of operation, and in regard to the discussion of what is "important" news.

CHEMICAL MANUFACTURING crosses disciplinary boundaries, and is a game in which the problems of business economics intrude on a specifically scientific context. It allows much discussion and "bargaining" within a simple rule structure.

The URBAN GROWTH model is of a different kind–an example of the mathematical model in which participants are operators of processes (through random numbers tables) rather than continuing decision makers. This Monte Carlo style simulation seeks to reproduce general patterns, rather than account for individual events.

CONGRESS OF VIENNA is essentially an open-ended simulation in which much background information is provided before open discussion; "anything may happen," including a simulated treaty disagreement, or final confusion (war?).

The CONSERVATION GAME, like CONGRESS, also takes some considerable time to organize and play and is different in scale from the earlier examples in this respect. Here there are a wide variety of role-briefs to be mastered, and a need to reach a final decision about siting an airport.

All six games and simulations do not lack classroom experience and testing, and all have proved themselves successful in the eyes of a number of teachers who have used them.

By the time this appears in print, the American edition should be available. The English edition bears a price of $1.95 Canadian. –S/G/N

Simulation Gaming News, an Alohn and Hyer publication, is issued five times a year (every other month except in the summer). Subscriptions are $4 for five issues, and checks (not purchase orders) should accompany subscription requests. Zip codes also should be supplied. Advertising rates and specifications are available upon request. Communications should be addressed to S/G/N, Box 3039, University Station, Moscow, Idaho 83843.

The S/G/N Mod Man Sketches are by Peter Bevacqua, 1007 Castro St., San Francisco, Ca. 94114.

LOOKING OVER THE LITERATURE.

Only 8 years old, but already a classic

PROBLEMS FOR COMPUTER SOLUTION

by Fred Gruenberger and George Jaffray
John Wiley and Sons, Inc.
605 Third Avenue
New York, NY 10016
Price: $6.95 1965; 401 pages

After you learn to talk to computers, what do you talk about? If you want inspiration, try this book. 92 problems, something for everyone – easy, hard, math, non-math, all beautifully written.

INTRODUCTION

PROBLEMS FOR COMPUTER SOLUTION

This book is addressed to the student of digital computing. Such a person presumably wishes to learn many things, among which are:

1. What is a digital computer?
2. How does it operate?
3. What is it used for?
4. How is it programmed?
5. What are its limitations?
6. What should we compute?

In the learning of any subject (tightrope walking, for example) there is a sharp distinction between theory and practice. Theory is fine up to a point, but there is no substitute for actual practice. To make the practice meaningful in a course in computing, the student should work independently on a problem, preferably one of his own choosing. He must avoid choosing too few problems, limiting himself to three or four grandiose problems. He should rather plan to do many of the easier exercises. He will find that he develops his problem-solving ability much faster by solving many apparently simple exercises. These prepare him for attacking the bigger problems. He can actually complete more big problems by first doing the easier exercises which lead up to them than he could accomplish by attacking those impressive problems directly.

The sixth question raised above (What should we compute?) thus becomes important. The question has a double meaning. In its smaller sense, it could mean the choice the student must make, to select a problem consistent with his capabilities that he can hope to complete in time. In its larger sense, it refers to a more fundamental problem; namely, what are the attributes of a good computer problem? In other words, what are the characteristics of any problem that is suitable for computer attack? These characteristics can be listed.

In the practical world, where computer time is measured in dollars per minute, an overriding attribute of a good computer problem is *usefulness*. With rare exceptions, industrial users of computing equipment are somewhat cool to the idea of extending tables in number theory, for example. In the atmosphere of the school, however, this requirement can be waived. Any problem that fits the other requirements is automatically useful for the training process.

"...and a little child shall lead them"

We recently received this letter from the director of a college computer center.

Dear Sirs:

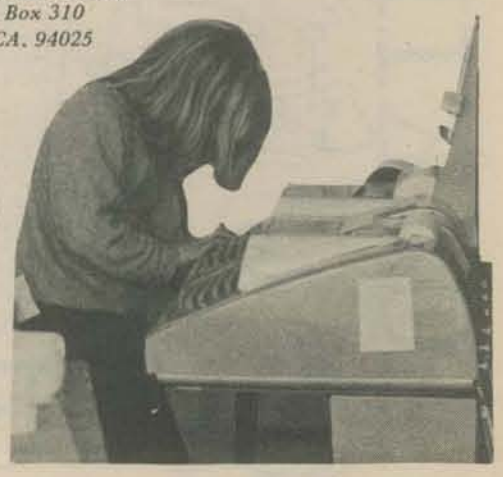
Would you please send me an examination copy of My Computer Understands Me. Recently we had some high school students on campus using our computer and they told me about your publication. It looks as if we right be able to use it in our programming class.

MY COMPUTER LIKES ME*
*when I speak in BASIC

Single copies: $1.19. Calif.res. add 5% tax.
Order from Dymax, P.O. Box 310
Menlo Park, CA. 94025

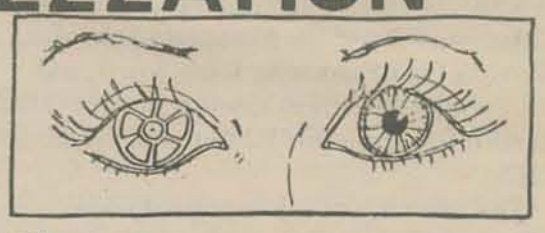
Formerly entitled My Computer Understands Me

The second printing of our very own introduction to BASIC. Completely re-typeset, now with a bright orange heavy duty cover. In an easy going, conversational style, this 64 page workbook introduces BASIC to young or old. Designed to be used with frequent access to a timeshare terminal (learn by doing!), we use this large format book in our introductory workshops for people with no previous computer experience or knowledge of programming. The teaching examples are oriented around population problems and demographic data.



AUDIO-VISUAL ACCESS AND UTILIZZZATION

COMPUTER FILM CATALOGS



Several months ago we began a search for comprehensive catalogs of films of interest to computer users and educators. To our disappointment, we discovered only two that were reasonably current. We were also disappointed to find that the only evaluative film reviews seem to be published sporadically in small, often locally-circulated newsletters like *Timely T.I.E.S. Topics on Instructional Services.*

Some time back, we received a preliminary manuscript for a film catalog to be published by the Association for Computing Machinery's Committee on Secondary School Programs. We wrote to Don Spencer asking the status of the project, and received this reply:

"Work on the ACM film list has terminated due to inadequate publishing funds. I am, however, producing a film list for a teachers manuscript. Will send you a copy of this book upon publication."

PCC would love to hear from you regarding films you have used or seen. Tell us about the bad ones as well as the good ones and the setting in which they were used, and we'll publish your reviews in future issues of PCC.

Directory of Films for Data Education
SDE Publishing Office
2–76 Union
Northfield, Vermont 05663

This catalog contains about 300 films, listed alphabetically by title, plus a listing of Film Sources. No subcatagories or cross referencing. It appears complete. Film descriptions are unfortunately nonevaluative. Each year the directory is bound in as a special section of *Data Education* magazine, or the 1972 catalog may be ordered separately, bound with a soft cover for $2.25, cash with order, postpaid from the address above. We assume that the 1973 catalog will be out in the February issue of *Data Education*. Examples of listings:

GROWING
A computer-animated film depicting growth. Provides an opportunity to become acquainted with computer animation. Growth is about life and the multitudes of experiences that make living what it is for each individual. Discussion needed in each use to interpret film in terms of past experience of the group watching it. EBEC
1969 color rental $3.00 7 minutes
University of Michigan

THE MYSTERY OF STONEHEDGE
Presents an account of Stonehedge, a prehistoric stone monument in England. Tests the theory that it was built as an observatory and computer. Produced by CBS-TV.
1965 rental $15.00 57 minutes
University of Southern California

NO. 00173
Into the cold, dispassionate atmosphere of a factory run by human automatons comes a small red butterfly. Attracted by the little creature and concerned for its safety as it flits close to the presses, the workers show their first sign of human emotion. The film comments on the dehumanization of life in a technological world. Produced by Short Film Studio, Warsaw. Script, direction and graphic design by Jan Habarta.
Color rental $13.50 9 minutes
Contemporary/McGraw Hill

HYPOTHESIS BETA
This cartoon, without narration, but with expressive sound effects, plays out a drama that takes place entirely on a computer card. An isolated perforation creates havoc out of sheer boredom between readings. (Societe des Film Orzeaux-McGraw Hill)
1965 color rental $5. 7 minutes
Kent State University

Audiovisual Media for Computer Education
Science Associates/International, Inc.
23 East 26th Street
New York, N.Y. 10010
(212)532-1955

48 pages, 452 listings, 50 classification headings with cross referencing, subject index, film source addresses. $5.00 plus 25 cents postage and handling.

This catalog offers a lot of films to choose from, but is not always good about how to get them. Many of the films are available from sources *in addition to* those listed (true also of the *DATA EDUCATION* catalog). This catalog includes films from other countries and in languages other than English. Examples of listings:

COMPUTING FOR FUN

28 min U.S.A.

Bell Telephone Laboratories

Dr. J.R. Pierce describing how computer music is made. Examples of the music, ranging from simple till highly complex are presented.

NH-5969E2-DIGITAL COMPUTER TECHNIQUES-LOGIC ELEMENT CIRCUITS.

16 min color, USN

Illustrates how solid state electronics are used in modern computers. Shows diagrams for diode, circuits, the P-N-P Transistor, its use in AND, OR, NOR. INVERTER and FLIP-FLOP gates. Shows how the circuit handles the input signals of high and/or low voltages representing binary ONES an binary ZEROS respectively, and how the proper output signal is produced.

DONALD IN MATHEMATIC LAND 1959

U.S.A. 16mm color, English, 26min. SD

Walt Disney productions Inc.

Proof that math need not necessarily be dull and boring. Donald Duck learns the importance of mathematics from early Greeks who discovered some of its basic principles. Later seqences show how these principles are related to music, art, architecture, mechanics, sports and other phases of our daily lives. Both animation and live action photography are used.

INTRODUCTION TO FEEDBACK 1960

Charles Eames and Ray Eames
Purchase, Charles Eames Productions

The cycle of measuring, evaluating, and correcting is called feedback. It has become a science and an art. This film is a simple presentation of the feedback idea, its growing importance in our culture and some examples of tools to facilitate its use, such as electronic data processing.

12 min., SD, color, 16mm.

IFM free Name

WHAT EXACTLY IS A PROGRAM ?

11 min. SD, color

ICE FILMS FOR INTERNATIONAL COMPUTERS LTD

What a computer program is, machine coding and program languages illustrated by animation.

A COMMUNICATIONS PRIMER 1952

U.S.A. 16 mm. English, color, 20 min. SD.

Charles Eames and Ray Eames
Released by classroom film distributors, 1959 Purchase. Classroom film distributors.

An introduction to the theory of communication. This very stimulating and creative film associates Dr. Claude Shannon's (mit) basic theoretical communications diagram (information-selector-transmitter-channel-signal-transmitter-channel-signal-receiver-selector-destination) to today's practical communications devices. A discussion of redundancy, symbols, time and binary mathematics is included.

MARK OF MAN

General Dynamics Corporation.

Traces history of man's efforts to record information from the marks made on walls of caves, through the development of mechanical printing devices to high-speed recording of computer data by cathode ray tube.

10 min., SD., color, 16mm.

Electronic Division of General Dynamics Corporation.

TO HARE IS HUMAN

8 min. Color 16 mm. Free. UNIVAC

A humorous cartoon in which Bugs Bunny is kept busy countering schemes devised by the Wolf and his do-it-yourself computer kit.

IBM Film Library

IBM was fortunate to have engaged the Eames brothers (Charles and Ray) as film producers many years back, an association that must have continued for some time. We mentioned the Charles Eames' film *A Communications Primer* in passing in the first issue of PCC, and it has the Eames stamp of excellent visualization of concepts and information, with good supporting narration. This same style is evident in our favorite IBM film *A Computer Glossary*, which is the only IBM film available from most Modern Talking Picture Service depositories.

A COMPUTER GLOSSARY—10 min. color. A computer glossary or coming to terms with the data processing machine. One way to understand this special field is to know something of its mood—a particular flavor given by its jargon, its technical vocabulary.
#3305 IBM CORPORATION

You pay return postage only

IBM also has a clever and interesting film entitled *House of Science.* However, I find its message very disturbing – namely, that science and technology will solve all our problems, a theme in which IBM has an obvious stake and which runs through most of the IBM films.

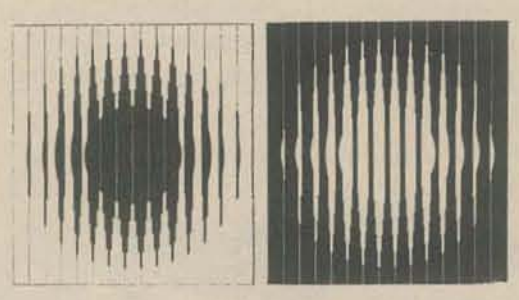
House of Science
16mm
14 minutes
color
"Not only does this film show the development of science and natural philosophy, it also dispels many illusions concerning the limitations of the field. Scientific procedure is shown to be a natural process arising out of man's curiosity about the world he lives in, and out of the increasing confidence which understanding brings."

The Information Machine
16mm
10 minutes
color
"A sophisticated, amusing account of the development of the electronic computer beginning with primitive man and ending with the advent of machine simulation. Colorful and imaginative, this film is an effective communications device for explaining the nature of data processing."

These films are only available from the IBM Motion Picture Library, c/o Modern Talking Picture Service
Atlanta, Ga. 30308, 412 W. Peachtree St., N.W.
Chicago, Ill. 60611, 160 E. Grand Ave.
Dallas, Texas 75207, 1411 Slocum Street
Los Angeles, Ca. 90038, 1145 N. McCadden Place
New York, 10036, 1212 Ave. of the Americas

And – we pass on these words from one of our favorite film librarians, Betty Paul of the Los Angeles IBM Film Library.

"This late in the year it is almost impossible to reserve our films due to prior reservations. If you are going to need films either for summer (after June) or for fall, we set up our fall reservations in May, so could you plan ahead for later programs. Please keep in mind that we have to schedule any of our films for just one day, as we serve the 11 western states from this one library (with very few prints!). Always include your zip code and complete street address."



READER RESPONSE: Plugging In

A note on your hassle with Bell & Howell external speakers – Switchcraft makes an adapter for about $3 that is simply a male plug that fits the B&H extension speaker jack on one end, and a standard ¼ in. female phone jack on the other end. This is great when you are using someone else's projector that you can't modify. Mine has a number 388 stamped on it. I don't know if that is a stock number or not, but I would suspect it is. Photo & Sound and other AV or electronics supply stores have it or can get it.

COMING ATTRACTIONS – *In our next issue we will discuss computer animation: techniques, reviews of films, sources of films. If you have any information about or experience with computer animation, please send it to PCC and we'll pass it on to our readers. Thanks.*

ORGANIZATION

In 1967, twenty school districts in the Twin Cities area formed the Minnesota School Districts Data Processing Joint Board, and undertook to establish a unique service called Total Information for Educational Systems – TIES.

The Joint Board was organized under a Minnesota law which provides that a local governmental unit can exercise, jointly with like agencies, the powers granted to it under Minnesota law. Each school district is represented on the Joint Board by two delegates. The Joint Board delegates elect an eight member Executive Committee which holds regular meetings, establishes policy and acts on behalf of the Joint Board. The Executive Committee is composed of four school superintendents and four school board members. The Committee employs an Executive Director of Educational Services as TIES' chief administrative officer. This organizational structure functions very much like the school board/superintendent relationship in any school district.

TIES employs a staff of 52 people, serving in the two divisions of Design-Development and Services. Each district assumes responsibility for in-district communication and data processing related activity. The major interface between the districts and TIES is embodied in a member district position titled Educational Information Systems Coordinator. The EIS Coordinator has been recruited from the ranks of educators in each district and assumes the role of communicator, coordinator, and information systems specialist for the district.

In the 1972-73 school year, TIES serves 29 school districts including one vocational-technical school district, encompassing over 230,000 students in grades K-12 and 35,000 district employees. Member districts are all within a 40 mile radius of the TIES center except for one at a distance of 120 miles, and range in size from 1400 to 31,000 students. Names of member districts appear at the end of this article. There are 36 high schools, 52 junior highs, and over 200 elementary schools in the 29 districts.

HARDWARE SYSTEMS

One major system employs two Burroughs B3500s linked to input and display terminals. It is a multi-processing system with 300 million bytes of permanent disk storage, eight tape drives, 360K of core memory, two high-speed printers and lesser peripherals. The dual B3500s share peripherals and the disk data bank.

Inquiry and update of individual file entries is done in seconds over Burroughs 9352 CRTs located in each district. Mass input such as mark reporting is sent through Bell & Howell mark readers in the district to keytapes at the computer center.

The second major system involves three Hewlett-Packard timesharing systems – 2000C, 2000B, 2000F. 84 ports are in service, with expansion to 96 ports imminent. Approximately 150 terminals are in the member districts, of which the majority are ASR-33 teletypewriters and including a number of PortaCom and Digilog terminals. Sixty of the terminals are in high schools, 43 in junior highs, with the remainder in elementary schools, district offices, or shared between schools. Nearly all such terminals have been acquired by purchase since most districts expect to be involved in computer usage permanently. Maintenance is mainly by contract with local firms at a cost of $175 to $195 per terminal per year. In conjunction with the terminals, 16 HP mark-sense card readers and two HP plotters are in use. One district has a teletype card reader system for each of its two senior highs and five junior highs.

SERVICES

Continuous in-service education and coordination activities are central to extensive, in-depth utilization and provision of services from the information and timeshare systems. Conferences, workshops and a variety of other training sessions backed by written documentation and user manuals support all systems and services. The services and coordination staff at TIES provide these in all areas ranging from cost accounting and class scheduling to field research, problem solving and achievement monitoring.

The TIES integrated data base information system is the data source from which all reports are produced whether they be a payroll every two weeks, report cards every quarter, the State Attendance Report annually or special census reports produced upon request to assist in enrollment projections. Routine reports and special reports can be produced with equal ease because of the design of the data base, which has the ability to expand both in content and types of reports which can be extracted from it. The system can generate new "products," as educators identify them, without extensive additional design or reprogramming.

INSTRUCTIONAL SERVICES

Related directly to instructional objectives, the TIES staff responsible for instruction are: Donald C. Holznagel and Norman E. Thompson, Project Managers; Linda J. Borry and James A. Sydow, Services Coordinators in Instruction; and Wilfred N. Nathe, Programmer-Analyst. These people coordinate the design, development and implementation of the following projects currently implemented or being developed.

TIES WORKSHOPS

During August of 1971, the instructional staff conducted 7 workshops covering STOP, BASIC, SIMULATIONS, COBOL and Junior and Senior High Applications. 87 teachers participated.

248 teachers attended one of five series of workshops given during the 1971-72 school year. The sites for these workshops were selected in such a way as to enable all TIES teachers to attend workshops in their vicinity. Each series was six weeks long and covered STOP, BASIC, and Elementary and Junior High Applications.

During the summer months of 1972, 107 teachers participated in at least one of the 11 workshops presented. These covered STOP, BASIC, COBOL, SIMULATIONS, Computer Science, and applications for various grade levels.

The 1972-73 in-service workshops conducted by the TIES staff include ADVANCED BASIC, COMPUTER SCIENCE, INFORMATION PROCESSING AND SOCIETY, COBOL, FORTRAN, ELEMENTARY SCHOOL APPLICATIONS as well as one day training sessions held for terminal supervisors, guidance counselors, administrators, and others on the various instructional services.

These are rough estimates of the number of students using the system.

High School	10,800
Junior High	10,000
Elementary	2,400
Guidance	1,200
Non-TIES schools	2,500

About 2/3 of high school and junior high use is general problem solving. Elementary use is split between drill and practice and introduction to computers.

TERMINAL SUPERVISION

To facilitate communication and implementation, personnel are needed who are close to teachers and classroom activities, who can disseminate information, assist with in-service activities, and schedule and control terminal usage. Every TIES school having a terminal has identified a teacher as Terminal Supervisor to carry out those functions. Monthly sessions are held for them with TIES instructional project managers to discuss problems, present ideas, and maintain human contact between TIES staff and teachers in the classroom. The degree and success of instructional computer usage in a school depends in large part on the Terminal Supervisor.

Since the member districts pay for the entire TIES operation on a per student basis (currently $6.25/student/year), their share of timesharing time and storage are allocated on the same basis. System ports and school day hours are finite and so usage must be controlled. Currently, districts are allotted 45 hours of on-line time per 1000 students per month, and 57K words of storage per 1000 students. The EIS coordinator and Terminal Supervisors determine the distribution of these resources within the district according to their priorities and needs. The time allotment covers only the hours between 8 AM and 4 PM daily which are the hours of heaviest demand. Usage outside those hours is unlimited.

TOTAL INFORMATION FOR

DRILL AND PRACTICE

During the 1971-72 school year, 19 districts experimented with the Hewlett-Packard Arithmetic Drill and Practice Package. This package is a series of programs designed to drill students on computational skills. At the end of the four week experimental period, each district was asked to complete an evaluation form. As the response was generally quite favorable, it was decided that closely controlled research should be done during the 1972-73 school year to obtain data on the effectiveness of the program.

As part of a short term study, 780 students used the Drill and Practice Program for six weeks during summer school in 1972.

The research project is taking place during the 1972-73 school year and involves an experimental group of third and fourth grade students from 7 districts, representing a cross-section of ability levels. Some students use the program on a daily basis, with others using the terminal only every other day. Non-experimental students in each participating school serve as a control group.

CAM (Comprehensive Achievement Monitoring)

The experimental work initiated by Hopkins District 274 under an E.S.E.A. Title III grant has proceeded with TIES taking over the processing and creation of computer reports for CAM. In September of 1971, TIES ran parallel with the University of Minnesota Computer Systems for a few courses on the CAM Project and then assumed more courses throughout the year. By June 1972, 62 courses were being processed at TIES. These involved 8 TIES districts as well as a few non-TIES districts working on the project with over 7,000 students enrolled in the courses. Currently, about 12,000 students in 100 courses are being served. Future plans include running reports for all courses at TIES and having TIES assume an increased role in controlling and distributing the input and output of data.

The Evaluation Center at Hopkins is promoting the following activities in implementing this program:

- **Collecting performance objectives for each course on the program together with test items to measure the attainment of each objective.**
- **Operating computer programs, using existing computer facilities, to process the data so that results may be returned to teachers and students within a day or two.**
- **Assisting teachers in the writing and choosing of behavioral objectives and test items and in the use of evaluation results.**
- **Developing training materials to explain the program, its capabilities and the procedures to actually use it in the classroom.**
- **Cooperating with selected schools outside the Hopkins district so that the program may be more widely demonstrable.**

BATCH SYSTEM

To improve the instructional applications using the Burroughs B3500, there has been an effort to develop a systematic method of handling BATCH compilations of COBOL and FORTRAN programs. During the school year 1971-72, use of COBOL by districts in instruction increased three-fold. COBOL programs written by students now are transmitted over the scanners and processed daily and returned by a delivery service. From one school in 1969-70, to three schools in 1970-71, the service now is being used by ten high schools with continued growth expected in 1972-73.

In addition, BATCH BASIC has continued to be used for running BASIC programs where the on-line turn around is not necessary. This past year there has been a growing interest in FORTRAN instruction, and therefore, more demand for FORTRAN compilations on TIES computer systems. To meet this demand, Instructional Services has developed BATCH FORTRAN processing on both the Burroughs system and the Hewlett-Packard system. It is anticipated that BATCH FORTRAN will be handled in much the same way as BATCH COBOL in 1973.

BUSINESS EDUCATION AND COBOL

This past year a committee of business education teachers representing six TIES districts have been active in creating some guidelines for business education curriculum using the TIES computer facilities. The discussions and workshop activities held have led to some excellent suggestions relative to the data processing and the business education curriculum.

The start at getting a library of programs for business education using the Burroughs computer system proceeded during the summer of 1972. Anticipated in the library are programs which will apply to BOOKKEEPING, MARKETING, ACCOUNTING, OFFICE MACHINES as well as DATA PROCESSING courses offered in the business education curriculum. The increased interest in offering COBOL instruction mentioned above in the BATCH SYSTEM developments has also created the interest in these further curriculum developments.

SIMULATION

Simulation programs and packets of related instructional and resource materials produced by the NSF sponsored Huntington Two Project were being tested and evaluated by students and teachers in 8 TIES schools during the 1971-72 school year. The programs were related to Physics, Biology and Social Studies. Critical comments and suggestions were relayed to the Huntington Project for use in improving the materials. Ten packets have been tested since January 1971, and all ten are available inexpensively through Digital Equipment Corporation. Huntington Two has received an extension of NSF support and will continue to produce packets through 1972-73, with TIES schools continuing to evaluate the first drafts.

A proposal developed by TIES for the purpose of training social studies teachers in computer applications for the social studies classroom has been approved by the Minnesota Council on Quality Education. The project takes advantage of the computer resource at TIES, the social studies expertise of the Social Studies Service Center of the Twin City Area, and the programs and materials developed by the Huntington Two Project. A series of inservice workshops are being conducted during the 1972-73 school year, and assistance to teachers in classroom implementation of simulation programs are being provided. Programs and materials will be revised and improved, and new ideas for useful programs will be collected for development.

COMPUTER SCIENCE

There has been effort this past year to acquaint TIES schools with the introductory study in computer science. Computer science has a variety of definitions so it is necessary to give the TIES Instructional Projects Staff's opinion. We feel computer science should introduce students to the hierarchy of computer languages including machine language, assembly language, and compiler languages. The major emphasis should be on problem solving but in addition, many non-numerical type situations are included in the study of the computer as we see it. As more expertise is developed using the timeshar computing system, there has been an increased demand for additional study about computers. This extension of computer study will be enhanced with the improvements in the hardware available in the timesharing mode over the next two or three years.

TIES INSTRUCTIONAL VIDEO-TAPE

In February 1972, the Hewlett-Packard Company and TIES Instructional Projects Staff planned and recorded a video-tape program covering the various instructional activities in TIES member districts related to the Hewlett-Packard timesharing systems in use at TIES. Many classrooms were visited during the week of taping, and TIES staff comments were recorded. The footage was edited to about twenty minutes in the final version. The tape will be circulated nationwide by Hewlett-Packard as an example of successful classroom use of timesharing computers. Copies are available at the TIES office for local use in presentations to groups of teachers, administrators, and parents.

LOGO LANGUAGE

In cooperation with Bolt, Beranek and Newman, TIES has been experimenting with a version of LOGO since the summer of 1971. Bolt, Beranek and Newman, and MIT have been developing and testing LOGO for several years as a tool for teaching elementary students a set of concepts related to programming to provide a natural foundation for the teaching of mathematics and the art of logical and rigorous thinking. It has been found useful with students at the college level as well. In the present year, 1972-73, the finishing touches are being put in the language program. As materials become available and teachers become interested, limited classroom experimentation will begin.

GUIDANCE INFORMATION SYSTEM

In cooperation with Time Share Corporation, TIES is supporting the Guidance Information System developed by Interactive Learning Systems. The system provides remote access to college data, vocational and specialty school data, occupational data and scholarship and financial aid data through the Hewlett-Packard timeshare computer system. In addition to the TIES network schools, Minneapolis and St. Paul schools are participating in the use of G.I.S. for their guidance and career information purposes.

More information about TIES may be obtained by writing Norm Thompson or Don Holznagel at TIES, 1925 West County Road B2, Roseville, Mn. 55113.

TIES MEMBER DISTRICTS 1972-73

Anoka	Bloomington
Burnsville	Chaska
Columbia Heights	Edina
Fridley	Golden Valley
Hennepin Voc-Tech	Hopkins
Inver Grove	Lakeville
Minnetonka	Mound
New Prague	Orono
Osseo	Richfield
Rosemount	Roseville
Shakopee	St. Louis Park
Stillwater	Spring Lake Park
Waconia	Wayzata
W. St. Paul	White Bear Lake
Willmar	

TIES EDUCATIONAL SYSTEMS

```
QUBIC5

YOUR FIRST NAME?PCC
THIS IS THE GAME OF QUBIC, PCC.
DO YOU WANT INSTRUCTIONS?Y
THE GAME IS TIC-TAC-TOE IN A 4 X 4 X 4 CUBE.
EACH MOVE IS INDICATED BY A THREE DIGIT NUMBER, WITH EACH
DIGIT BETWEEN 1 AND 4 INCLUSIVE.  THE DIGITS INDICATE THE
LEVEL, ROW, AND COLUMN, RESPECTIVELY, OF THE OCCUPIED PLACE.
YOU WILL HAVE TO PICK A STRATEGY LEVEL, BETWEEN 1 AND 5.
1 IS THE EASIEST, 5 IS THE HARDEST.
WHEN IT IS YOUR MOVE, SHOULD I PRINT OUT THE BOARD?YES
YOUR POSITIONS ARE INDICATED BY X'S AND MINE ARE O'S.
WHAT STRATEGY LEVEL, PCC?3

LEVEL 3
DO YOU WANT TO GO FIRST?YES
YOUR MOVE, PCC?111
I CLAIM 122

X...  ....  ....  ....
.O..  ....  ....  ....
....  ....  ....  ....
....  ....  ....  ....

YOUR MOVE, PCC?444
I CLAIM 123

X...  ....  ....  ....
.OO.  ....  ....  ....
....  ....  ....  ....
....  ....  ....  ...X

YOUR MOVE, PCC?121
I CLAIM 132

X...  ....  ....  ....
XO0.  ....  ....  ....
.O..  ....  ....  ....
....  ....  ....  ...X

YOUR MOVE, PCC?114
I CLAIM 133

X..X  ....  ....  ....
XO0.  ....  ....  ....
.OO.  ....  ....  ....
....  ....  ....  ...X

YOUR MOVE, PCC?  and so on...
```

We got QUBIC5 and ZEROS from Lawrence Hall of Science in Berkeley, Ca. (See PCC, Oct 1972 and Dec 1972 for information on LHS.)

What's a HURKLE?

HURKLE was inspired by MUGWUMP and MUGWUMP was inspired by Project SOLO module no. 0201. Module no. 0201??? Contact Project SOLO Computer Science Department, University of Pittsburg, 15213.

What's a MUGWUMP?

```
MUGWMP

A MUGWUMP IS HIDING IN A 10 BY 10 GRID. TRY TO
FIND HIM BY GUESSING HIS GRIDPOINT. HOMEBASE IS
GRIDPOINT 0,0 AND A GUESS IS A PAIR OF WHOLE
NUMBERS (0 TO 9) SEPARATED BY A COMMA. THE FIRST
NUMBER IS THE DISTANCE TO THE RIGHT OF HOMEBASE
AND THE SECOND NUMBER IS THE DISTANCE ABOVE THE
HOMEBASE. YOU GET 4  TRIES. AFTER EACH TRY, I
WILL TELL YOU HOW FAR (IN A DIRECT LINE) YOU ARE
FROM THE MUGWUMP.

GUESS # 1  ?5,5
YOU ARE 4.1  UNITS FROM THE MUGWUMP.

GUESS # 2  ?9,5
YOU ARE 8  UNITS FROM THE MUGWUMP.

GUESS # 3  ?1,5
YOU ARE 1  UNITS FROM THE MUGWUMP.

GUESS # 4  ?1,6
YOU ARE 2  UNITS FROM THE MUGWUMP.

SORRY, THAT'S 4  TRIES.
MUGWUMP IS AT GRIDPOINT 1  , 4

LET'S PLAY AGAIN.

GUESS # 1  ?5,5
YOU ARE 6.4  UNITS FROM THE MUGWUMP.

GUESS # 2  ?0,1
YOU ARE 8  UNITS FROM THE MUGWUMP.

GUESS # 3  ?0,9
YOU FOUND HIM IN 3  GUESSES!!!

LET'S PLAY AGAIN.

GUESS # 1  ?
DONE
```

```
A HURKLE IS HIDING ON A 10  BY 10  GRID. HOMEBASE
ON THE GRID IS POINT 0,0 AND ANY GRIDPOINT IS A
PAIR OF WHOLE NUMBERS SEPARATED BY A COMMA. THE
FIRST NUMBER TELLS HOW FAR TO THE RIGHT OF HOMEBASE
AND THE SECOND NUMBER TELLS HOW FAR ABOVE HOMEBASE
YOU THINK THE HURKLE IS HIDING. FOR EXAMPLE, IF YOU
THINK THE HURKLE IS 7 TO THE RIGHT AND 5 ABOVE
HOMEBASE YOU ENTER 7,5  AS YOUR GUESS.

O.K. START GUESSING. YOU GET 5  GUESSES.
AFTER EACH TRY, I WILL TELL YOU THE APPROXIMATE
DIRECTION TO GO TO LOOK FOR THE HURKLE.

GUESS # 1  ?5,5
GO SOUTHWEST

GUESS # 2  ?3,3
GO SOUTHWEST

GUESS # 3  ?1,1
GO SOUTHEAST

GUESS # 4  ?2,0
YOU FOUND HIM IN 4  GUESSES!!!

LET'S PLAY AGAIN. HURKLE IS HIDING.

GUESS # 1  ?5,5
GO NORTH

GUESS # 2  ?5,8
YOU FOUND HIM IN 2  GUESSES!!!

LET'S PLAY AGAIN. HURKLE IS HIDING.

GUESS # 1  ?5,5
GO WEST

GUESS # 2  ?3,5
GO WEST

GUESS # 3  ?1,5
GO EAST

GUESS # 4  ?2,5
YOU FOUND HIM IN 4  GUESSES!!!
```

If you are looking for some programs to write, try your hand at one of these games. We'll publish our programs in the next couple of issues.

HURKLE

TWO RUNS DON'T MAKE A WRITE.

make the trap
smaller
&
smaller
&
smaller

GOTCHYA!

TRAP was suggested by an 11 year old, then he and I wrote the program together.

```
TRAP

DO YOU WANT INSTRUCTIONS?YES

I WILL THINK OF A WHOLE NUMBER FROM 1 TO 100
TRY TO GUESS MY NUMBER. ENTER TWO NUMBERS, TRYING
TO TRAP MY NUMBER BETWEEN YOUR TWO NUMBERS. I WILL
TELL YOU IF YOU HAVE TRAPPED MY NUMBER OR IF MY
NUMBER IS SMALLER THAN YOUR TWO TRAP NUMBERS OR
IF MY NUMBER IS LARGER THAN YOUR TWO TRAP NUMBERS.
IF YOU THINK YOU KNOW WHAT MY NUMBER IS, ENTER
YOUR GUESS FOR BOTH TRAP NUMBERS.

YOU GET 7  GUESSES. GOOD LUCK!


GUESS NUMBER 1
FIRST TRAP NUMBER?40
SECOND TRAP NUMBER?70
MY NUMBER IS TRAPPED BY YOUR NUMBERS.

GUESS NUMBER 2
FIRST TRAP NUMBER?50
SECOND TRAP NUMBER?60
MY NUMBER IS TRAPPED BY YOUR NUMBERS.

GUESS NUMBER 3
FIRST TRAP NUMBER?57
SECOND TRAP NUMBER?53
MY NUMBER IS TRAPPED BY YOUR NUMBERS.

GUESS NUMBER 4
FIRST TRAP NUMBER?54
SECOND TRAP NUMBER?55
MY NUMBER IS LARGER THAN YOUR TRAP NUMBERS.

GUESS NUMBER 5
FIRST TRAP NUMBER?56
SECOND TRAP NUMBER?56
YOU GOT IT...LETS PLAY AGAIN, LUCKY.


GUESS NUMBER 1
FIRST TRAP NUMBER?
```

```
ZEROS

RULES?YES

WE START WITH A BOARD LIKE THIS:

      1 2 3 4 5 6 7
    0 0 0 0 0 0 0 0

YOU AND I TAKE TURNS.  WE CHOOSE ONE OF THE NUMBERS AND I
DRAW A BRIDGE BETWEEN THE TWO  0'S  BELOW THAT NUMBER.
ONCE AN  0  HAS BEEN USED FOR A BRIDGE, IT CAN'T BE USED AGAIN.

FOR INSTANCE, IF YOU CHOOSE THE NUMBER 3,

      1 2 3 4 5 6 7
?3    0 0 0--0 0 0 0 0

THEN I CAN'T CHOOSE NUMBERS 2 OR 4.

THE WINNER IS THE LAST PERSON WHO CAN DRAW A BRIDGE.

      1 2 3 4 5 6 7
?2    0 0--0 0 0**0 0 0
?7    0 0--0 0 0**0 0--0

YOU WIN

AGAIN?YES

      1 2 3 4 5 6 7 8
?2    0 0--0 0 0 0**0 0 0
?4    0 0--0 0--0 0**0 0**0

I WIN

AGAIN?NO
```

GOT THE MUNCHIES? HAVE A BYTE...

C·H·O·M·P

But watch out for that last one!!

The game of CHOMP was introduced in Martin Gardner's Mathematical Games Department of *Scientific American* for January, 1973. It was invented by David Gale at UC Berkeley.

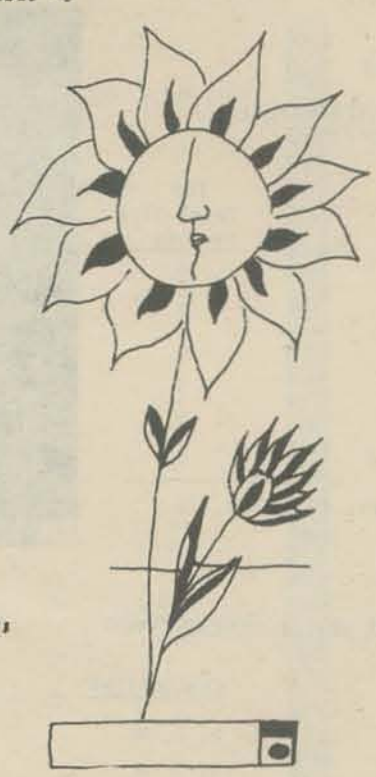
This version is our first pass. We changed the rules somewhat from the published version. Not only that, but this version doesn't play the game at all – it just keeps track of the moves and informs the loser (who already knows he lost, anyway).

We'd like very much for you to send us any BASIC implementations of CHOMP, any comments, etc. We'll probably have a smarter version up and running pretty soon. *Scientific American* has described some winning strategies for boards of given sizes. In our version the players INPUT the dimensions – makes it harder to figure out the trivial wins.

The rest of the way our program works should be clear from the directions. We're still finding out how kids solve the puzzle of deciphering printed rules to games (this is a game in itself sometimes). The program runs on HP 2000 series, and on 8K PDP8/L with Edu 20.55.

```
100  REM *** THE GAME OF CHOMP *** COPYRIGHT PCC 1973 ***
110  PRINT
120  PRINT "THIS IS THE GAME OF CHOMP (SCIENTIFIC AMERICAN, JAN 1973)"
130  PRINT "WANT THE RULES (1=YES, 0=NO!)";
140  INPUT R
150  IF R=0 THEN 340
160  F=1
170  R=5
180  C=7
190  PRINT "CHOMP IS FOR 1 OR MORE PLAYERS (HUMANS ONLY)."
200  PRINT
210  PRINT "HERE'S HOW A BOARD LOOKS (THIS ONE IS 5 BY 7):"
220  GOSUB 540
230  PRINT
240  PRINT "THE BOARD IS A BIG COOKIE - R ROWS HIGH AND C COLUMNS"
250  PRINT "WIDE. YOU INPUT R AND C AT THE START. IN THE UPPER LEFT"
260  PRINT "CORNER OF THE COOKIE IS A POISON SQUARE (P). THE ONE WHO"
270  PRINT "CHOMPS THE POISON SQUARE LOSES. TO TAKE A CHOMP, TYPE THE"
280  PRINT "ROW AND COLUMN OF ONE OF THE SQUARES ON THE COOKIE."
290  PRINT "ALL OF THE SQUARES BELOW AND TO THE RIGHT OF THAT SQUARE"
300  PRINT "(INCLUDING THAT SQUARE, TOO) DISAPPEAR -- CHOMP!!"
310  PRINT "NO FAIR CHOMPING SQUARES THAT HAVE ALREADY BEEN CHOMPED,"
320  PRINT "OR THAT ARE OUTSIDE THE ORIGINAL DIMENSIONS OF THE COOKIE."

330  PRINT
340  PRINT "HERE WE GO..."
350  DIM A(10,10)
360  F=0
370  FOR I=1 TO 10
372  FOR J=1 TO 10
375  LET A(I,J)=0
377  NEXT J
379  NEXT I
380  PRINT
390  PRINT "HOW MANY PLAYERS";
400  INPUT P
410  I1=0
420  PRINT "HOW MANY ROWS";
430  INPUT R
440  IF R <= 9 THEN 470
450  PRINT "TOO MANY ROWS (9 IS MAXIMUM). NOW, ";
460  GOTO 420
470  PRINT "HOW MANY COLUMNS";
480  INPUT C
490  IF C <= 9 THEN 530
500  PRINT "TOO MANY COLUMNS (9 IS MAXIMUM). NOW, ";
510  GOTO 470
530  PRINT
540  FOR I=1 TO R
550  FOR J=1 TO C
560  A(I,J)=1
570  NEXT J
580  NEXT I
590  A(1,1)=-1
600  REM PRINT THE BOARD
610  PRINT
620  PRINT TAB(7);"1 2 3 4 5 6 7 8 9"
630  FOR I=1 TO R
640  PRINT I;TAB(7);
650  FOR J=1 TO C
660  IF A(I,J)=-1 THEN 700
670  IF A(I,J)=0 THEN 720
680  PRINT "* ";
690  GOTO 710
700  PRINT "P ";
710  NEXT J
720  PRINT
730  NEXT I
740  PRINT
750  IF F=0 THEN 770
760  RETURN
770  REM GET CHOMPS FOR EACH PLAYER IN TURN
780  LET I1=I1+1
790  LET P1=I1-INT(I1/P)*P
800  IF P1 <> 0 THEN 820
810  P1=P
820  PRINT "PLAYER ";P1
830  PRINT "COORDINATES OF CHOMP (ROW,COLUMN)";
840  INPUT R1,C1
850  IF R1<1 THEN 920
860  IF R1>R THEN 920
870  IF C1<1 THEN 920
880  IF C1>C THEN 920
890  IF A(R1,C1)=0 THEN 920
900  IF A(R1,C1)=-1 THEN 1010
910  GOTO 940
920  PRINT "NO FAIR. YOU'RE TRYING TO CHOMP ON EMPTY SPACE!"
930  GOTO 820
940  FOR I=R1 TO R
950  FOR J=C1 TO C
960  A(I,J)=0
970  NEXT J
980  NEXT I
990  GOTO 610
1000  REM END OF GAME DETECTED IN LINE 900
1010  PRINT "YOU LOSE, PLAYER ";P1
1020  PRINT
1030  PRINT "AGAIN (1=YES; 0=NO!)";
1040  INPUT R
1050  IF R=1 THEN 340
1060  END
```



```
RUN
CHOMP

THIS IS THE GAME OF CHOMP (SCIENTIFIC AMERICAN, JAN 1973)
WANT THE RULES (1=YES, 0=NO!)? 1
CHOMP IS FOR 1 OR MORE PLAYERS (HUMANS ONLY).

HERE'S HOW A BOARD LOOKS (THIS ONE IS 5 BY 7):

     1 2 3 4 5 6 7
1    P * * * * * *
2    * * * * * * *
3    * * * * * * *
4    * * * * * * *
5    * * * * * * *

THE BOARD IS A BIG COOKIE - R ROWS HIGH AND C COLUMNS
WIDE. YOU INPUT R AND C AT THE START. IN THE UPPER LEFT
CORNER OF THE COOKIE IS A POISON SQUARE (P). THE ONE WHO
CHOMPS THE POISON SQUARE LOSES. TO TAKE A CHOMP, TYPE THE
ROW AND COLUMN OF ONE OF THE SQUARES ON THE COOKIE.
ALL OF THE SQUARES BELOW AND TO THE RIGHT OF THAT SQUARE
(INCLUDING THAT SQUARE, TOO) DISAPPEAR -- CHOMP!!
NO FAIR CHOMPING SQUARES THAT HAVE ALREADY BEEN CHOMPED,
OR THAT ARE OUTSIDE THE ORIGINAL DIMENSIONS OF THE COOKIE.

HERE WE GO...

HOW MANY PLAYERS? 2
HOW MANY ROWS? 4
HOW MANY COLUMNS? 8

     1 2 3 4 5 6 7 8 9
1    P * * * * * * * *
2    * * * * * * * * *
3    * * * * * * * * *
4    * * * * * * * * *

PLAYER  1
COORDINATES OF CHOMP (ROW,COLUMN)? 3,6

     1 2 3 4 5 6 7 8 9
1    P * * * * * * * *
2    * * * * * * * * *
3    * * * * *
4    * * * * *

PLAYER  2
COORDINATES OF CHOMP (ROW,COLUMN)? 2,7

     1 2 3 4 5 6 7 8 9
1    P * * * * * * * *
2    * * * * * *
3    * * * * *
4    * * * * *

PLAYER  1
COORDINATES OF CHOMP (ROW,COLUMN)? 4,1

     1 2 3 4 5 6 7 8 9
1    P * * * * * * * *
2    * * * * * *
3    * * * * *
4

PLAYER  2
COORDINATES OF CHOMP (ROW,COLUMN)? 3,2

     1 2 3 4 5 6 7 8 9
1    P * * * * * * * *
2    * * * * * *
3    *
4

PLAYER  1
COORDINATES OF CHOMP (ROW,COLUMN)? 2,3

     1 2 3 4 5 6 7 8 9
1    P * * * * * * * *
2    * *
3    *
4

PLAYER  2
COORDINATES OF CHOMP (ROW,COLUMN)? 1,4

     1 2 3 4 5 6 7 8 9
1    P * *
2    * *
3    *
4

PLAYER  1
COORDINATES OF CHOMP (ROW,COLUMN)? 2,2

     1 2 3 4 5 6 7 8 9
1    P * *
2    *
3    *
4

PLAYER  2
COORDINATES OF CHOMP (ROW,COLUMN)? 3,1

     1 2 3 4 5 6 7 8 9
1    P * *
2    *
3
4

PLAYER  1
COORDINATES OF CHOMP (ROW,COLUMN)? 1,3

     1 2 3 4 5 6 7 8 9
1    P *
2    *
3
4

PLAYER  2
COORDINATES OF CHOMP (ROW,COLUMN)? 2,2
NO FAIR. YOU'RE TRYING TO CHOMP ON EMPTY SPACE!
PLAYER  2
COORDINATES OF CHOMP (ROW,COLUMN)? 2,1

     1 2 3 4 5 6 7 8 9
1    P *
2
3
4

PLAYER  1
COORDINATES OF CHOMP (ROW,COLUMN)? 1,2

     1 2 3 4 5 6 7 8 9
1    P
2
3
4

PLAYER  2
COORDINATES OF CHOMP (ROW,COLUMN)? -10,-10
NO FAIR. YOU'RE TRYING TO CHOMP ON EMPTY SPACE!
PLAYER  2
COORDINATES OF CHOMP (ROW,COLUMN)? 1,1
YOU LOSE, PLAYER  2

AGAIN (1=YES; 0=NO!)? 0

DONE
```

ZINGO! A NEW COMPUTER GAME

"Dice in quantity, instead of just singles or pairs, provide an exciting 'learn-as-you-play' introduction to probability and statistics. They are much more interesting and much easier to toss, than pennies in quantity."

Edmund C. Berkeley
Editor, Computers and Automation

From time to time computer people hunt for games that are fun to investigate, fun to play with another person, and fun to play with a computer.

Such a game is Zingo. The rules for playing it are as follows:

Rules of Zingo

1. Number of Players. There are two or more players, each using 21 dice (or some other chosen number of dice).
2. Choices. The players agree on a NUMBER to be PRODUCED from a throw of the dice and the allowable arithmetical OPERATIONS to produce it.

For example, in Advanced Zingo, the number to be produced might be 35, and the allowable operations might be addition, subtraction, multiplication, division, raising to a power, and factorial. In Elementary Zingo, the number to be produced might be 2, and the allowable operations might be addition and subtraction.

3. Throw. Each player then rolls his 21 dice, and obtains a THROW.
4. Production. Each player then arranges his dice in allowed arithmetical COMBINATIONS to PRODUCE the agreed NUMBER.

Thus in Advanced Zingo, suppose the NUMBER to be produced is 35. If a player's THROW of 21 dice included a two, a three, and a five, he could use those 3 dice to PRODUCE 35 because of the COMBINATION 2 to the 5th power plus 3 equals 35.

In Elementary Zingo, suppose the NUMBER to be produced is 2. Then the player could use the two by itself to PRODUCE one 2, and the three and the five to PRODUCE a second 2 because of the COMBINATION 5 minus 3 equals 2.

5. Scoring. If a player uses up all the outcomes shown by his dice in his throw, by making combinations that produce the agreed number, he scores 2 points, for "going out". If the number of his combinations exceeds the number of combinations of the other player (or all the other players), then he scores 3 additional points.

Thus there is a premium on using all of the dice in one's throw, and a premium on making more combinations than the other player (or players).

Incidentally 35 is a particularly interesting number to produce because it cannot be produced by two dice, but it can be produced by about 10 or 11 or 12 combinations of 3 of the numbers 1 to 6 using addition, subtraction, multiplication, division, raising to a power, factorial, and square root. If a player finds that he cannot produce 7 combinations making 35, each of them using 3 dice, he is compelled to drop back to 6 combinations and is very likely to lose.

An Example

For example, suppose that Player A rolls the following throw:

1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 6 6 6 6 6

In Advanced Zingo, he can use up all the outcomes of his dice in the manner given in Table 1, and he will thus score 2 points. Whether Player A scores 3 additional points depends on Player B, and whether B makes 6 combinations or fewer.

In Elementary Zingo he can use up all the outcomes of his dice to produce 2, in the manner given in Table 2, and he will thus score 2 points. Whether Player A scores 3 additional points depends on Player B and whether Player B makes 9 combinations or fewer.

The Working Out of a Throw

For example, suppose a throw of 21 dice is as follows:

1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 6 6 6 6 6

and the Agreed Number to be produced is 35. The possible combinations of least cost (which is 3) are shown in Table 3.

It is usually easy to "use up" left-over numbers n by means of one or both of the following devices:

(1) Plus zero, which equals plus n minus n;
(2) Times one, which equals n divided by n;

In fact, it may be possible to demonstrate that "going out" is fairly trivial, and can be achieved in a great many common cases.

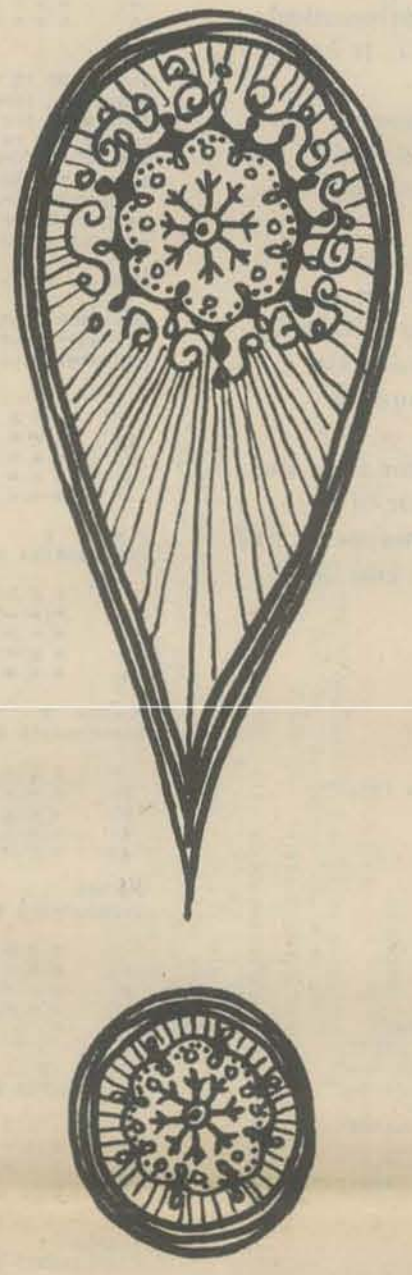


Table 1

USE OF THE THROW TO PRODUCE 35 — ADVANCED ZINGO

(1) Formula	(2) Combination	(3) Amount of Use	(4) Total Dice Used Up
(6X6)-1 = 35	1, 6, 6	3	9
4!+3!+5 = 35	3, 4, 5	2	6
2^5+3 = 35	2, 3, 5	1	3
(2+5)X5 = 35	2, 5, 5	1	3
		Count, 7	Cost, 21

Table 2

USE OF THE THROW TO PRODUCE 2 — ELEMENTARY ZINGO

(1) Formula	(2) Combination	(3) Amount of Use	(4) Total Dice Used Up
2	2	2	2
1+1 = 2	1, 1	1	2
5-3 = 2	3, 5	3	6
6-4 = 2	4, 6	2	4
6+1-5 = 2	1, 5, 6	1	3
(6+6/6)-5 = 2	5, 6, 6, 6	1	4
		Count, 10	Cost, 21

Table 3

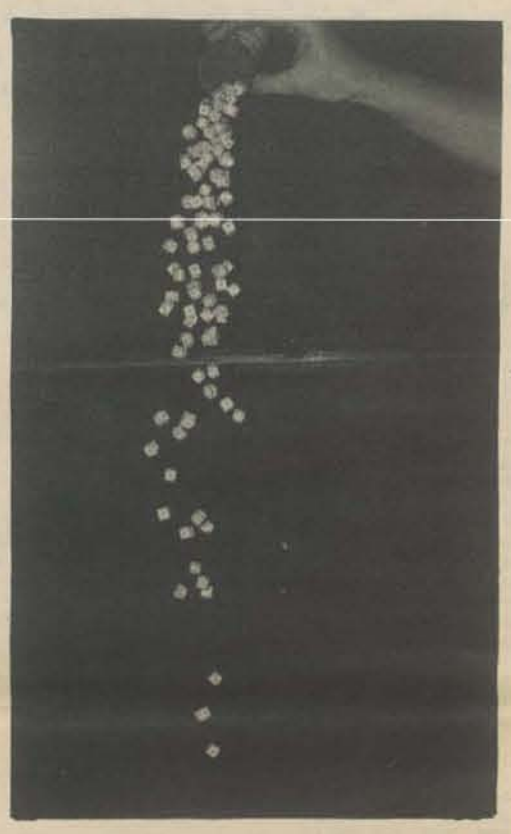
COMBINATIONS THAT PRODUCE 35 — ADVANCED ZINGO

Ident. No.	Formula	Combination
1	6^2-1	1, 2, 6
2	(6+1)X5	1, 5, 6
3	(6X6)-1	1, 6, 6
4	2^5+3	2, 3, 5
5	(5+2)X5	2, 5, 5
6	(3+4)X5 or 4!+3!+5	3, 4, 5
7	5!/3-5	3, 5, 5
8	5!/4+5	4, 5, 5
9	4!+5+6	4, 5, 6
10	(6X5)+5	5, 5, 6

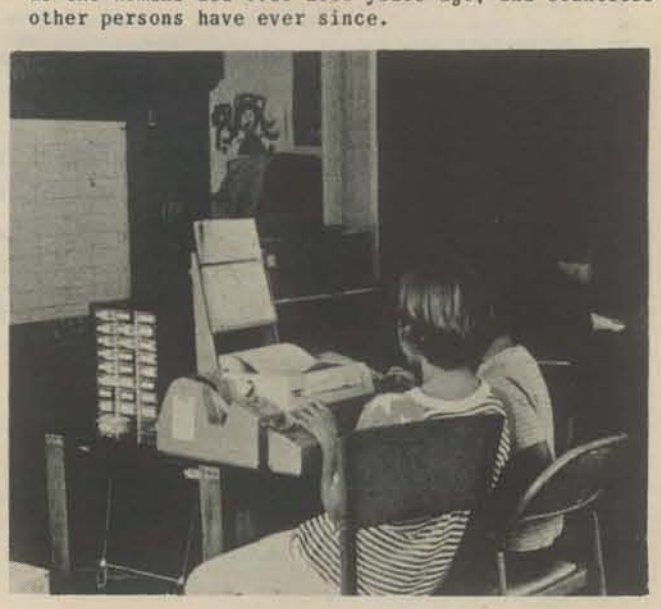
Supply of Dozens of Dice

It is usually difficult to buy or obtain a supply of dozens of dice at a reasonable price. Yet dice in quantity — instead of just singles or pairs — provide an exciting "learn-as-you-play" introduction to probability and statistics. They are much more interesting — and much easier to toss — than pennies in quantity. I remember the first time I tossed about 60 dice together on to a table, and began to note the proportions of the outcomes 1, 2, 3, 4, 5, 6. Of course, the proportion tended to be 1/6 (or ten dice) for each outcome. Right in front of me was visible evidence of the working of probability laws.

If any reader is interested in obtaining dozens of dice for use in Zingo (and similar games and statistical experiments), please see our offer at the end of this article.



A computer, of course, is a source that is even better than a large supply of dice for obtaining random or pseudo-random numbers in quantity. Also, the computer can be programmed to count, average, determine the standard deviation, etc., for each category of observations that one thinks of. The computer eliminates much tedious clerical work with statistical observations. But even so, there is still an undeniable satisfaction in actually taking many small dice in one's hands, and tossing them — as the Romans did over 2000 years ago, and countless other persons have ever since.



- - - - - (may be copied on any piece of paper) - - - - -

To: Computers and Automation
815 Washington St., Newtonville, MA 02160

( ) Yes, please send me_____package(s) of 100 small dice (about 3/8-inch on an edge) for playing Zingo, and making other statistical investigations.

For each package, I enclose $4.70 plus 30 cent for handling (a total of $5.00 per package).

Total enclosed $_____ (Prepayment is necessary.)

Name_____

Address_____

_____ Zip_____

THE PROGRAMMER'S TOOLBOX

by marc le brun

[Each issue we will present an "advanced" programming technique: with explanations, examples, programs and problems. We welcome suggestions for topics of interest to you.]

STACKS

The stack is a very widely used programming tool. A stack consists of a set of data items which are kept in some particular sequence. To help visualize this, think of a deck of playing cards, each card is "stacked" on top of the cards below it. Unlike arrays, the number of items in a stack may vary during a RUN of a program, much as the number of cards in a pile may vary during the course of a card game.

There are two simple operations which are associated with stacks; they are called "push" and "pop." Pushing an item onto a stack is equivalent to placing a card on top of a pile. Popping an item off the stack is the same as drawing a card from the top of a pile.

To implement a stack on a computer it is necessary to have the following things: a place to keep the items in the stack (in the program below we use the array S), a variable in which to keep the number being pushed or popped (N below), a count of the number of items in the stack (T), and finally, the maximum number of items the stack has room for (T1).

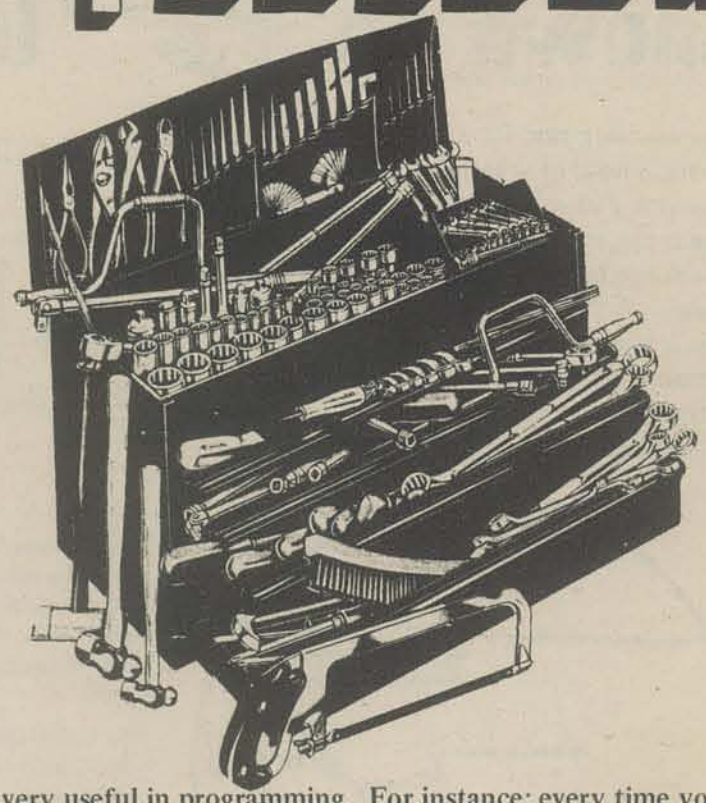
We must also have two subroutines; one for pushing and one for popping. The last element pushed onto the stack at any given moment is called the "top" of the stack. In the program below the top of the stack is S(T).

```
  10 REM *** DEFINITION OF A STACK ***
  20 DIM S(10)
  30 LET T1=10
  40 LET T=0
1000 REM *** PUSH ***
1010 IF T<T1 THEN 1040
1020 PRINT "STACK IS FULL."
1030 STOP
1040 LET T=T+1
1050 LET S(T)=N
1060 RETURN
1500 REM *** POP ***
1510 IF T>0 THEN 1540
1520 PRINT "STACK IS EMPTY."
1530 STOP
1540 LET N=S(T)
1550 LET T=T-1
1560 RETURN
2000 END
```

Type the program into your computer. Then add the following lines and RUN the program to get a feel for how a stack works.

```
100 PRINT "TYPE 0 TO PUSH, 1 TO POP:";
110 INPUT X
120 IF X=1 THEN 170
130 PRINT "WHAT NUMBER";
140 INPUT N
150 GOSUB 1000
160 GO TO 180
170 GOSUB 1500
180 FOR I=1 TO T
190 PRINT S(I);
200 NEXT I
210 PRINT
220 GO TO 100
```

```
RUN
TYPE 0 TO PUSH, 1 TO POP:? 0
WHAT NUMBER? 1
 1
TYPE 0 TO PUSH, 1 TO POP:? 0
WHAT NUMBER? 2
 1  2
TYPE 0 TO PUSH, 1 TO POP:? 0
WHAT NUMBER? 3
 1  2  3
TYPE 0 TO PUSH, 1 TO POP:? 1
 1  2
TYPE 0 TO PUSH, 1 TO POP:? 0
WHAT NUMBER? 4
 1  2  4
```

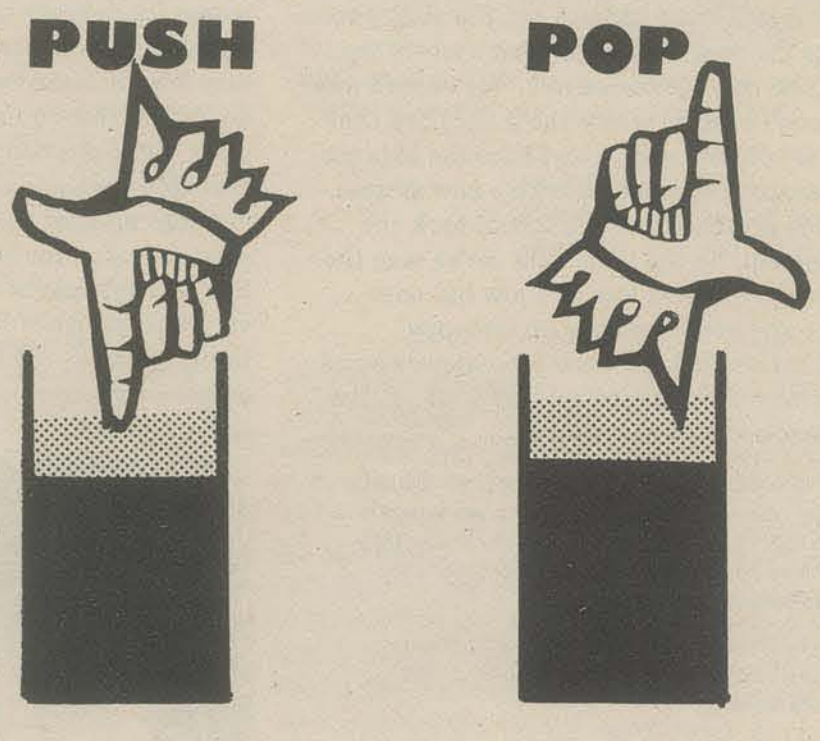


Stacks are very useful in programming. For instance; every time your program does a GOSUB, BASIC pushes the line number to RETURN to onto a stack. That is why you can execute several GOSUB's in a row and always be sure of RETURNing to the right place in your program. Here are some questions concerning the GOSUB stack your BASIC uses:

(1) What does the computer do when you ask it to pop an item off the GOSUB stack when it is empty? (This happens when you do a RETURN without doing a GOSUB first.)
(2) What does the computer do when you ask it to push an item onto the GOSUB stack and the stack is full? (This happens when you do a whole lot of GOSUB's without doing a RETURN.)

Stacks are also used for many other things; they are used to untangle complicated arithmetic expressions, translate your program into a form the computer can more easily understand, perform calculations and keep track of complicated processes. Here are some things to try:

(1) Write a program that INPUTs six numbers and then types them out again in reverse order.
(2) Write a program that randomly pushes and pops random numbers, printing out the stack at each step.
(3) Write a program that finds out how big the GOSUB stack is.
(4) Write a set of subroutines which pop the first two numbers off the stack; add, subtract, multiply or divide the first by the second and then push the answer onto the stack. Use the routines in a program which simulates a desk calculator.
(5) Write a program which computes X! recursively.



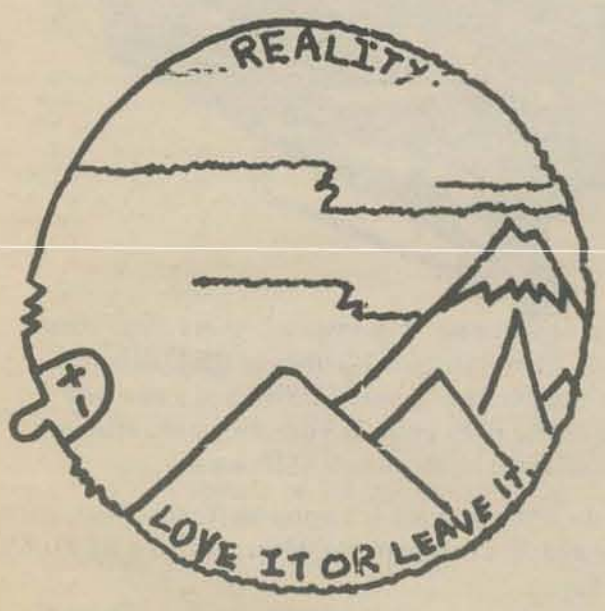
For more information about stacks –

The Art of Computer Programming
Vol. 1 Chapter 2
by Donald Knuth
Addison Wesley Publishing Co., 1968

Writing Bid Specs: Part I

The True Scam On That Delicate Process Known As "GOING TO BID"

If you are shopping for a mini computer system for your school or whatever, you can choose from some 150 mini manufacturers. Nearly ALL of them can provide you with *hardware*. SOME of them can provide you with BASIC language *software*. A FEW can provide *maintenance* within a reasonable period of time and with reasonable efficiency. About TWO can give you the kind of *support* that we think is essential for school installations.



Depending on WHO you are, WHAT experience you have, the RESOURCES you have available and how much pure, raw COURAGE you possess, you may look to any of these mini manufacturers or you may limit yourself to the two who will "hold your hand" while you breakin your system. If all you need is hardware (you feel you can get software and maintenance from other sources) than you can write wide open bid specs and buy from the cheapest source. For the rest of us the job is not so easy. We have to look at everything that is available to meet our needs (keeping GROWTH in mind), narrow our choice down to one or two systems, and then write a set of specs that will encourage more than two bidders but at the same time not stick us with some hoky system from Fly-By-Nite Manufacturing. What you really want is 5 or 6 legitimate bidders and the ability to choose the one YOU want (that's where the pure, raw courage comes in!). We've seen more than one situation where the school had their heart set on one system and have the bids produce a strong competitor with a new system. Courage prevailed and the school took the new system. In the same light we've seen the "preferred" system lose to a low bid competitor and everyone ends up unhappy.

All bids must have some general provisions regarding bid bonds and all that stuff. A few extras you should throw in are:

1. No bidder may withdraw his bid for 90 days after the opening of the bids – *this gives you protection against any price increases (decreases they should give you). Also gives you plenty of time to make up your mind.*

2. The bid should include all freight charges, taxes, installation charges, etc. – *everything to make the thing go!*

3. Include a solid delivery date – *delivery defined as up and running, not just on your doorstep (be reasonable). Allow the vendor to state alternatives if he cannot meet your delivery date.*

4. Liquidated damages – *if the contract is not completed (delivery) within the time required in the contract then an amount ($50 to $100 per day) shall be deducted from the contract total. What a club this gives you if things go awry or delivery is delayed (and it will be!).*

Fig. 14 Jackknife positioning for relief of acute back strain.

5. Manufacturer's name and model number must be shown under each item bid. *(Require all new equipment if you wish.) The prime contractor should be responsible for the quality and the compatibility of all the equipment he bids.*

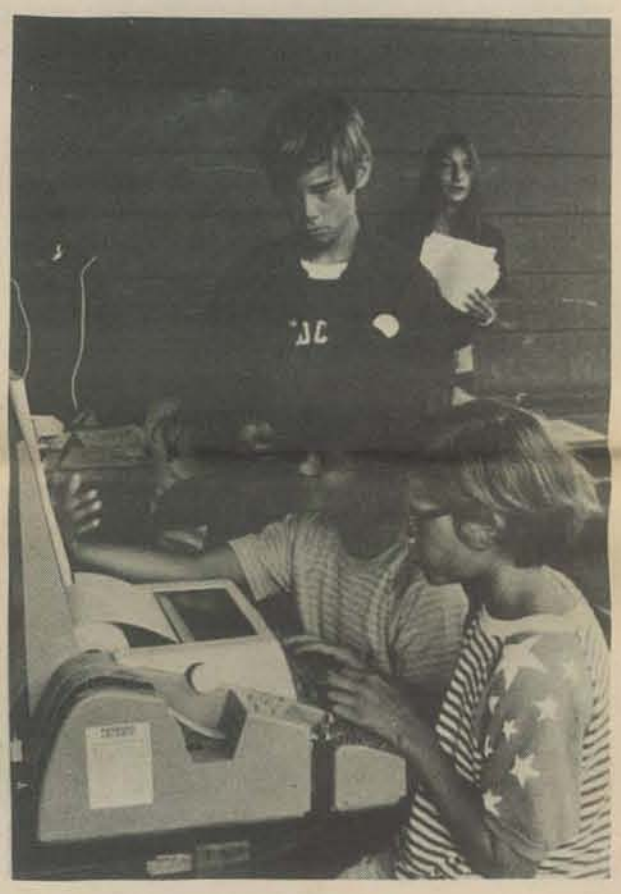
6. Bidders will present alternative purchase, lease-purchase and lease arrangements – *we discovered a wide range of variations between vendors in this area. HP offers a full payout 4 year lease at some ridiculously low interest rate.*

7. Certificate of non-discrimination – *the bidder must submit with his bid a certification that his firm does not discriminate in employment with regard to race, religion, creed or national origin . . . in your heart you know this is right.*

And then there is a whole array of other things you can add before you even get into the specifics of your hardware and software.

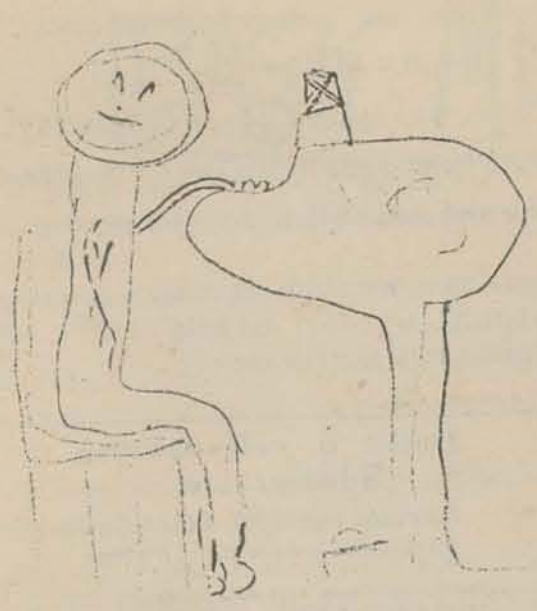
The most significant section in any bid spec should be worded along the following lines: *The system must be demonstrated on demand with all requirements before the bid shall be accepted*. This one section may save you more grief than all the rest of the specs. With all due respect for my friends who sell computers, you can't always believe what the salesman TELLS you. MAKE HIM SHOW it to you (and if you're smart, you'll bring along someone to this demonstration who is capable enough to verify that you *really* are seeing what they say you are seeing). A salesman's promise that "it will be available by the time your system is delivered ... we're working on it" is usually just so much salesman's talk. When the time comes for delivery of your system, he'll pop-up with "it's not ready yet but it will be an easy job for one of your hotshot students to do." And there you are, up the proverbial creek without a paddle! By the way, you'll probably get a good system anyway. It's just that most of us are in the habit of getting what we asked for and plan accordingly. The loss of some special system capability may very well be harmful to the planned instructional program. This one clause (and your diligent enforcement of it) should keep out shaky bidders.

To assure yourself a computer or computer time until delivery of your system you can insert a clause stating that *the vendor shall provide you with time on a computer similar to the bid item from date of contract to date of delivery*. You should specify hours of the day, number of terminals, disk space requirements and so on. If the interim system is a timesharing system, available over phone lines, be sure to specify that the telephone calls *must be* a LOCAL call from your location (or else the vendor must pay all phone charges). This section should be included as a biddable item, the vendor can charge you for the service. In two bids locally, HP bid no charge while other vendors were going to charge as much as $600 per month per terminal!



To cover yourself and assure you sole discretion in the ultimate choice you can add the following clause: *The contract will be awarded to the responsible bidder(s) who in the judgement of the district make(s) the most cost effective proposal(s). The district reserves the right to reject any or all bids and to sit and act as sole judge on the merit and quality of the material, or equipment, or service offered and on the responsibility of the bidder and may accept whatever bid or combination of bids is deemed to be in the best interest of the district.* This essentially allows you to reject or accept any bidder for nearly any reason. This clause takes away the sanctity of "low bid" and places the bid process into the category of an information gathering procedure that allows the district to choose from what the vendors offer, without regard to price. We have seen an entire set of bids rejected under this clause and in another case, saw Data General low bid a 12K, 5 terminal Nova system for $17300 and lose to an 8K, 5 terminal DEC Edusystem 20 bid in at $17990 (explain that one!).

To be continued next issue –



H·P 2000E UPDATE

Our first issue introduced you to HP's latest timesharing system, the HP2000E. At that time we made some favorable comments about this new low cost system and its BASIC software. Well, I won't retract what was said, but had I been keeping a diary of the ups and downs of our system since then, reading it would have blown your mind!

We've had every kind of problem that was possible. Erratic software crashes; known software crashes; disk crashes; disk alignment problems; multiplexer problems; modem problems; you name it, we had it. We reached the point where we felt we knew more about their problems than HP did. But they responded, and quickly, and our net down time (system inoperable) was really quite low considering ... I must give HP credit. When problems began to appear they shuffled to fix our system and keep us on the air. I should mention that we exercise the hell out of our system. Prime time runs timeshared BASIC while the 4–10 PM shift operates in Batch FORTRAN processing our Comprehensive Achievement Monitoring data.

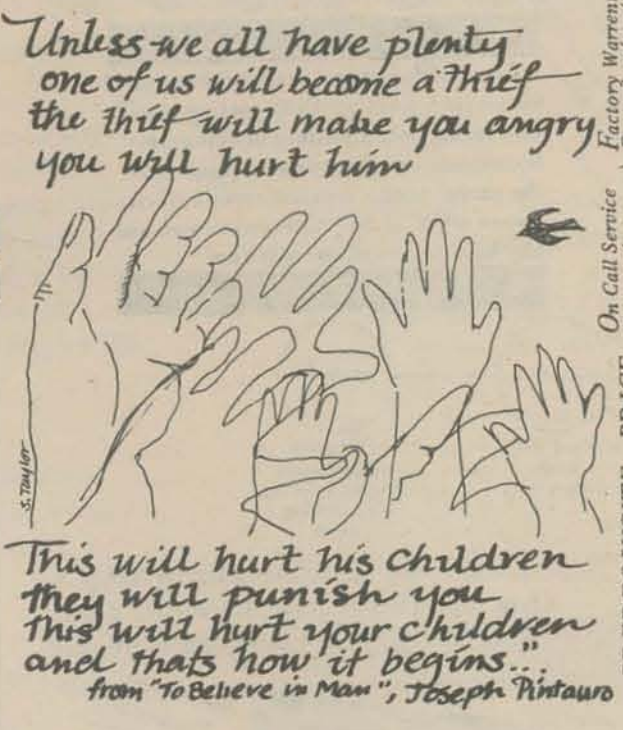
The problems seem to be over (I may regret having said that). At this writing the hardware is running smoothly and the first "released" version of the software hasn't crashed yet and they tell us that the second revision is on the way already. (New revisions are usually improvements.) I must also mention that the current status of our system is 12 months behind schedule; however, during this year HP gave us free time on a 2000C located nearby (local call).

You can thank us and two other users for debugging this system for you. NOW it's ready for public consumption. The price has been reduced to $40,000 (probably because DEC now offers a MINI–RSTS in the same price range and it has a similar hardware configuration). With all our problems, I'll still recommend the 2000E as a good starter timesharing system (is that blind faith we hear?)

[LeRoy and the 2000E reside at Ravenswood High School, one of six schools in the Sequoia Union High School District, Redwood City, Ca. He also works at Dymax/PCC.]

Jealous Computers?

Last issue we suggested that the Lawrence Hall of Science HP2000B was jealous of the newly installed HP3000, so it stopped working temporarily. Well, here's another one. The HP2000B at TIES in Minnesota had a huge drum crash (same problem as that at LHS) shortly after the delivery of a new HP2000F . . . draw your own conclusions.



ONE MAN'S OPINION

At a recent conference in San Francisco, I found myself answering the same question from teachers all day long. So, I thought I'd commit my response to writing and if you'd care to respond, do so and it will appear in a later issue of PCC.

The problem presented was: How can I get the money for hardware or how can I get more money to increase the system we have? The situation is the same and therefore my response is the same to each question. YOU HAVE TO GET THE ENTIRE SCHOOL INVOLVED IN YOUR COMPUTER EDUCATION PROGRAM! If you set up a program that is limited to math students or you set up all sorts of fancy prerequisites so that only a limited number of students use your computer, then you cannot expect support or more money from anyone but the few people who use the system. Even if every math student in school uses the computer at some time during the year, only you and he know it and he can't do you much good when it comes to promoting more money.

You have to get out of the math problem-solving syndrome (that's what I call it) and try to get as many other people involved with your computer as possible. The science department is the first logical choice. The Huntington Project computer programs (see page 3) make it easy for any science teacher to get involved with a computer. These programs cover a wide range of science topics and are available, ready to run on most educational computer systems. The business department is the next logical user. I'm a business teacher and I'm not convinced that you'll find much support there, but look anyway for the one person who is teaching data processing or is interested in teaching it. Social studies teachers have an inherent disdain for computers but you can probably find one who is into gaming or simulations who would enjoy having his students do a simple economic simulation or simply play a computer game. The resources are available from HP and DEC. All you need to do is get them and use them.

Some schools have done some far out things like scouting football games for the athletic department using the computer. Some have done work in English on a very basic level. There are even things that can be done with home economics and art. One easy thing to do for anyone, is the tabulation of surveys or correcting tests, if you want to get into that.

The important thing is you have to get others involved. You'll break your fanny doing it, but if you want to get more than a one terminal minimum system you are going to have to substantiate your need. You can't substantiate a need if only the math department is using the computer.

Finis LF

Quick Look at DCC-116

We recently paid a brief visit to Don Nelson, and played a bit with DCC's multi-user BASIC. The system looked pretty good (the one we used had strings and MAT functions). The strong point of the setup, however, is its reasonable cost. Here are a few excerpts from DCC's price list, which represent the main parts of the system we looked at.

TYPE NUMBER	DESCRIPTION	PREREQUISITE	PRICE	On Call Service Contract (per mo.)	Factory Warranty Extension (per/mo.)
116840	D-116 central processor with 16K core memory, and 5 additional subassembly slots. Includes DMA, programmers console and external I/O connector. Slide mountable in 19" rack. Chassis if 5¼" high. 50/60 Hz, 117 VAC. For operation at 230 VAC order 116834-2. Without console reduce price by $300.		6,460	70	35
116407	I/O interface subassembly for interface types. Occupies one subassembly slot.	Any D-116 CPU	180	2	1
116410	Teletype I/O interface for Models 33ASR, 33KSR, 35ASR and 35KSR.	116407	150	1	1
	The Teletype models listed below are for 60 Hz, 117 VAC operation. For operation at 50 Hz, 117 VAC, order with type number suffix 1 (e.g., 116410A-1). For operation at 50 Hz, 230 VAC, order with type number suffix 2 (e.g., 116410A-2) and add $50 to price.				
116410A	Teletype Model 33ASR 10 cps keyboard/printer; 10 cps 8 channel paper tape reader/punch.	116410	1,250	27	14
116431	8-Line Asynchronous line unit Multiplexer Controller. Occupies 1 subassembly slot (each line implemented by 116431-1 or -2)	116801 or 116802, 116450 or 116451	800	20	10
116431-1	EIA R5232 Interface full or half duplex, line double buffered, 0-20,000 baud, odd, even, no parity, programmable data word (5, 6, 7 or 8 bits). Character assembly/disassembly – max 8 per 116431 sub-assembly board.	116431	150	5	3
116431-2	20 ma Loop Current Interface Teletype Lines, programmable data word (5, 6, 7 or 8 bits). Character assembly/disassembly – max 8 per 116431 sub-assembly board. Local teletypes less than 100 feet.	116431	150	5	3

16K for $6400! Moreover, educational discounts are available (we promised not to tell how much), on items *without* trailing alphabet letters. There may be some software deficiencies at this point (e.g., a "floppy disc" system is available, but no software yet). This should get better. If you're interested, as well you might be, check with:

Don Nelson
Digital Computer Controls Inc.
20430 A Town Center Drive
Cupertino, Ca. 95014

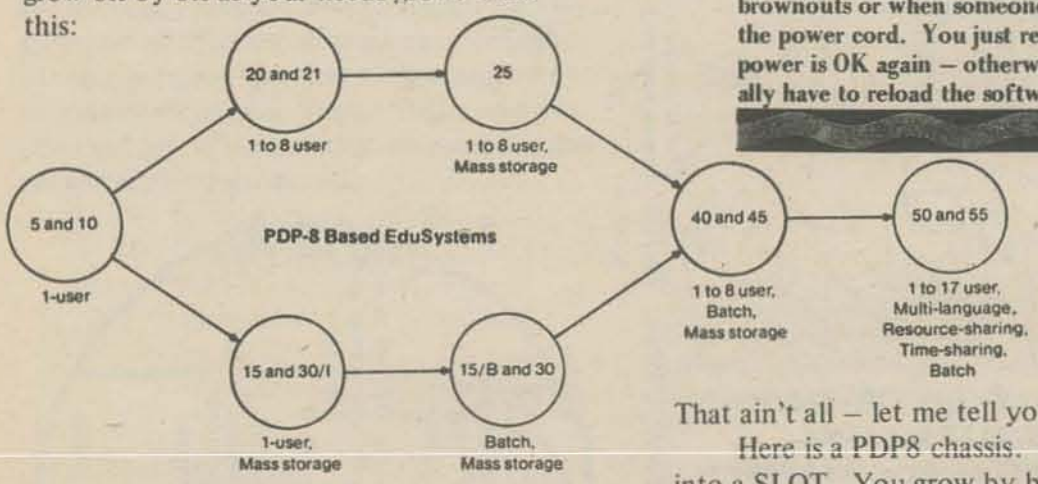
PLS

WEATHER REPORT *** NOV AND DEC OF 1972 BROUGHT SOME OF THE COLDEST WEATHER WE CALIFORNIA RESIDENTS HAVE EVER ENCOUNTERED. ALONG WITH THE BAD WEATHER CAME A SERIES OF INTERESTING COINCIDENCES. EVERY COMPUTER WE USE (ABOUT 4 IN NUMBER) WAS EXPERIENCING WEIRD PROBLEMS. SOME WERE DOWN ALTOGETHER, SOME WERE JUST ERATIC. MINI COMPUTERS ARE SUPPOSED TO BE IMPERVIOUS TO WEATHER FLUCTUATIONS. SO WHAT HAPPENED? PERHAPS IT'S COINCIDENCE. PERHAPS IT HAS TO DO WITH POWER FLUCTUATIONS. PERHAPS STATIC ELECTRICITY WHICH BUILDS UP IN COLD WEATHER CAUSED PROBLEMS. WHO KNOWS? THINK BACK ... DID YOU HAVE PROBLEMS? WRITE AND TELL US ABOUT IT.

HOW TO BUY AN EDUSYSTEM

EduSystem? An EduSystem is an educational computer system made and sold by DEC . . . Digital Equipment Corporation . . . the largest mini computer manufacturer. EduSystems are built around the PDP8 and PDP11 minicomputers.

In looking over DECs catalog, I see lots of EduSystems – like Edu5 and Edu10 and Edu20 and so on. Some use the PDP8 computer and some use the PDP11. This time I'll talk about some, but not all, of the PDP8 EduSystems. They let you start small and then grow bit by bit as your needs grow. Like this:



I'm going to take the high road and talk about Edu10 and Edu20 (this time) and Edu21 and Edu25 (next time).

You can start with EduSystem 10 or EduSystem 20.

A *one user* EduSystem 10 costs $6960.

• PDP8e computer with 4K words of memory	4490
• hardware bootstrap*	500
• one TTY (Teletype)	1620
• EduSystem 10 software	250
• Textbook kit	100
	$6960

A *one user* EduSystem 20 costs $8370.

• PDP8e computer with 8K words of memory	5650
• hardware bootstrap*	500
• power fail detect and restart	250
• one TTY (Teletype	1620
• EduSystem 20 software	250
• Textbook kit	100
	$8370

**Hardware bootstrap is a luxury . . . YOU DON'T NEED IT . . . save money by not getting it.*

If at all possible – start with Edu20 instead of Edu10. For only $1410 more you get a much, much, much (how many muches will convince you?) better system – a system that provides a better base for *growing*.

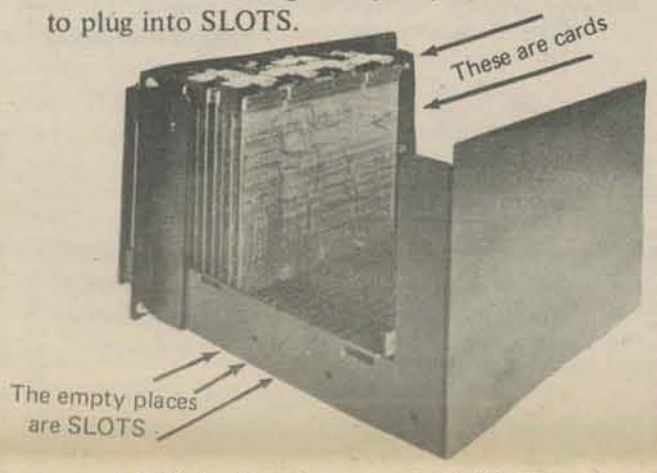
A bootstrap is a short program used to load bigger programs into the computer. You can hand load a bootstrap in about one minute – then it sits there in memory day after day – it's usually there when you need it. Once in awhile, it gets clobbered and you have to spend a minute reloading it.

Hardware bootstrap ($500) is a permanent builtin bootstrap – it will save you a minute of your time every few days or weeks.

Power fail detect and restart is handy! It keeps your software from getting wiped out during power failures or temporary brownouts or when someone trips over the power cord. You just restart when power is OK again – otherwise, you usually have to reload the software.

That ain't all – let me tell you about SLOTS.

Here is a PDP8 chassis. Each card plugs into a SLOT. You grow by buying more cards to plug into SLOTS.



A PDP8e chassis comes with 20 slots. A 4K memory computer eats up 10 slots, leaving you 10 to grow into.

An 8K memory computer eats up 11 slots leaving you 9 to grow into.

Expanding a 4K memory to 8K eats up 4 slots. Hardware bootstrap takes 1 slot. Power fail detect and restart takes 1 slot.

• Start with Edu10 and grow to Edu20 (8K)	• Start with Edu20 (8K)
Takes 16 slots, leaves only 4 to grow into.	Takes 13 slots, leaves 7 to grow into.

Now let's start adding Teletypes to a one user Edu20. First, let's suppose you buy them from DEC. For *each* add-on TTY, you also need an *interface card*, (sort of like a United Nations translater . . . it translates TTY talk to PDP8 talk and PDP8 talk to TTY talk).

For **EACH** additional TTY (from DEC)

• TTY	$1620
plus installation	120
• interface card (and 1 slot)	300
plus installation	60
(and 1 slot)	$2100

Here is how you get from Edu10 to one user (8K) Edu20.

• Edu10	$6960
• additional 4K memory	2750
+ installation charge	150
• power fail detect and restart	250
+ installation charge	60
• EduSystem 10 software	250
	$10420

To start with Edu10 and then expand to one user Edu20 costs you: $10420

But you could have started with Edu20: 8370

Growing pains: $2050

An 8K Edu20 can handle up to 4 Teletypes. Let's look at the difference in price in buying a 4 TTY Edu20 or buying an Edu10 then expanding it later to a 4 TTY Edu 20.

Edu10	6960	1 user Edu20	8370
+ Edu20 stuff*	3460	+ 3 TTYs**	4860
+ 3 TTYs*	5120	+ 3 interfaces	1080
+ 3 interfaces*	1080		
	$16620		$14310

* includes installation

** if you buy them *with* the original system *no* installation charges.

Your turn. Compute growing pains:

16620 – 14310 = _____

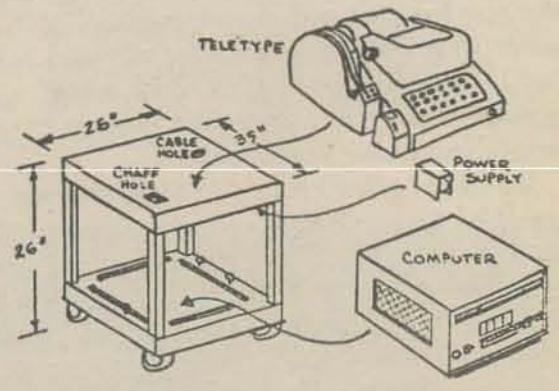
Oh yes, with system ☹ you have used 19 slots – only 1 left for growing. With system ☺ you have used 16 slots, 4 left for growing.

Well – more next issue, like adding core memory to Edu20, and Edu21 and Edu25 and . . . well, what do YOU want to know?

Build a roll-around EduSystem

Reprinted from EDU. EDU is DEC's educational newsletter . . . it's free!

- Use a sturdy wood like oak (teletypes vibrate quite a bit)
- Bolt the teletype on with an overhang so the paper tape reader clears.
- Use luggage hold down elastic cords (available in auto stores) with eyebolts for the computer.
- Place small furring strips around the base of the computer so it won't slide.
- Use large (4-5") casters so the cart is easy to push around.
- Attach the teletype power supply under the top. Put a wire mesh cage around it to keep out curious fingers.



Want to save some $$$

Buy only your FIRST Teletype from DEC. (They will probably insist on this because of maintenance considerations.) Buy the rest of your Teletypes from someone else. You should be able to save about $500 per TTY. [See PCC, Oct., 1972, p. 13 and Dec., 1972 p. 12 and 13]

TO: David Ahl
Digital Equipment Corp.
146 Main Street
Maynard, Mass. 01754

I read about DEC in the People's Computer Company. Please place my name on your mailing list to get EDU and other information about your educational computer products.

Thanks.

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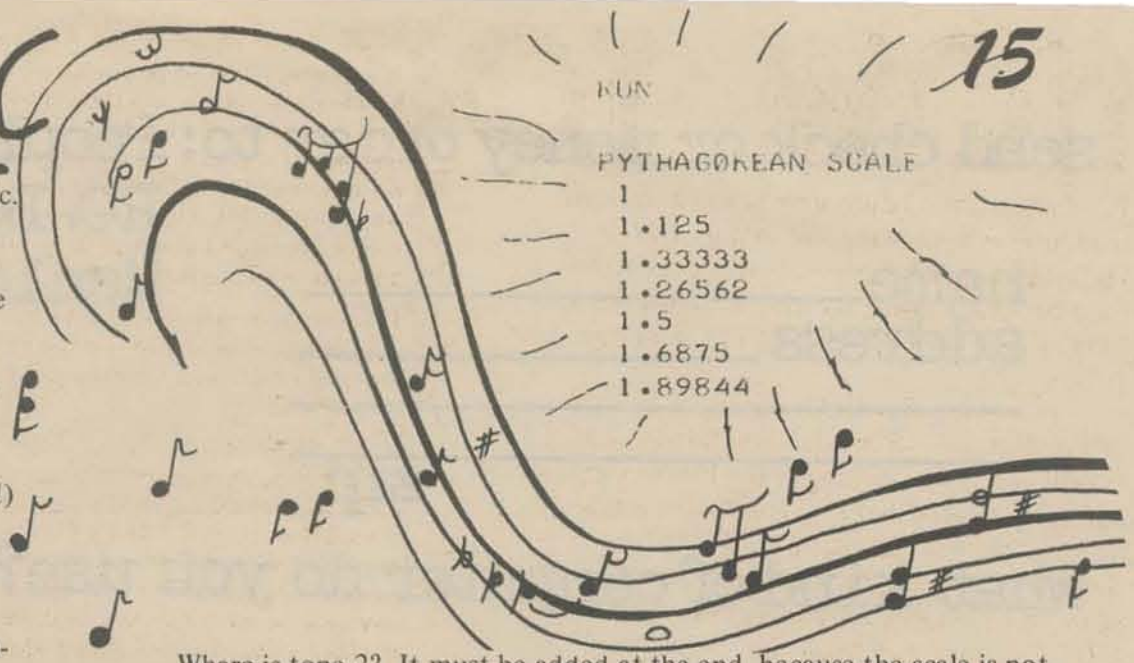
BASIC MUSIC

RATIONAL SCALES



Last issue we looked at some BASIC applications in the field of music. We promised a Pythagorean program. Here it is, and some problems based on its key ideas.

Pythagoras' gifts to music and musicians were many; the two we will use here are:

(1) A vibrating object produces *overtones* with frequencies that are integer multiples of the fundamental frequency (see PCC No. 2 to avoid confusion).

(2) Intervals between tones are specified (and apparently perceived!) as the *ratio* of the frequencies of the two tones.

This second idea suggests that *rational*† approximations to any interval are possible. As it turns out, until the time of Bach all constructed scales (in the West) were based on this idea. Pythagoras himself constructed one which became the basis for our music system.

To start with, remember that the overtones are integers, if the fundamental is set equal to 1. When Pythagoras plucked his one-stringed "monochord", he obtained as the strongest and most pleasing overtones the frequencies

1 2 3

He then reduced this 3-tone scale to the range of one octave (the interval between 1 and 2). To do this he used a lower octave of the 3 overtone, a note with frequency 3/2. The scale then became

1 3/2 2

This is the basic scale. What next?

Well, the 3 overtone has an overtone with frequency 3*3 = 9 which sounds pleasing when it accompanies overtone 3 (for the same reason that 3 sounds good when it sounds together with tone 1). Moreover, tone 9 has the same "good vibes" with tone 27. Pythagoras continued to add tones in this fashion until he had a scale of seven different tones, two of which were the original 1 and 2. They were

1 9/8 81/64 3/2 27/16 243/128 2

These frequencies have been reduced to one octave by successive division by 2, and arranged in numerical order.

Pythagoras also added an eighth tone to his scale. This interval does not appear in the overtone series of the fundamental, but it is closely related to the fundamental. It is a note with frequency

2/3

The fundamental is the 3 overtone of this note. In order to place it in the same octave (from 1 to 2) as the rest of the notes, it must be multiplied by 2. Here is the complete scale, together with the names for these scale degrees derived from the medieval theorist Guido of Arezzo:

1	9/8	81/64	4/3	3/2	27/16	243/128	2
DO	RE	MI	FA	SOL	LA	TI	DO

This eight-tone scale has dominated Western musical thinking for thousands of years. It also appears in Hindustani music. Here is a program which generates the frequencies in the true Pythagorean manner, and prints them out in decimal notation.

† A rational number is a number that can be written as the ratio of two integers. E.g., 1.5 is a rational number because it can be written as 3/2.

```
100  PRINT "PYTHAGOREAN SCALE"
110  DIM F[7]
120  REM STARTING WITH 2/3, MULTIPLY SUCCESSIVELY BY 3/2
130  LET F[1]=2/3
140  FOR I=2 TO 7
150  LET F[I]=F[I-1]*3/2
160  NEXT I
170  REM CONVERT TO NUMBERS BETWEEN 1 AND 2
180  FOR I=1 TO 7
190  IF F[I] >= 1 THEN 210
200  LET F[I]=2*F[I]
210  IF F[I] <= 2 THEN 240
220  LET F[I]=F[I]/2
230  GOTO 210
240  NEXT I
250  REM SORT LOWEST TO HIGHEST
260  FOR I=1 TO 6
270  FOR J=1 TO I
280  IF F[J] <= F[J+1] THEN 320
290  LET X=F[J]
300  LET F[J]=F[J+1]
310  LET F[J+1]=X
320  NEXT J
330  NEXT I
340  REM PRINT THE SCALE
350  FOR I=1 TO 7
360  PRINT F[I]
370  NEXT I
380  PRINT
390  END
```

Written for PDP-8L

Hey, computer people. Turn on some music people with this stuff after you've tried it yourself.

Where is tone 2? It must be added at the end, because the scale is not complete without it; like the NEXT statement, it tells you where to start repeating. But – it cannot be generated like the rest of the tones: no power of 3 ever exactly equals any power of 2. This problem plagued Pythagoras, and every other musical thinker after him. In a scale based on the 3 overtone as this one is, only intervals which can be reduced to powers of 3 divided by powers of 2 are "in tune." All the others are out of tune. In the 12-tone tempered scale we discussed last time, all the octaves are "true," and everything else is out of tune. Which is better? Some partial answers may appear in future issues, but check out the literature first (assuming you have virtually unlimited time).

Now for some problems. You can modify or adapt our program to solve these if you wish.

First, you might wish to be able to INPUT the frequency of the fundamental in cycles per second, and obtain the Pythagorean frequencies in the same units. Do it!

Second, there are other important intervals besides 2 and 3/2. One of the most important of these is the ratio 5/4, which is the 5 overtone reduced to the lowest octave. The system of "just" intonation uses the 5/4 overtone along with the 3/2, to create a scale that fits the "3 main chords" very well indeed. For a complete explanation of the terms which follow, you'll need a music text. First, the Tonic (home base) chord is defined as consisting of the following tones

Tonic	1	5/4	3/2
	root	3rd	5th

This pattern is characteristic of "major triads" in the just intonation system. The other two of the 3 main chords are called the Dominant and the Subdominant. The Dominant starts with tone 3/2, and the Subdominant starts with tone 2/3 (symmetrical, no?).

The tones of the Dominant are computed as follows

root = 3/2
3rd = (3/2)*(5/4) = 15/8
5th = (3/2)*(3/2) = 9/4

Note that the relative frequencies of the 3 tones are the same as in the Tonic. Only the starting frequency has been changed.

Similarly, we can describe the Subdominant.

root = 2/3 (moved up to 4/3)
3rd = (2/3)*(5/4) = 5/6 (moved up to 5/3 that is, 10/6)
5th = (2/3)*(3/2) = 1

This gives us a complete scale of eight tones if we count the 2 overtone. Here is the scale (rearranged).

1	9/8	5/4	4/3	3/2	5/3	15/8	2
DO	RE	MI	FA	SOL	LA	TI	DO

Can you program this one?

Next, here are two "approximately Oriental" scales. One is pentatonic, the other diatonic (eight tones).

1 5/4 3/2 7/4 2

1 9/8 5/4 11/8 3/2 7/4 15/8 2

Naturally, "do" "re" etc., don't do justice to the sounds of either of these two scales.

Can you program them? Can you play them?

Final question: If the overtones go up to infinity, do all intervals appear when you play one tone? Can any interval be approximated (to a given level of error) with a rational fraction?

Quick and easy reference:

Paul S. Malcom, "Mathematics of Musical Scales," *The Mathematics Teacher*, November, 1972.

* *

In future issues of PCC, Peter Lynn Sessions will present a transposing program, review existing music programs, and discuss "advanced" techniques for writing music composing programs.

send check or money order to: People's Computer Company
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