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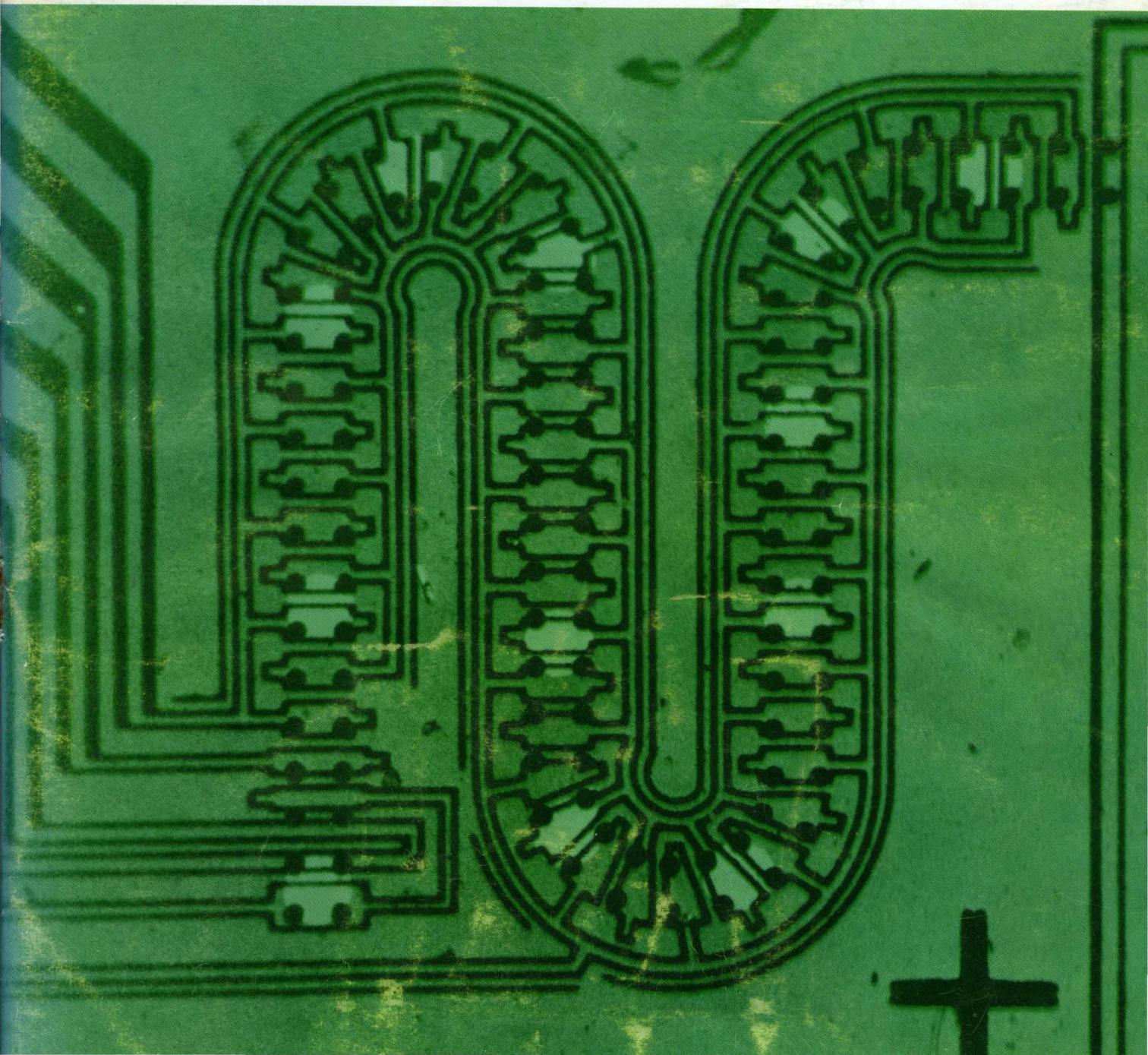
October, 1969

Vol. 18, No. 11

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computers and automation

Tiny Magnetic "Bubbles" for Data Storage



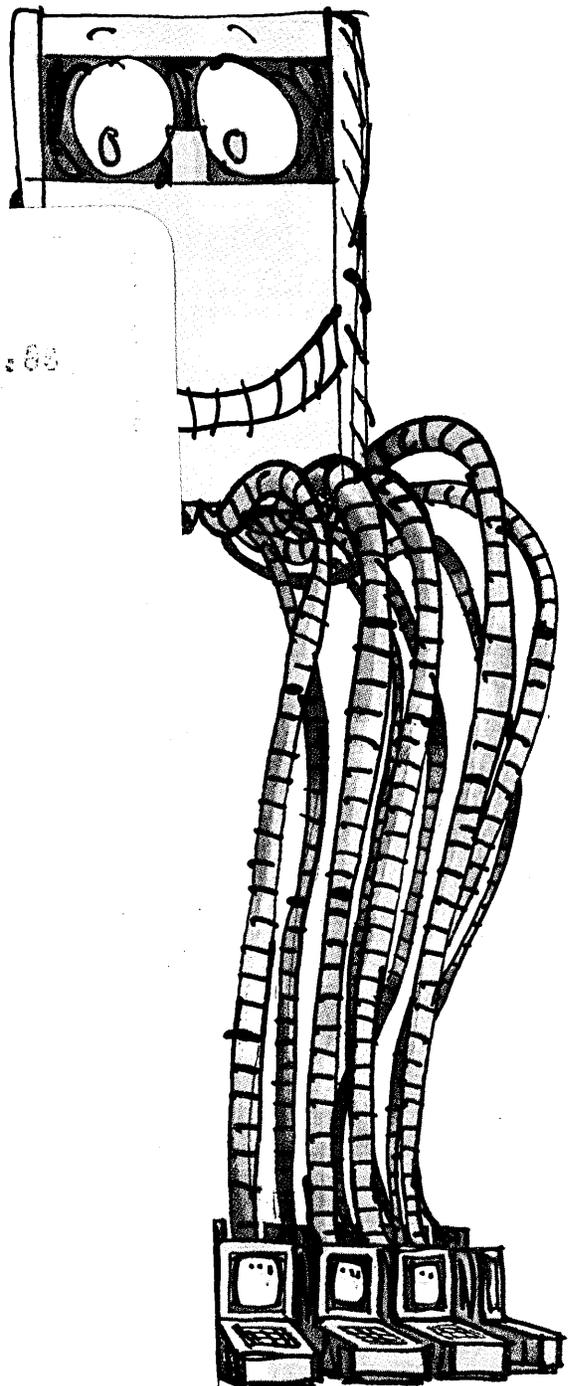
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Big Brother—without rewriting a single program. They're blood brothers, completely compatible. The Octoputer Family Plan—two now and more to come.

COMPUTERS AND
AUTOMATION
OCTOBER, 1969



SDS just made a name for itself in the business world:

Xerox Data Systems.

When scientific data systems were all we made, Scientific Data Systems was an excellent name.

But for the past few years distinctions between scientific and business computing have been disappearing. And we've been

expanding into applications for general business and industry.

So we're adopting our parent company's name. It's as respected in the business world as the one SDS has in the technical world.

XDS
Xerox Data Systems
El Segundo, California

Letters To The Editor

computers and automation

Accreditation vs. Approval

On page 62 in your August issue, you published a story titled "Computer Environment Institute Accredited by the Veterans Administration". Please be advised that the veterans administration does not *accredit* any school, they *approve* them only for veterans training.

There is a big difference. There are only two agencies in the U.S. that are approved by the U.S. Office of Education for accrediting data processing

schools. They are the Accrediting Commission for Business Schools (ACBS) and the National Association of Trade and Technical Schools (NATTS).

Accreditation, approvals and licensing are worlds apart.

The V.A. has minimum requirements for approval. ACBS and NATTS make an extensive evaluation and inspection of all phases of the schools from marketing, to administration, to

(Please turn to page 7)

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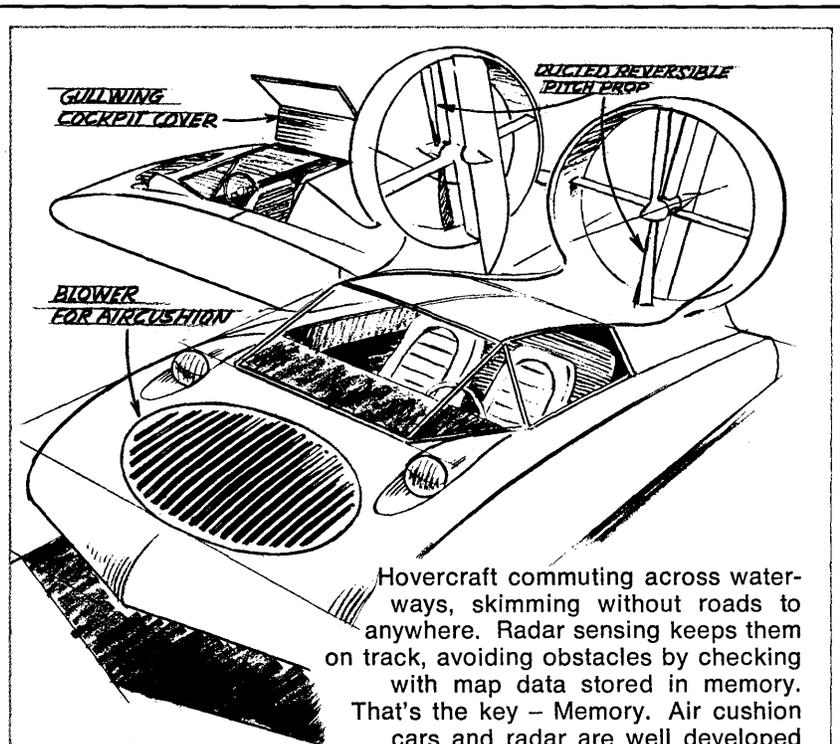
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automatics

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computers and automation

Vol. 18, No. 11 — October, 1969

The magazine of the design, applications, and implications of information processing systems.

Special Feature:

Time Sharing

22 HOW A POWERFUL TIME SHARING SYSTEM BECAME INDISPENSABLE

by Monroe M. Spierer and Robert D. Wills

A survey of the applications developed over six years for the time sharing system at System Development Corporation—a system which has provided a large community of on-line users with practical experience in solving real-life problems directly via computer.

38 TIME SHARING FOR VERY SMALL BUSINESSES

by Edward Yourdon

Where do time sharing services currently fall short in meeting the demands of very small businesses for low cost, security, and reliability?

42 THE LANGUAGE BASIC AND ITS ROLE IN TIME SHARING

by Michael F. Lipp

A history of the development of a language which is now offered by every major computer manufacturer, and almost every independent supplier of time-sharing.

47 THE ECONOMIC PROMISE OF COMPUTER TIME SHARING

by Herbert S. Kleiman

The potential of time sharing to expand significantly the base of computer users—and thus change the economic base of the computer industry.

50 COMPUTER-BASED STUDY OF MENTAL RETARDATION

by James F. Donohue

How a computer has been used by a hospital for the mentally retarded to: reduce death and disease; monitor physiological processes; improve patient care; and analyze the findings of research in social behavior.

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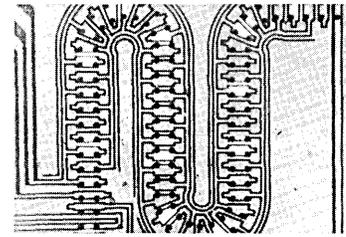
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The front cover picture represents magnetic "bubbles" (large white dots) moving through a shift register in an experiment at the Bell Telephone Laboratories in Murray Hill, N.J. The "bubbles" are actually $4/1000$ of an inch in diameter. They are the key to a potential new technology which would enable small computers and electronic telephone switching systems of the future to accomplish counting, switching, memory, and logic functions, all within one solid magnetic material. For more information, see page 66.

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by Neil Macdonald

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by Walter Penney, CDP

Time was when alphanumeric computer outputs chugged away on the line printer, line drawings zig-zagged on the pen plotter, and creative designs flickered momentarily on the scope face. In fact they still do chug, zig-zag, and flicker.

Something better is called computergraphics, where the computer's tapes can be given to one peripheral that is fast enough, precise enough, and versatile enough to handle all kinds of outputs.

Our FR-80 Film Recorder is a computergraphics system. Give it a personnel listing with corrections to merge and record in one pass. Or a digitized engineering drawing to be recorded and blown back to E-size from 35 mm film. Or a strip chart to be continuously recorded in abutting frames, perfectly registered. Or a directory to be set up in book-quality, like this ad.

FR-80 not only does all of these things to higher accuracy than any other electro-optical system (resolution on 35 mm film: 80 line pairs per mm), it does them in quick succession with a few seconds setup time, accepting tape formatted for any output device by any host computer. Because FR-80 is a programmable system, flexible, versatile, responsive to special graphic requirements, receptive to new methods.

To put it another way, adaptable species flourish, while specialized forms die out. And FR-80 is thoroughly adapted to the age of computers and automation.

Let us send you the complete story of FR-80.

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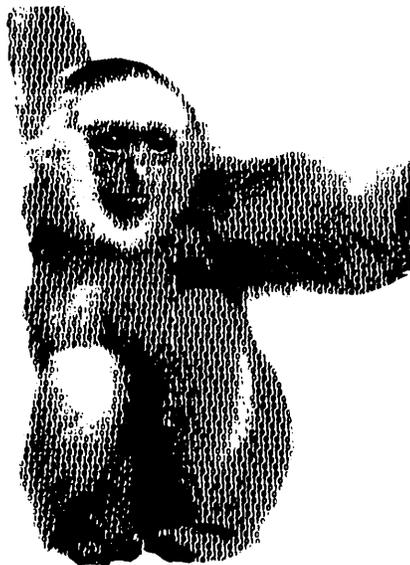


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Computergraphics have come a long way



MEANWHILE, BACK AT THE PFR-3...

... we have further improved our Programmable Film Reader/Recorder to make it the most sophisticated image analyzer available. New software has been developed for these applications:

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LETTERS TO THE EDITOR

(Continued from page 4)

instructors, to having a computer on the premises.

Over 70% of all data processing schools have V.A. approval, less than 10% are accredited.

WAYNE R. ZANARDELLI
*National Director of Education
Institute of Computer Management
Div. of Litton Industries
600 Washington Ave.
Carlstadt, N.J. 07072*

Ed. Note-The use of the word "accreditation" was an editorial error on our part; the press release we received from the Computer Environments Institute used that term, and we neglected to correct it.

Incidentally, according to the ACM Accreditation Committee, the Office of Education has also approved the National Home Study Council for accrediting data processing schools.

Seeks Job Advice

This letter is from an Indian boy who is seeking your most valuable advice as well as your kind help. I have just read your April 1969 issue. I am very much influenced by the many topics and articles on computers by

renowned men of many business concerns, particularly your editorial, which inspired me to write this letter to you.

I have passed the Higher Secondary Examination in Science group and am now pursuing higher studies in statistics in the Indian Statistical Institute.

I am very much interested in computer science, and am undergoing training in a computer programming course (by correspondence) in the British Institute of Engineering and Technology whose headquarters are in London. My age is 22.

Could you kindly advise me whether it would be possible for me to get a job in the United States after completion of this course?

ANJAN K. SARKAR
*44, Ramlal Agarwala Lane
P.O. Sinthee
Calcutta-50, India*

Ed. Note-Thank you for telling us of your interest in computer science. I am not familiar with the particular course you are taking, but I would suggest you write to some of the larger computer companies in the U.S. for specific information regarding qualifications and opportunities for employment relative to your training. [The names and addresses of a number of large computer companies were sent to Mr. Sarkar.]

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Marketing in Computers and Data Processing

The field of computing and data processing has become one of the fastest expanding industries ever seen. The computer furnishes an enormous advantage: often it provides a gain of a factor of one million over the best preceding way of doing something involving the handling or processing of information.

This has placed a huge burden on the marketing and sales departments of all suppliers of equipment and services in this field. The new director of marketing of the new firm in this field has very large problems for each new product:

- Who are my logical customers?
- How do I find them?
- What are their names and addresses?
- How do I convince them of the value of our equipment and services?

Probably at least half of all the telephone calls from strangers that come into the editorial office of *Computers and Automation* are telephone calls from persons who are trying to find out some marketing information that will help them market a product or service in the computer field.

At the present time, we are unfortunately not able to provide many of these persons with the kinds of specific information they want and need. But *Computers and Automation*, as a part of the computer industry, has been pursuing a number of directions of activity in an effort to help the marketing segment of the computer field.

Among these activities are the following:

- production of a census of computers installed;
- product releases and advertising published in the pages of *Computers and Automation*;
- maintenance and offering of 16 mailing lists of various segments of the computer field, ranging from a mailing list of 20,000 installations of computers to some 35,000 persons known to be interested in computers;
- articles on marketing and related subjects; etc.

For more than two years we have been working to organize a "Computers and Automation Data Base", which now contains over 100,000 names and addresses of computer people, organizations, and installations. The Data Base is slowly becoming better organized, depending on the extent to which financial resources can be devoted to its construction.

An example of a new activity in the general area of marketing is our sponsorship of REGIONAL computer shows, by COMPSO (Computer Software and Peripherals Show) that are being organized by Show World Inc., 37 West 39 St., New York, N.Y. For 1970, COMPSO has scheduled a regional computer show in New York (Hilton Hotel) January 19-21, another in Chicago (Palmer House) February 17 to 19, and another in Los Angeles (Anaheim Convention Center) April 7 to 9. The basic importance of regional shows is that these marketing efforts will attract (in addition to data processing people) management people who are important buying influences, but who do not consider themselves DP men and who are unlikely to attend distant computer expositions.

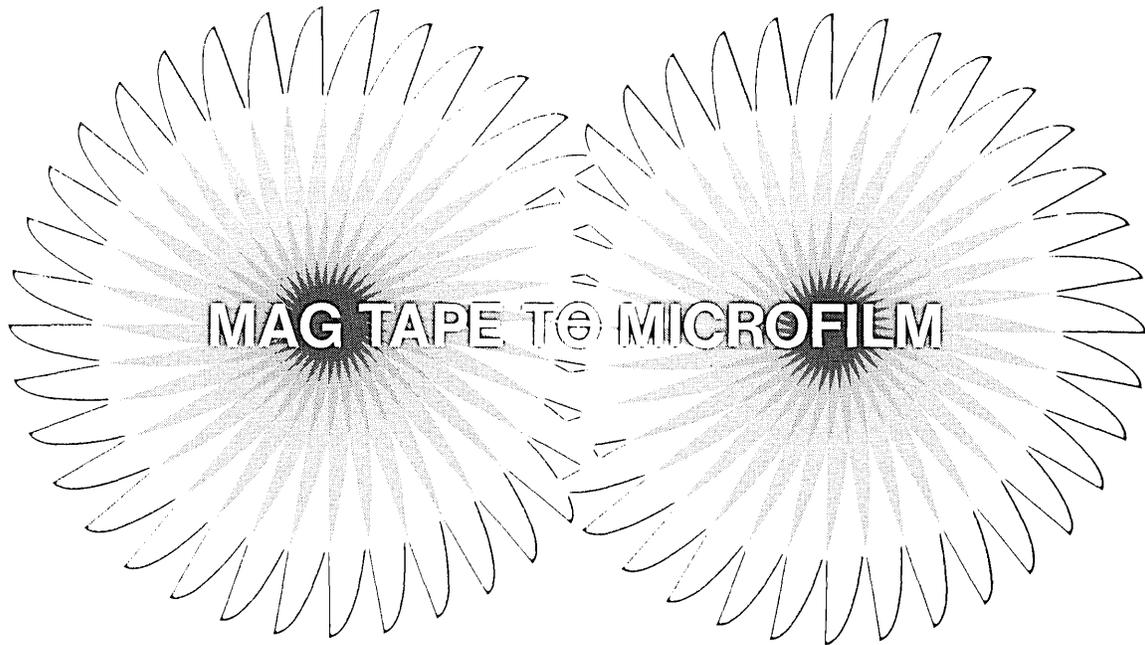
We hope the day will come eventually when a great part of the marketing problem in the computer field can be handled directly by means of computers. Sales directors will be able to dial into a future "Computers and Automation Data Base" and find out rapidly the potential market, and the names and addresses of persons and organizations who might well be interested in their products, equipment, and services. And customers will be able to dial into the data base, and find out sources of supply for things that they want.

For example, as a customer I want a simple little attachment to a KSR-33 teletype which will enable my DEC PDP-9 computer to impulse the teletype platen to roll back from 1 up to 10 lines or so. Then my computer can impulse the KSR 33 teletype to make a random X-Y graph for me, with positive Y (vertical axis) increments (accomplished by "roll back") as well as negative Y increments (accomplished by "line feed"). The company that makes the teletype flatly refuses to pay any attention to my need. Out of 3 or 4 other purchasing efforts so far, I have drawn a complete blank. But one day I should be able to dial into the data base, and find half a dozen companies looking for new products to design and offer, and then I can specify my need, and the price I am interested in, and buy the attachment.

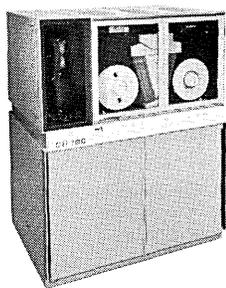
Not only in the field of computers and data processing will countrywide, computerized, automatic marketing appear. In many more fields besides, we can expect industry data bases so that sales directors and prospective customers can find each other effectively. Then the hit or miss methods and armchair methods of the present day will look as old-fashioned as they really are.

Edmund C. Berkeley

Editor



at COMPUTER INDUSTRIES
it happens for \$2,304* per month



And there are no special format requirements to play your tape, no reprogramming costs. Just put your tape on our Computer-Out-put-Microfilm (COM) System and it will play. Dual input format provides for either computer line printer (1403) simplicity or high speed (MICROMATION) mode.

There are no additional rental requirements for input tape decks or engineering interface to your

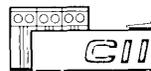
computer. Our systems are off-line, will read 7 or 9-track tapes, recorded at 556, 800, or 1600 bpi, and can be

located inside or outside the computer room for ready access to all users.

Computer Industries COM systems are built with optional capabilities that include MICROFICHE Camera; retrieval coding; and expandable character sets for special symbols, upper case letters, numeric, algebraic, or other unique characters.

**Standard Model 180 Microfilm Printer—price includes camera, tape deck, forms projection, horizontal and vertical tab capability, parity checking and automatic re-read feature (maintenance not included).*

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See us in Las Vegas at the FJCC, booths 1107-1114.

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Plan to attend Compso. The first regional computer software and peripherals shows for businessmen as well as DP men.

The COMPSO Regional Shows will be held in New York (N.Y. Hilton—January 19-21, 1970), Chicago (Palmer House—February 17-19, 1970), and Los Angeles (Anaheim Convention Center—April 7-9, 1970).

If you're a management man who's concerned with the efficient operation of your company's data processing installation, COMPSO will provide you with the latest information on equipment, software and services.

If you're in the management of a company that has not as yet found an efficient means of utilizing data processing, COMPSO will bring you up-to-the-minute on developments such as the new small computers, time sharing and data communications.

If you're a data processing professional, COMPSO will give you a convenient way to check on a broad range of new products and services tailored to meet the needs of your company.

COMPSO will also offer two technical seminars each day. One directed to data processing professionals. One for management. From these seminars, you'll have the opportunity to increase your knowledge of data processing and learn how you can broaden data processing applications in your company.

Plan to attend the COMPSO show in your area. There's no charge for admission to the exhibits if you pre-register. Send in the pre-registration form today and your badge will be waiting at the door.

PRE-REGISTRATION FORM: COMPSO, 37 W. 39th Street, New York, N.Y. 10018.

Please pre-register me for the following COMPSO show:

COMPSO East COMPSO Midwest COMPSO West
(Please print)

Name _____ Title _____

Firm _____

Address _____

City _____ State _____ Zip _____

Country _____

Occupation or Function.

Principal type of business.

Admin. Exec. Financial Officer Manufacturing Insurance
 Office Mgt. DP or Systems Mgt. Bank/Finance Printing/Publishing
 Other _____ Utility Trans./Comm.

Government Retail

I am interested in the seminars. Wholesale Institution/Service

Please send program and rates. Other

REGIONAL COMPUTER SOFTWARE AND PERIPHERALS SHOWS & CONFERENCES

COMPSO

EAST: NEW YORK CITY
MIDWEST: CHICAGO
WEST: LOS ANGELES

AS WE GO TO PRESS

CONTROL DATA CORP. (CDC) HAS "UNBUNDLED" AND RAISED PRICES; GENERAL ELECTRIC PLANS TO STAY "BUNDLED" — AND INCREASE PRICES. Following its July announcement that it was studying the possibility of unbundling, CDC has now decided to separately price its hardware, software, and services in the U.S. Support services which will be priced separately are: maintenance for lease systems, effective Oct. 1; and education and training services, systems and application analysts support services, and new standard software systems and programs, effective Jan. 1. CDC's new price schedules will be effective Oct. 1. Hardware price increases, including maintenance on lease systems, will average 5%. Existing lease customers will not be affected by the price increases until the expiration of the initial term of their lease contracts or Jan. 1, whichever comes later.

Just prior to CDC's announcement, General Electric announced it would not separate pricing for its hardware, software, and services, but that it would increase prices for its medium- and large-scale computer products and maintenance services. Price increases, which will apply to all contracts entered into on or after Oct. 1, range from 3% on purchase prices to 5.1% on rental rates for the GE-400 and GE-600 lines.

Thus the effect of IBM's June 23 unbundling continues to be felt. CDC has now joined IBM in setting up separate pricing formulas. GE, Univac, RCA, and Honeywell have announced their intentions to stay "bundled". (Honeywell also announced a 1% price increase on leased systems — and an increase of 30% in its planned expenditures for computer research in 1969.) Scientific Data Systems (currently undergoing a name change to Xerox Data Systems) is expected to unbundle soon. Burroughs announced some separate pricing on new systems shortly before IBM's announcement; NCR has not yet spoken out.

TWO MORE SUITS HAVE BEEN ADDED TO THE RAPIDLY GROWING LIST OF "SUITS PENDING" IN THE COMPUTER INDUSTRY. In the first, a \$2 billion patent suit was filed by Photo Magnetic Systems, Inc., Beltsville, Md., against American Telephone and Telegraph Co., International Business Machines, Chesapeake and Potomac Telephone Co., and Western Electric Co. The suit charged the companies with infringing on a computer-systems patent held by Peter James, chairman and president of Photo Magnetic. The system uses standard tone-generating telephones to control computers.

In the second suit, California Computer Products of Anaheim, Calif., filed a civil action against Simplicity Pattern Co., Inc. and its wholly-owned subsidiary, Graphical Technology Corp., charging infringement on a California Computer patent covering "method and apparatus for pattern data processing". Both defendants are New York corporations doing business in California.

WESTERN UNION EXPECTS TO SPEND UP TO \$500 MILLION BY THE MID-1970'S TO BUILD A NEW TYPE OF "NATIONAL COMPUTER-BASED COMMUNICATIONS COMPANY". In making the announcement, Russell W. McFall, Western Union's chairman and president, said: "In a scant two decades, communications has moved from an industry that has relied for more than a century almost solely on the telephone and telegraph into one that is based on the relatively revolutionary concept of total

ANNOUNCEMENT

"WHO'S WHO IN COMPUTERS, DATA PROCESSING, AND THE INFORMATION SCIENCES"

to be published jointly by the

NEW YORK TIMES

and

COMPUTERS AND AUTOMATION

Computers and Automation and the New York Times Book and Educational Division have agreed to publish jointly:

"Who's Who in Computers, Data Processing, and the Information Sciences" will be published annually. The regular annual subscription rate, for the present, will be unchanged. The first annual issue is scheduled to be published in three volumes in hard cover in January and will include upwards of 8000 capsule biographies. It will be typeset by computer, and the basic records will be accessible by computer codes. This takes the place of the 5th and later editions of "Who's Who in the Computer Field" heretofore planned.

The editors of Computers and Automation believe that this is a very favorable arrangement for the readers of Computers and Automation and other persons and users of "Who's Who in the Computer Field"; and we are delighted to have the cooperation of the New York Times, a world famous supplier and organizer of information, in improving and publishing "Who's Who in the Computer Field", which has now become "Who's Who in Computers, Data Processing, and the Information Sciences."

Interested persons are invited to subscribe before October 31 and to take advantage of the pre-publication offer stated on page 19.

integrated communications. As a result, the computer has become a basic and growing part...of the services we offer now and plan to offer in the near future." The proposed restructuring is the company's first in 118 years.

A SURVEY OF SALARIES FOR COMPUTER JOBS WAS RECENTLY COMPLETED BY THE BUREAU OF LABOR STATISTICS OF THE U.S. DEPARTMENT OF LABOR. The survey revealed average weekly salaries of from \$159.50 to \$133.50 for top computer operators, from \$275.50 to \$203 for top systems analysts (the highest paid job in the survey), and from \$228 to \$164 for top programmers. The survey was conducted in ten geographic areas throughout the U.S. between Sept. 1968 and April 1969. For each occupation, salary information was collected at three levels of job complexity.

Copies of the descriptions used to classify workers may be obtained by writing the Bureau of Labor Statistics, Washington, D.C. 20210, or one of its regional offices.

MULTI-ACCESS FORUM

DAILY SURVEILLANCE SHEET, 1987, FROM A NATIONWIDE DATA BANK

Dennie Van Tassel
 Head Programmer
 San Jose State College
 125 S. 7th St.
 San Jose, Calif. 95114

The "Daily Surveillance Sheet" below is offered as some food for thought to anyone concerned with the establish-

ment of the proposed "National Data Bank". Hopefully, it will help illustrate that *everyone* should be concerned.

NATIONAL DATA BANK
 DAILY SURVEILLANCE SHEET
 CONFIDENTIAL
 JULY 11, 1987

SUBJECT. DENNIE VAN TASSEL
 SAN JOSE STATE COLLEGE
 MALE
 AGE 38
 MARRIED
 PROGRAMMER

PURCHASES.

WALL STREET JOURNAL	.10
BREAKFAST	1.65
GASOLINE	3.00
PHONE (328-1826)	.10
PHONE (308-7928)	.10
PHONE (421-1931)	.10
BANK (CASH WITHDRAWL)	(120.00)
LUNCH	2.00
COCKTAIL	1.00
LINGERIE	21.85
PHONE (369-2436)	.35
BOURBON	8.27
NEWSPAPER	8.10

** COMPUTER ANALYSIS **

OWNS STOCK (90 PER CENT PROBABILITY)

HEAVY STARCH BREAKFAST. PROBABLY OVERWEIGHT.

BOUGHT 3.00 DOLLARS GASOLINE. OWNS VW. SO FAR THIS WEEK HE HAS BOUGHT 12.00 DOLLARS WORTH OF GAS. OBVIOUSLY DOING SOMETHING ELSE BESIDES JUST DRIVING THE 9 MILES TO WORK.

BOUGHT GASOLINE AT 7.57. SAFE TO ASSUME HE WAS LATE TO WORK.

PHONE NO. 328-1826 BELONGS TO SHADY LANE - SHADY WAS ARRESTED FOR BOOKMAKING IN 1972.

PHONE NO. 308-7928. EXPENSIVE MEN'S BARBER - SPECIALIZES IN BALD MEN OR HAIR STYLING.

PHONE NO. 421-1931. RESERVATIONS FOR LAS VEGAS (WITHOUT WIFE). THIRD TRIP THIS YEAR TO LAS VEGAS (WITHOUT WIFE). WILL SCAN FILE TO SEE IF ANYONE ELSE HAS GONE TO LAS VEGAS AT THE SAME TIME AND COMPARE TO HIS PHONE CALL NUMBERS.

WITHDREW 120.00 DOLLARS CASH. VERY UNUSUAL SINCE ALL LEGAL PURCHASES CAN BE MADE USING THE NATIONAL SOCIAL SECURITY CREDIT CARD. CASH USUALLY ONLY USED FOR ILLEGAL PURCHASES. IT WAS PREVIOUSLY RECOMMENDED THAT ALL CASH BE OUTLAWED AS SOON AS IT BECOMES POLITICALLY POSSIBLE.

DRINKS DURING HIS LUNCH.

BOUGHT VERY EXPENSIVE LINGERIE. NOT HIS WIFE'S SIZE.

PHONE NO. 369-2436. MISS SWEET LOCKS.

PURCHASED EXPENSIVE BOTTLE OF BOURBON. HE HAS PURCHASED 5 BOTTLES OF BOURBON IN THE LAST 30 DAYS. EITHER HEAVY DRINKER OR MUCH ENTERTAINING.

*** OVERALL ANALYSIS ***

LEFT WORK AT 4.00, SINCE HE PURCHASED THE BOURBON 1 MILE FROM HIS JOB AT 4.10. (OPPOSITE DIRECTION FROM HIS HOUSE.)

BOUGHT NEWSPAPER AT 6.30 NEAR HIS HOUSE. UNACCOUNTABLE 2 1/2 HOURS. MADE 3 PURCHASES TODAY FROM YOUNG BLONDES. (STATISTICAL 1 CHANCE IN 78.) THEREFORE PROBABLY HAS WEAKNESS FOR YOUNG BLONDES.

COMPUTER PROGRAMMER TRAINEES CAN'T FIND JOBS — COMMENTS

I. From Mr. Richard Bigelow
COSSECC (Connecticut Suburban and Shoreline
Educational Computer Center)
2040 Dixwell Ave.
Hamden, Conn. 06514

I am interested in the letter on page 40 of the August issue ("Computer Programmer Trainees Can't Find Jobs") written by Mrs. Helen Solem. What she says there confirms a suspicion which we had entertained for some time.

Do you concur in her conclusions which seem to be that students of low aptitude should not attempt to enter data processing and that there is little value in private computer schools as a means for preparing for entry level employment in the field?

If you feel that there is substantial worth in Mrs. Solem's letter, we would appreciate permission to reprint it as part of our Newsletter sent to public school guidance people and other concerned citizens throughout the State. Since Connecticut does sponsor worthwhile college level training courses in data processing at its technical institutes, the door is certainly not closed completely to such training by the exclusion of private schools. A word of caution about the private schools to some of the guidance counselors might encourage them to send likely prospects to the technical schools where they will receive a reasonable background in basic business principles in accordance with the suggestion in Mrs. Solem's letter.

II. From the Editor

I do agree with Mrs. Solem's conclusions that students of low aptitude should not be encouraged to try to learn computer programming. I think the key term in Mrs. Solem's comments is "computer programming *trainees*". The use of that term by a school should be a warning to people to carefully investigate the school, for what the school is really saying is that it will "train" people to become "trainees", which, of course, is quite primitive.

I am very sure that many private computer schools take much money from naive people and cheat them, knowing that they cannot be expected to qualify as good computer programmers. And unfortunately, this sometimes reflects on the really good private computer schools.

One way to judge a private computer school is to check its accreditation. Three agencies have been authorized by the Office of Education to accredit private computer schools. They are: the Accrediting Commission for Business Schools; the National Association of Trade and Technical Schools; and the National Home Study Council.

We are glad to give you permission to reprint Mrs. Solem's letter in the way you request, subject to including our customary reprint clause:

Reprinted with permission from *Computers and Automation*, August, 1969, copyright 1969 by and published by Berkeley Enterprises, Inc., 815 Washington St., Newtonville, Mass. 02160. □

"TALKING" TYPEWRITER HELPS MENTALLY HANDICAPPED CHILDREN LEARN

(Based on a report by Pamela Buonaventura in the August 14, 1969 edition of *The Times*, Printing House Square, London, E.C. 4, England)

A machine based on computer technology is being used in Britain by the National Society for Mentally Handicapped Children to help mentally handicapped children. In the United States, where the machine was originally used to teach normal children to read, the children dubbed the machine their "talking" typewriter.

The computer looks like a small upright piano, but has a keyboard like that on a typewriter. The child sits in a booth with the computer, and the teacher feeds in the learning programs from outside, and watches the child's progress by means of one-way mirrors and a telephone. If the child does not want to be alone, the teacher may leave the door of the booth open and pop his head around the door from time to time to talk to the child.

After a period of "free typing", the child is expected to carry out the computer's instructions. If it says "a", the child must press the key marked "a". If he presses the wrong one, the key locks and there is no response. The computer will continue to ask the child to type "a" until the child succeeds.

The great advantage of the machine is its limitless patience. For retarded children this is especially important, for they are slow to learn, and it creates a learning situation where the child is boss. The mentally retarded do not respond to what they see. Some of them cannot read or speak. But when they are put in front of the talking typewriter, they see a computer responding to them. As soon as the child sees himself as the master and the typewriter (backed by the computer) as the slave, he is able to begin to learn.

Another advantage of the computer is that it provides multiple learning. Take the word cow. The child sees a slide of a cow, sees the word cow printed before him, learns eventually that the letters "c", "o", and "w" are printed on the keys in front of him, and hears a voice saying cow.

David V. Moseley, who runs the Society's Centre for Learning Disabilities in London, is optimistic about these "press-button" teachers: "Our first pieces of work here show the computer is as good as the best individual teacher. Where it comes into its own is with children who have not responded to other types of teaching."

A case history supports his optimism. There was one boy who could read only one word when he came to the Centre at the age of seven years and seven months. He could not put two sounds together. He could not remember three sounds in a sequence, and he had difficulty in recognizing shapes. He had not responded to individual treatment and was very tense. He used to ask, "Is that right?" after everything he tried. The computer helped him because it rapidly reassured him when he pressed the right letters. This gave him confidence and after a year he had reached a spelling age of six years six months, and a reading accuracy of seven years.

About 40 children have used the computer since the Centre was opened in January, 1968. The Centre has begun to find out if the machine can help severely sub-normal children.

Two limitations are currently holding research back. The first is a shortage of the necessary software specially suited to the needs of the handicapped—the staff at the Centre has had to supply their own software to teach letters, based on diagnostic tests. The second limitation is that the computer now being used has a poor frequency range. It was designed for continuous speech training, but is less good for the whole range of sounds the handicapped children need to recognize. In addition, at present, children have to wait ten seconds to hear their voice repeated after they have been asked to say something. An instant replay, it seems, would prevent them from becoming bored.

While these limitations need to be remedied, it is reassuring that an industry whose business is concerned with communications is helping those people whose handicap is communicating. □

SPECIAL INTEREST COMMITTEE ON COMPUTERS AND SOCIETY ESTABLISHED BY THE COUNCIL OF THE ASSOCIATION FOR COMPUTING MACHINERY

**The Association for Computing Machinery
1133 Avenue of the Americas
New York, N.Y. 10036**

A Special Interest Committee on Computers and Society (SICCAS) was established by the Council of the Association for Computing Machinery at its August 26th meeting in San Francisco. The new SIC will work "in areas where the computer in the operation of society has or may have prime importance". A specific objective of the Committee is "furthering an understanding of how the structure and operation of society may be affected, positively or negatively, by the development and application of computers and automata".

After the Council action, President Bernard Galler announced the appointment of Robert P. Bigelow as chairman of SICCAS. Mr. Bigelow, a lawyer, was one of those members who worked in regard to the establishment of the Committee; he is also one of the 1969-1970 National Lecturers of the ACM.

Bigelow said that he was honored by being selected for the chairmanship and would do his best to have SICCAS make a meaningful contribution. The first meeting of the Committee—open to all who are interested—will be in the International Room (East) of the Stardust Hotel in Las Vegas, Nevada, at 8:00 p.m. on November 18th during the Fall Joint Computer Conference. It is hoped to present a speaker as well as to accomplish Committee business.

One of the major projects of SICCAS in its first year will be a newsletter, under the editorship of Grenville R. S. Bingham of Project MAC, Mass. Inst. of Technology, Cambridge, Mass. Study Committees are being established on: Data Banks and Privacy; Jobs and Automation; and Education of Non-Computer People about Computers. A liaison committee under M. H. Schwartz of the A.E.C. has been set up to provide an interface with organizations outside ACM who have an interest in topics within the fields of the Committee's interests.

Under the ACM constitution, Special Interest Committees are established for a one-year period by Council action, and, unless extended by the Council, expire at the end of the year. However, a Special Interest Group, whose establishment requires a petition by 100 full members of the Association, is a self-supporting organization which does

not need annual Council action. One of the objectives of SICCAS is to become a SIG.

Anyone who is interested in working with SICCAS should write to Robert Bigelow at 28 State Street, Boston, Mass. 02109.

AFIPS ESTABLISHES PUBLISHING OPERATION

H. G. Asmus, Executive Secretary
American Federation of Information
Processing Societies (AFIPS)
210 Summit Ave.
Montvale, N.J. 07645

The American Federation of Information Processing Societies (AFIPS) has established a publishing operation, AFIPS Press, to serve the computing and information processing field.

AFIPS Press will provide all required coordinating and management functions necessary for publication of proceedings of the Spring and Fall Joint Computer Confer-

ences, as well as additional AFIPS proceedings, reports, brochures and information booklets.

AFIPS Press is planning to make available copies of all Joint Computer Conference proceedings since the inception of the conferences in 1951. Investigations are underway to examine the possibility of making the proceedings available on either microfilm or microfiche.

AFIPS publishing services will also be made available to constituent societies on an as-required basis. AFIPS, through its 10 constituent societies, represents over 100,000 professionals engaged in the advancement and application of computer technology.

ABSTRACTS OF INDUSTRIAL ENGINEERING RESEARCH SOUGHT

Dr. Jay Goldman, Chairman
Research Information Committee
American Institute of Industrial Engineers, Inc.
Dept. of Industrial Engineering
University of Missouri
Columbia, Missouri 65201

Once a year the Research Information Committee of the American Institute of Industrial Engineers requests that research sources throughout the world submit abstracts of research performed in the field of Industrial Engineering. Sources from which abstracts have been obtained include universities, industrial organizations, research institutions, and non-profit organizations, including government agencies and professional societies. These research abstracts are published annually in The Journal of Industrial Engineering and provide a valuable service to both industry and universities. Research abstracts are collected in the areas of:

Work Measurement
Methods
Plant Engineering
Human Engineering
Engineering Economics
Organization Planning
Industrial Statistics
Production Control
Data Processing
Operations Research
Cost Analysis
Industrial Engineering Education

The Committee would appreciate receiving abstracts of any Industrial Engineering research, past and present, which have not been published to date. Standard abstracting forms may be obtained by writing to the address above.

IFIP WORLD CONFERENCE ON COMPUTER EDUCATION — CALL FOR PAPERS

D. H. Wolbers, Chairman
Program Committee
IFIP Computer Education 1970
6 Stadhouderskade
Amsterdam, 13, Netherlands

A World Conference on Computer Education is to be held in Amsterdam, Netherlands August 24-28, 1970. The Conference is being sponsored by the International Federation of Information Processing Societies through its Technical Committee for Education and Administrative Data Processing Group.

The program for the Conference is being developed on

the following themes: computer education at secondary school, junior college, and university levels; curricula and examinations; teacher training; computer appreciation for everyone; responsibility of governments for computer education; and educational technology, including computer-assisted instruction. Papers are invited on all topics relating to these themes.

A draft paper or an abstract should be submitted to the Program Committee no later than Nov. 1, 1969. The title of the paper and the author's name, affiliation, city, state, mail address and telephone number should be given on the first page. Draft papers and/or abstracts should be sent to the address above.

1969 COMPUTER DIRECTORY AND BUYERS' GUIDE: SUPPLEMENT

The following information is a supplement to, or a correction of, information published in the COMPUTER DIRECTORY AND BUYERS' GUIDE, 1969 (the June 30, 1969 Mid-year issue of Computers and Automation). Part I contains entries in the "Roster of Organizations in the Electronic Computing and Data Processing Industry"; Part II contains entries in the "Roster of College and University Computer Facilities".

Key to Abbreviations

*C 69 - information "compiled" in 1969
 Sv - computing and data processing services
 Tl - commercial time-shared computing services
 Tr - commercial courses, training, seminars, or instruction in computing, programming, or systems
 Co - consulting services in the computer field
 Le - lease data processing equipment to the computer field
 Sf - sell or produce software
 S - size (number of employees)
 E - established (year organization was established)

We expect to mail out entry forms for the 1970 COMPUTER DIRECTORY AND BUYERS' GUIDE in February, 1970. If you wish to be certain that you receive an entry form for your organization, please send your name, organization name, and address to: 1970 Directory Editor, COMPUTERS AND AUTOMATION, 815 Washington St., Newtonville, Mass. 02160

I. ROSTER OF ORGANIZATIONS IN THE ELECTRONIC COMPUTING AND DATA PROCESSING INDUSTRY

A

ATLANTIC INFORMATION SYSTEMS, 100 E. President St., Savannah, GA 31402 / (404) 233-9363 / *C 69

Commercial service bureau, management consulting, education; equipment is IBM 360/40 with 131K memory / Sv Ti Tr Co Sf / S 55 / E 69

AUTOMATED ACCOUNTING SERVICES, INC., 1306 McPherson St., P.O. Box 865, Port Huron, MI 48060 / (313) 982-6261 / *C 69

Data processing services for payroll, accounts receivable, inventory and statistical analysis. Unit record equipment with access to outside IBM 360/20 / Sv / S 3 / E 67

AUTOMATED INFORMATION, Inc., 309 S.W. 4th Ave., Portland, OR 97204 / (503) 223-2139 / *C 69

Consultants in management information systems, engineering, statistical and management science applications of computers. Perform computer planning studies, contract programming, critical path scheduling and work with inventory control systems / Sv Tr Co Sf / S 4 / E 63

AUTOMATION INSTITUTE OF SAN FERNANDO VALLEY, 14003 Ventura Blvd., Sherman Oaks, CA 91403 / (213) 981-5100 / *C 69

Training in computer programming/systems; key punch training also offered / Sv Tr / S 25 / E 66

B

BRACA SYSTEMS, INC., 2450 Adie Rd., Maryland Hgts, MO 63042 / (314) 432-6265 / *C 69

Sell Monrobot XI computer; provides business reports, disbursements, total accounting, payroll services. Uses Monrobots XI, Dura, Addo-X / Sv Co Le Sf / S 5 / E 68

C

COMMERCIAL COMPUTER SERVICES INC., 210 W. 6th St., Ft. Worth, TX 76102 / (817) 335-6411 / *C 69

Provide consulting, systems design, programming, installation management, application processing, computer time sales. Has 4 S/360 30's and two others under contract / Sv Ti Tr Co Le Sf / S 67 / E 68

COMMONWEALTH DATA SERVICES, INC., 5001 W. Broad St., Richmond, VA 23230 / (703) 288-6045 / *C 69

Provide computing and DP services to commerce and industry; systems and programming for federal, state and local government; education, training, seminars, management facilities, consulting / Sv Ti Tr Co Sf / S 15 / E 69

COMPUTER AND BUSINESS MACHINE SCHOOL, 276 Genesee St., Utica, NY 13502 / (315) 735-5201 / *C 69

Education facilities / Sv Ti Tr Co Sf / S 7 / E 60

COMPUTER AND BUSINESS MANAGEMENT, INC., (CBM), 1407 N. Main Ave., San Antonio, TX 78212 / (512) 224-5838 / *C 69

Computer leasing; provides systems design, programming, testing and implementation, documentation, application software, computer services; seminars and courses in computing, programming and systems / Sv Tr Co Le Sf / S 30 / E 68

COMPUTER & BUSINESS MANAGEMENT, INC., 24700 Chagrin Blvd., Cleveland, OH 44122 / (216) 464-9960 / *C 69

Software work, both the sale of packages and large contracts for business and government; computer leasing; data processing education / Sv Tr Co Le Sf / S 32 / E 68

COMPUTER TRANSCIEVER SYSTEMS, INC., 123 Pleasant Ave., Upper Saddle River, NJ 07458 / (201) 825-0820 / *C 69

Design, develop and manufacture portable data communication terminals, high-speed page printer terminals, magnetic tape memory units and display terminals / S 40 / E 68

CONSULTANTS ASSOCIATED, INC., Lakeside Office Park, North Ave., Wakefield, MA 01880 / (617) 245-0148 / *C 69

Management consulting, systems analysis and design programming services; development and marketing of software packages; education seminars; facilities management / Sv Tr Co Sf / S 15 / E 66

COOPER COMPUTER SERVICES, 14003 Ventura Blvd., Sherman Oaks, CA 91403 / (213) 872-0131 / *C 69

Systems design, consulting, programming, service bureau; EDP training / Sv Tr Co Sf / S 15 / E 68

D

DACONICS, INC., 505 W. Olive Ave., Suite 300, Sunnyvale, CA 94086 / (408) 732-2634 / *C 69

Manufacture computer systems for data communications and data acquisition systems; provide special systems using components from other manufacturers as well as own / Co Le / S 25 / E 68

DATA CENTRAL INC., 2500 39th St., N.E., Minneapolis, MN 55421 / (612) 788-8627 / *C 69

Provides facilities management, management consulting, applications analysis and programming, computer service operations, EDP training, management sciences, used equipment leasing, franchising, employment agencies and services / Sv Tr Co Le Sf / S 70 / E 69

DATA CENTRAL INSTITUTES, Subsid. of Data Central Inc., Minneapolis, 728 El Camino Real, Redwood City, CA 94062 / (415) 369-6226 / *C 69

Training in computer programming, key-punching, computer operations, software documentation; typing and keypunch services / Sv Tr / S 9 / E 69

DATA DOCUMENTS/INC. (executive office), 105 South 70th St., Omaha, NB 68132 / (402) 558-5700 / *C 69

Manufacture and sell data processing supplies including punched cards, continuous forms, pressure sensitive labels, magnetic tape, computer ribbons, forms binders / S 600 / E 58

DATA PROCESSING CONSULTANTS, INC., 771 Valley St., Seattle, WA 98109 / (206) 282-1550 / *C 69

Provides systems consulting, DP consulting, systems design, programming, computer processing, EDP applications packages, software programming; also EDP facilities management, computer time brokering, systems planning, EDP reviews and studies, hardware and software evaluations. Have IBM 1440 Disc, IBM 360/25, IBM 360/30, card, disc and tape / Sv Ti Tr Co Sf / S 10 / E 68

E

EXECUTIVE COMPUTER SYSTEMS, 1121 W. 22nd St., Oak Brook, IL 60521 / (312) 325-6040 / *C 69

Provide systems support, facilities management, software education, processing management; environmental construction, equipment leasing / Sv Tr Co Le Sf / S 75 / E 67

F

FACTS, INC., 345 Hudson St., New York, NY 10014 / (212) 924-0414 / *C 69

Data processing service firm specializing in financial applications, such as portfolio analysis and appraisal; stock market analysis; the sale of stock market data in machine rentable form. Use CD 3100 which is interfaced to the Ultronic Systems Stockmaster Computer. Design systems, programs, and operate reporting systems / Sv Sf / S 40 / E 64

FINLEY, HOWARD, CORP., 6400 Westpark, Houston, TX 77027 / (713) 785-4549 / *C 69

Technical management consultants specializing in total system analysis, system development and operations research. Capability in computer simulation, linear programming, dynamic programming, data reduction and analysis / S ? / E 66

FISCHBACH, McCOACH & ASSOC., INC., 30 E. 42nd St., New York, NY 10017 / (212) 682-5696 / *C 69

Provides data processing and computer technology including development, evaluation and implementation of advanced systems and related communications; logical design and specification for new equipment; operations research; information retrieval; numerical and statistical analysis for scientific computing; market research; economic and feasibility studies; organization studies; contract preparation; recruitment; personnel appraisal / Sv Tr Co Sf / S 12 / E 59

I

INFORMATION SYSTEMS MANAGEMENT, 1201 Jadwin Ave., P.O. Box 839, Richland, WA 99352 / (509) 946-9605 / *C 69

Design, develop and market generalized data management systems, text management systems. Consulting in same areas plus time-sharing and facility management / Sv Co Sf / S 30 / E 68

INSTITUTE OF COMPUTER TECHNOLOGY, 121 N. President, Jackson, MS 39201 / (601) 948-2405 / *C 69

IBM-oriented programming school; teach BAL, RPG, COBOL, FORTRAN, and PL/I using various IBM System/360 installations / Tr / S ? / E ?

C.a BOOK REVIEWS

Neil Macdonald
Assistant Editor
Computers and Automation

We publish here citations and brief reviews of books which have a significant relation to computers, data processing, and automation. We shall be glad to consider any book in this category for future reviews if a review copy of the book is sent to us.

Each entry below contains: author or editor / title / publisher / date, hardbound or softbound, number of pages, price / comments.

If you write to a publisher or author, we would appreciate your mentioning *Computers and Automation*.

Entelek Inc., Compiler / Computer-Assisted Instruction Guide / Entelek Inc., 42 Pleasant St., Newburyport, Mass. 01950 / 1968, softbound, 160 pp., \$?

This book answers the question, "What CAI programs are actually operational and available?"

The Guide contains the specifications of all operational CAI programs that have "come under Entelek's surveillance" since the inception of the "CAI Information Exchange." The Guide contains three sections: Preface, How to Use This Book, and the Data Bank; and indexes by subject, title, language, computer and source.

Although this book's pages are not numbered, the entries are numbered, and can be found without trouble via the indexes. This guide is an indispensable ref-

erence for persons interested in computer-assisted instruction, giving a great deal of information about what is available and under what conditions. The book is an outgrowth of a contract from the Office of Naval Research to Entelek.

Kinter, Paul M. / Electronic Digital Techniques / McGraw-Hill Book Co., 330 W. 42 St., New York, N. Y. 10036 / 1968, hardbound, 315 pp., \$11.95

This book gives an exposition of electronic digital technology. It is non-mathematical. It is concerned with actual design problems and the techniques for their solution. The book considers input-output problems characteristic of almost all digital systems. It provides a

comprehensive introduction to electronic digital techniques practically oriented for the working engineer or technician. The 12 chapters in the book include: The Synthesis of Logic Operations, Electronic Digital Circuits, Logic Design Applications, Time-Based Logic Signals and Pulse Generators, Rate Scalars on Multipliers, Input-Output Translation. There is an index.

The author is Manager, Digital Systems and Product Development, Industrial Systems Division, Cutler Hammer Inc.

The book seems to be full of useful and practical information for those persons interested in or needing to design digital electronic circuits, although this is a narrow field.

L

LAMBDA CORP., 1501 Wilson Blvd., Arlington, VA 22209 / (703) 528-8200 / *C 69
Provide systems analysis, operations research, management science; have computing services only in connection with consulting in computer based analysis systems; general purpose software packages / Co Sf / S 50 / E 64

M

McLAUGHLIN, GEORGE S., ASSOC., INC., 785 Springfield Ave., Summit, NJ 07901 / (201) 273-5464 / *C 69
Purchase, sell and lease 2nd and 3rd generation computers and components / Sv Co Le / S 6 / E 66
MUTUAL COMPUTER SERVICES INC., 5531 Dyer St., Dallas, TX 75206 / (214) 368-3631 / *C 69
Real time airline reservations - message switching with Dual IBM 360/65 computers / Sv Tr Co Le Sf / S 47 / E 68

N

NATIONAL KEYPUNCH SERVICES, INC., 430 Oak Grove, Minneapolis, MN 55403 / (612) 332-6596 / *C 69
Input specialists serving the computer and microfilm industries; keypunching, microfilming, typing/optical scanning. Branch operations in Washington, D.C. area / Sv Co Sf / S 89 / E 65

O

OPTICAL SCANNING CORP., 332 East St., Box 40, Newtown, PA 18940 / (215) 968-4611 / *C 69
Manufactures and sells mark readers, character readers and hand block print readers outputting to cards or magnetic tape / Sv Le / S 600 / E 63
OPTIMAL COMPUTER SERVICES, INC., 485 Fifth

Ave., New York, NY 10017 / (212) 986-2900 / *C 69

EDP consultants, primarily in operations analysis; also, systems analysis, programming, and software development / Sv Tr Co Sf / S 10 / E 69

Q

QICSYS SYSTEMS, INC., 128 West 58th St., Bayonne, NJ 07002 / (201) 437-9363 / *C 69
Manufacture modular plug in hardware and related solid state control components for building general and special purpose controllers. Provide complete turn-key systems / Co / S 20 / E 69

R

RFL INDUSTRIES, INC., Powerville Rd., Boonton, NJ 07005 / (201) 334-3100 / *C 69
Manufactures and supplies complete line of data communications equipment including Bell compatible data sets (modems), multiplexers, equalizers, telemetering systems, and other related equipment / Sv Le / S 350 / E 22
RESEARCH EDP, INC., 277 Broadway, New York, NY 10007 / (212) 227-7522 / *C 69

With various IBM equipment, create data bases for research analysts; speciality includes questionnaire development, sample selection, and all phases of processing data through documentation of our work / Sv Co Sf / S 20 / E 68

S

SUMMIT COMPUTER CORP., 785 Springfield Ave., Summit, NJ 07901 / (201) 273-6900 / *C 69
Broker, deal and lease used data processing systems and components / Sv Le / S 6 / E 66

T

TAURUS ASSOC., 300 N. Lee St., Alexandria,

VA 22314 / (703) 548-2103 / *C 69

Provide consulting, systems and applications, contract programming, application software; specialities include information storage and retrieval systems, automated microform systems, production and inventory control / Sv Co Sf / S 15 / E 68

TECTONICS, INC., 215 N. Aurora St., P.O. Box 848, Ithaca, NY 14850 / (607) 273-5555 / *C 69

Provide scientific computing, business data processing, special applications in building industry, contract programming, education, facilities planning and design. Use IBM 1130, 360/20 (future 360/25) / Sv Tr Co Sf / S 20 / E 66

II. ROSTER OF COLLEGE AND UNIVERSITY COMPUTER FACILITIES

B

BOSTON UNIVERSITY, Commonwealth Ave., Boston, MA 02215 / *C 69
USE: admn / EQPM: IBM 360/40, 4 tapes, 4 disks (2311), plus EAM / COURSES: none / S 35 / E 60
BOSTON UNIVERSITY COMPUTING CENTER, 111 Cummington St., Rm. 3, Boston, MA 02215 / *C 69
USE: educ, res / EQPM: IBM 360/50H, 27 2741 terminals, 8 2260 terminals, 5 2314 disks. Operates under RAX with 27 2741 terminals, 8 2260's / COURSES: 19 courses in Comp Sci / S 12 / E 56

N

NEW YORK STATE UNIVERSITY COLLEGE at OSWEGO, Culklin Hall, Oswego, NY 13126 / *C 69
USE: admn, educ, res / EQPM: IBM 1130, 5 disk drives, 2501 reader, 1403 printer, 1627 plotter / COURSES: Prin of Computing, Comp and Prgmng, Bus Prgmng, Num Meth, Information Processing, etc. / S 15 / E 63

Who's Who in Computers, Data Processing, and the Information Sciences — Entries

Who's Who in Computers, Data Processing, and the Information Sciences will be published jointly (as an annual publication) by Computers and Automation and the New York Times Book and Educational Division. The first annual issue is scheduled to be published in three volumes in hard cover in January, 1970, and will include upwards of 8000 capsule biographies; the three volumes are scheduled as follows:

- Vol. 1 — Systems Analysts and Programmers
- Vol. 2 — Data Processing Managers and Directors
- Vol. 3 — Other Computer People

Following are sample capsule biographies which will be published in the first annual edition of Who's Who in Computers, Data Processing, and the Information Sciences:

Special Abbreviations	Main Interest Abbreviations
b: born	A Applications
ed: education	B Business
ent: entered computer field	C Construction
m-i: main interests	D Design
t: title	L Logic
org: organization	Mg Management
pb-h: publications, honors, memberships, and other distinctions	Ma Mathematics
h: home address	P Programming
	Sa Sales
	Sy Systems

PAGEN, Dr. John / director - CAI project / b: 1926 / ed: BS; MEd; EdD / ent: 1967 / m-i: A P Sy; computer assisted instruction / t: director - INDICOM / org: Waterford Township School District, 3101 W Walton, Pontiac, MI 48055 / pb-h: AERA; Phi Delta Kappa; MASA; AASA; reports on CAI / h: 463 Berry-patch, Pontiac, MI 48054

PALM, John N. / EDP management / b: 1938 / ed: BA, math / ent: 1957, part time; 1960, full time / m-i: P Sy; management of systems, programming, operations, etc. as applied in solving retail problems / t: vice president, information systems / org: Target Stores, Inc., 8700 W 36 St, Minneapolis, MN 55426 / pb-h: CDP, SPA / h: Route 1, Box 27, Wayzata, MN 55391

PALMER, Dennis W. / EDP mgr / b: 1937 / ed: 2 yrs college / ent: 1959 / m-i: Mg P Sy / T: EDP mgr / org: Protected Home Mutual Life Ins Co, 30 E State St, Sharon, PA 16146 / pb-h: DPMA, SPA, CDP / h: Rt 3, Box 700, Corland, OH 44410

PALMER, Fred E. / systems & programming / b: 1935 / ed: 3 years college / ent: 1960 / m-i: A B P Sy / t: manager of programming / org: Western Farmers Association, 201 Elliott Ave W, Seattle, WA 98119 / pb-h: CDP, DPMA / h: 19611 62nd NE, Seattle, WA 98155

PAN, George S. / senior technical management / b: 1939 / ed: BSEE, Illinois, MSEE, Syracuse / ent: 1960 / m-i: A Mg Ma P Sy; simulation / t: director, management sciences division / org: Interactive Sciences Corp., 170 Forbes Rd, Braintree, MA 02184 / pb-h: "Weighted File System Design Method", 1965 IBM National Systems Symposium, "Generalized File Structure and Optimum Design Considerations", 5th Nat'l Computer Conference of Canada / h: 5146 N 11th Ave, Phoenix, AZ 85013

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6. Your Main Interests?

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Business	()	Programming	()
Construction	()	Sales	()
Design	()	Systems	()
Logic	()	Other	()
Management	()	(Please specify)	
7. Year of Birth? _____
8. Education and Degrees? _____
9. Year Entered Computer Field? _____
10. Occupation? _____
11. Publications, Honors, Memberships, and other Distinctions? _____

(attach paper if needed)

12. Do you have access to a computer? () Yes () No
 - a. If yes, what kind of computer?

Manufacturer?	_____
Model	_____
 - b. Where is it installed:

Manufacturer?	_____
Address?	_____
 - c. Is your access: Batch? () Time-shared? () Other? () Please explain: _____
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SAMPLE CAPSULE BIOGRAPHY (many abbreviations expanded)

CHAPIN, Ned / consultant / born: 1927 / educ: PhD, IIT; MBA, Univ of Chicago / entered computer field: 1954 / main interests: applications, business, logic, management, programming, systems, data structures / title: data processing consultant / organization: InfoSci Inc, Box 464, Menlo Park, CA 94025 / publications, honors: 3 books, over 50 papers; member, over 12 assoc; CDP; lecturer for ACM / home address: 1190 Bellair Way, Menlo Park, CA 94025

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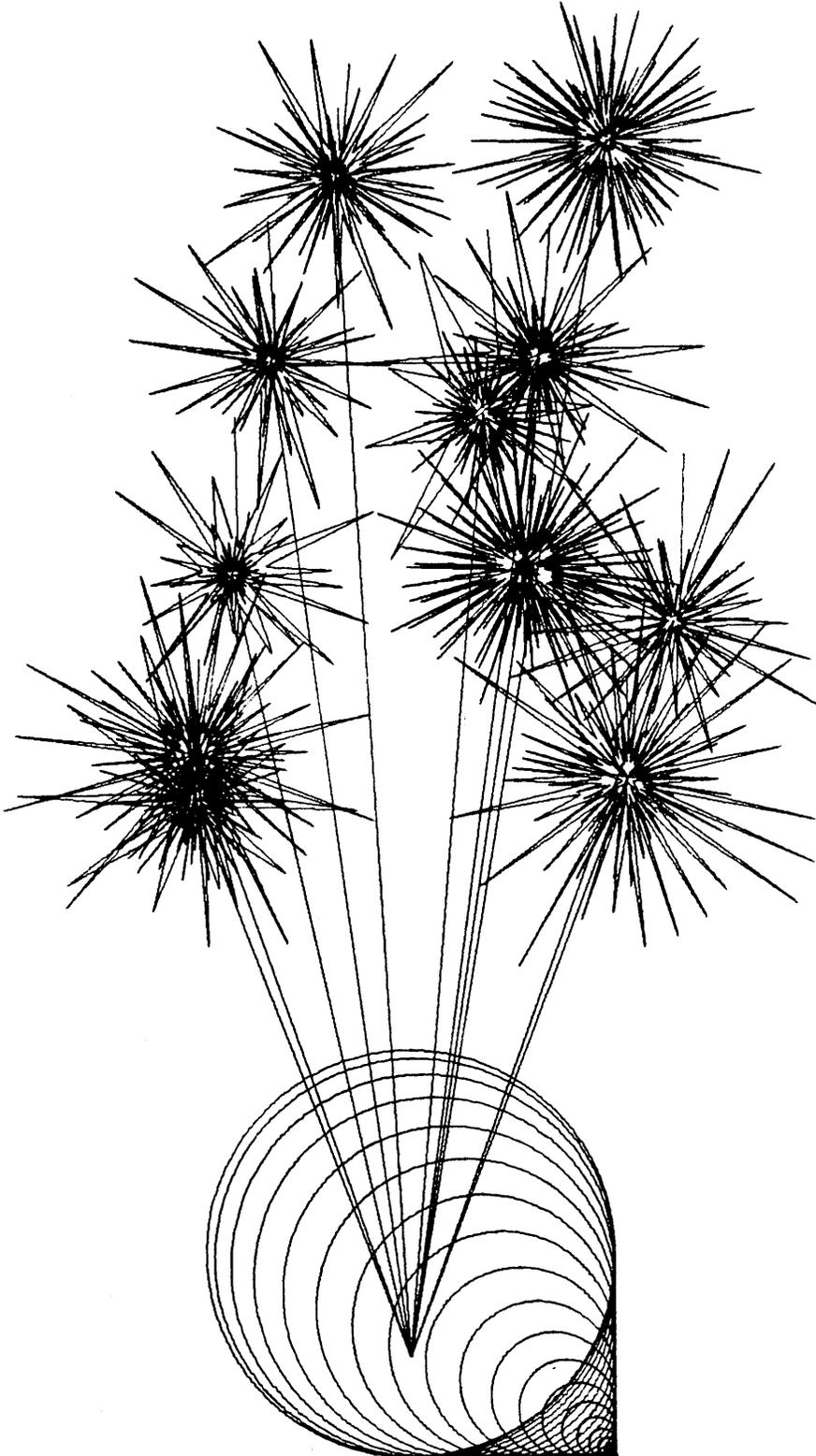
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COMPUTER ART

The Seventh Annual Computer Art Contest of *Computers and Automation*, presented in our August, 1969 issue, set a new record: more than 165 pieces of computer art were received. Because only a fairly small number of the 165 could be published in the August issue, we are

including a number of the other entries as a Computer Art Department in each issue.

For August, 1970, we plan our Eighth Annual Computer Art Contest. We cordially invite entries from all our readers, and from all others who are interested in computer art.



DAISIES

— William A. Carpenter
University of Virginia
10-6 Copeley Hill
Charlottesville, Va. 22904

This drawing was programmed in ALGOL on a Burroughs 5500 computer, and drawn with a CalComp 570 plotter. The location of each flower is randomly chosen. Then three star-like figures are drawn at each location so chosen by randomly moving the pen out and back from the center of each flower within controlled limits. Each of the three successive figures is smaller than the last by a controlled random amount. The modernistic flower pot is made up of a simple rectangle and a series of successively smaller circles having a common origin.

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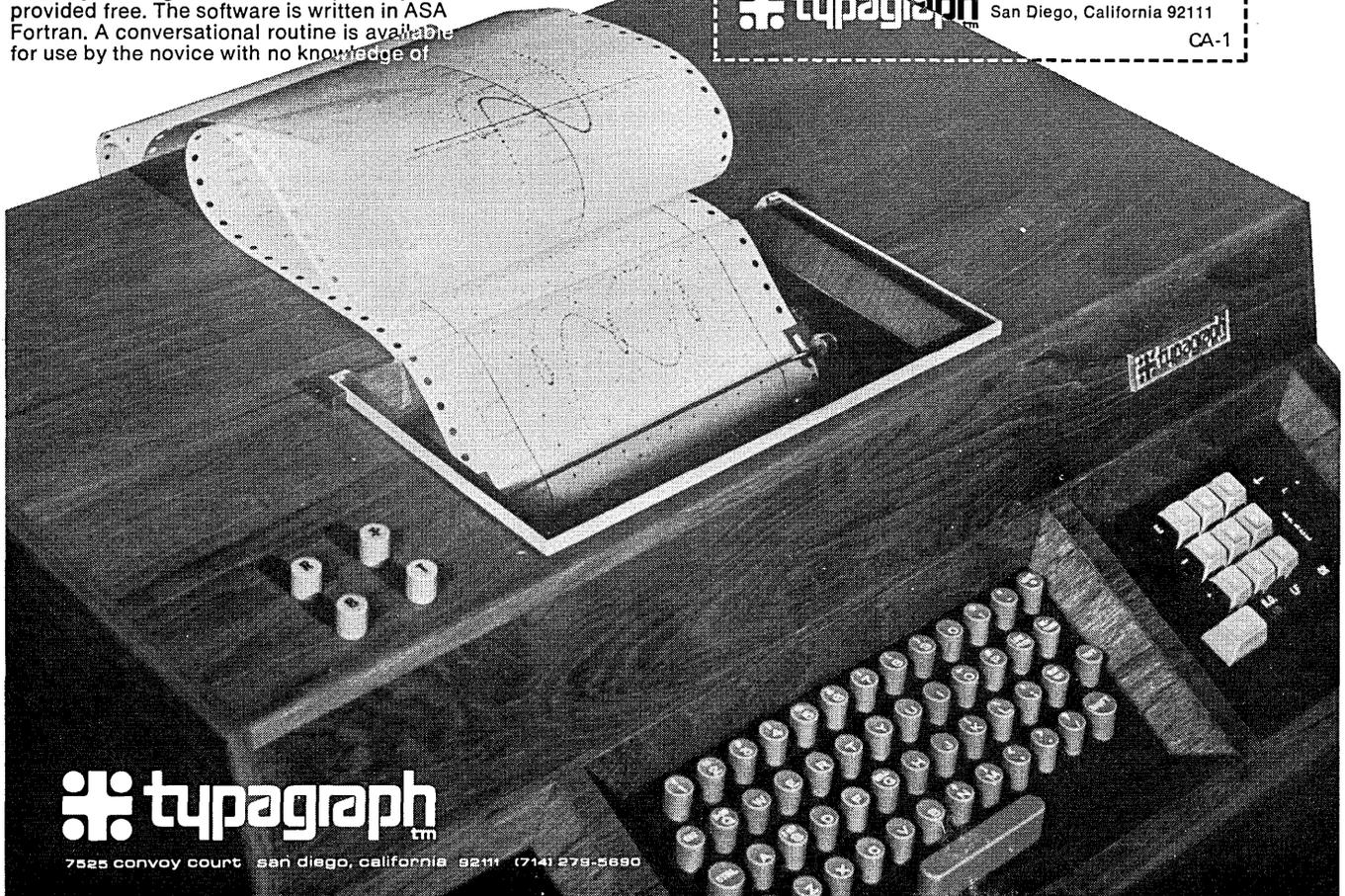
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HOW A POWERFUL TIME SHARING SYSTEM BECAME INDISPENSABLE

*Monroe M. Spierer and Robert D. Wills
System Development Corp. (SDC)
2500 Colorado Ave.
Santa Monica, Calif. 90406*

The original SDC Time-Sharing System (TSS) was developed in order to test experimentally the concept of allowing a large, diverse community of users to share the resources of a single centralized computer system.* Although the idea of time sharing seemed workable in theory, it remained to be seen what effect on-line operation would have on both human and computer productivity, and how it would affect the number and type of applications. The system was placed in operation in June, 1963, after roughly six months of developmental work. Initially, it provided only eight teletype terminals, and—due to its constant modification—was relatively unstable. Since that time, TSS has grown steadily in size and power, and has constantly expanded the range and quality of services offered to users.

Hardware Facilities

Hardware facilities provided by the system include the Q-32 computer, which is a large 7090-type machine designed for use in SAGE; five 16,384-word core memory banks; a PDP-1 computer which serves as an input/output preprocessor; and IBM 1401 computer used for off-line printing; large amounts of bulk storage; and numerous input/output devices and terminals, including six displays and a RAND tablet. At present, there are 53 communication channels available that can handle approximately 48 physical terminals simultaneously. One of these provides a network link with the TX-2 computer located at Lincoln Laboratory in Massachusetts.

Software

Software resources available to the Q-32 user include the executive, which resides permanently in one 16,384-word core module; a large number of utility programs and service routines; and a diversified set of application programs. The time-sharing executive handles the tasks of scheduling object programs, interpreting commands, assigning core and auxiliary storage, performing input/output message control, managing system loads, performing accounting functions, and recovering from errors. The utility programs include numerous language processors such as JOVIAL, IPL-V and LISP compilers, a teletype interpreter (TINT), an assembler (SCAMP), and several metacompilers (META, META5, DBL), as well as a wide variety of routines that allow programmers to edit and debug programs, manage program and data files, and gain information on-line about their programs or the use of the TSS.

*Development of TSS for the Q-32 was sponsored by the Advanced Research Projects Agency of the Department of Defense.

The Q-32 user community initially consisted of about 50 authorized users who were located at SDC in Santa Monica; simultaneous access was provided for eight users. During the period when the Q-32 was supported entirely by ARPA, the number of authorized users was as high as 500, over half of which operated the system from remote locations. The largest number of simultaneous users during that period was 31. Since November, 1966, the average number of simultaneous users during daily working hours has been about 20, and the total user population has been approximately 200.

Applications

When the initial version of TSS was released, the only application available was that of on-line programming and checkout (although the system was designed to be general purpose). About a year later, the system was being used to support a variety of other applications, including the ARPA/SDC Command Research Laboratory's work on behavioral gaming and simulation of military command/control systems, retrieval of medical and police data, processing of natural and artificial languages, and manipulation of large data bases via CRT display⁸.

Currently, there are about 175 different application programs running under TSS each week. In a typical week there are between 2500 and 3000 console sessions, and about 1200 hours of terminal time are used. Roughly half of the users are remote from SDC, located in one of the 17 external organizations authorized to use the Q-32. The largest external users are the Department of Defense and the U.S. National Institutes of Health, and the National Bureau of Standards; educational groups such as the Southwest Regional Educational Laboratory and the University of California; and industrial users such as the McDonnell Douglas Aircraft Company. To the original list of application areas, the following have been added: general-purpose data management; document and text retrieval; computer-aided instruction, counseling, and school administration; and on-line data reduction and analysis.

In general, applications supported by the TSS can be characterized in four ways. First, most of them are aimed at solving symbolic data handling problems rather than problems involving large amounts of numerical data. This is in contrast with most commercially available time-sharing systems, which support principally scientific and engineering applications. Second, many of the "program systems"

“When the initial time sharing system was released six years ago, the only application available was that of on-line programming and check-out. Currently, there are about 175 different application programs running under the system each week, with between 2500 and 3000 console sessions, and about 1200 hours of terminal time used.”

running on the Q-32 (which can be considered applications) are generally applicable to a variety of problems and data, rather than being specifically task-oriented, as are most commercial applications. Third, while users are applying the tools available under TSS to the solution of pressing every-day problems, these same tools are being simultaneously tested and improved by research workers at SDC. Also, new tools—such as programming languages, processors, and programming aids—are continually being developed, without tying up all the resources of the system. A fourth and final characteristic of TSS applications is that they tend to show the greatest pay-off for highly interactive problems—that is, in situations where the speed and accuracy of the computer can be combined with the adaptability and judgment of its human users.

Eight major TSS application areas are outlined in the sections that follow. The specific applications described are meant to be representative of typical TSS applications, rather than an inclusive listing of such applications.

On-Line Programming and Debugging

TSS provides a number of programming tools that allow programmers of varying skill levels to write, check out, and execute programs on-line. The ability to create new application programs without tying up all the resources of the machine is considered to be one of the most useful features of TSS, and has continued to be the one most heavily used. Currently, on-line programming and debugging accounts for approximately one-third of both the total console time and total processing time.

For the experienced programmer working under TSS, there are a number of high-level programming languages available. Of these, the most widely used is JOVIAL, an ALGOL-like language originally designed for military command/control applications. JOVIAL is sufficiently generalized to be suitable also for scientific and engineering problems involving numeric computation, business problems involving large data files, and logically complex problems involving symbolic data. A large percentage of the application programs and program systems now running on the Q-32 were produced by one of the two JOVIAL (JTS) compilers.

Another programming language that has been widely used is LISP 1.5. It has been used to solve problems in such diverse fields as heuristic programming, linguistic analysis and machine translation of natural and artificial languages,

analysis of particle reactions in high-energy physics, artificial intelligence, pattern recognition, mathematical logic and automata theory, machine checking of mathematical proofs, game playing, information retrieval, display programming, and interactive text editing.

In addition to the JOVIAL and LISP compilers, there are a number of other language processors on the Q-32 available for use by experienced programmers. Two that have generated considerable interest are META and META5. The first of these is a syntax-directed meta-compiler that accepts as input a specification (written in metalanguage) of an object compiler, and produces as output a machine-executable version of that compiler. Although META is still in the experimental stages, it has already been used to produce several META compilers, two machine-oriented language compilers (for the Q-32 and IBM 360 computers), and a LISP 2 syntax translator. Current work on META is aimed at producing a JOVIAL compiler for operation on an IBM 360 computer.

META5 is similar to META in many ways, but provides some features not available in META that are useful in data manipulation and in parsing context-sensitive grammars. META5 has been especially useful for translating between problem-oriented languages such as FORTRAN, JOVIAL, and PL/1, and for automatically changing the format of large data bases. It has also been used to analyze a subset of English used in questions, to legality-check the syntax of programs, and to reformat META5 programs. Using META5, for example, programs have been translated between various dialects of JOVIAL and PL/1 or FORTRAN.

One of the most frequently used applications of META5 is that of reformatting large data bases so that data acceptable to a particular program can be used by other programs (having different format requirements). To illustrate, a Q-32 user—the National Institutes of Health (NIH)—wanted to use a Q-32 data management system on a data base describing 2500 cancer research projects. The data were in machine-readable form suitable for processing by an NIH computer, but were not acceptable to the Q-32 program. Using META5, however, a program was written that automatically transformed the NIH data base within a few hours. The META5 program was only five lines long.

A Teletype Interpreter

Probably the most useful tool available under TSS is TINT, a teletype interpreter designed for use by the casual programmer who writes small-to-moderate sized programs.

TINT allows the user to create, check out, execute, modify and re-execute JOVIAL programs directly from the teletype; usually the entire process can be completed in a single session. TINT is particularly useful: for writing compact programs such as short mathematical routines; for checking out sub-programs of a larger program system; and for solving other "one-shot" problems. Since TINT is designed for use by people who may not be professional programmers, several tutorial features are built into the system, providing information about TINT and how to operate it. Programs written in TINT must be limited to 150 lines of code; however, TSS users whose programs exceed that limit can employ TINT to write and check out their programs by segments, and then compile those programs with the JTS (JOVIAL) compiler.

Virtually every organization authorized to use the Q-32 has found some application for TINT. One Air Force organization, for example, has used TINT for problems ranging from aerodynamic calculations (such as finding the center of gravity of an aircraft at various angles of flight) and aircraft and weapon system simulations, to the use of TINT as a management tool (for calculating work standards to determine manning requirements, and for simulating a telephone system for an Air Force base). Two indirect applications that have proved to be beneficial are the use of TINT to train personnel in JOVIAL programming, and its use in "driving" other on-line programming systems such as SLIP (Symmetric List Processing), LESSN (an aid to teaching statistics), and EPIC (a personnel information retrieval system).

Finally, in the area of on-line programming and debugging, there are a number of service routines that assist the programmer in on-line creating, editing, debugging, executing, modifying, and managing both program and data files, and that provide on-line instruction in the use of the Time-Sharing System. For example, a debugging program (DEBUG) allows the programmer to debug either symbolic or binary programs by displaying parts of the program, changing registers, inserting or deleting lines, setting break-points, tracing program operation, etc. Other editing programs allow the programmer to merge, transfer, update, and

list symbolic files either on a line-by-line basis or by context, and to create tape libraries for his own use. If the user is unfamiliar with TSS, or has forgotten some aspect of its operation, he can get on-line help from the system by simply typing in the word "HELP".

Data Base Management

Next to the use of the Q-32 to support on-line programming and debugging, the most heavily used capability of the system is that of managing large files of data on-line. One system in particular, TSS-LUCID, usually accounts for about 15 percent of the total computer processing and console time. TSS-LUCID was originally designed in 1962 as a vehicle for research and experimentation in information-system design. It has been continually refined since that time in response to user demand. The increasing demand for this kind of system can generally be traced to its responsiveness in meeting the needs of a multiplicity of users for storing, maintaining, and retrieving information from large data bases.

TSS-LUCID is a general-purpose system designed to provide the nonprogrammer user with immediate access to information in his data base, without having to relay his information requests through a number of intermediary specialists in data-handling problems. The generality of the system allows the same set of programs to operate on many different kinds of data and different types of data problems.

As shown in Figure 1, the system allows the user to define the contents of his data base in an easy-to-use, nonprogramming language. (He does this only once for each separate data base.) The user then loads the actual data values into the system in the accepted format. The system automatically creates the data base structure, which includes a cross-indexed, inverted file directory. The user is then ready to interrogate the data base using English-like queries; to update the data base on-line; or to merge additional data sets into his original data base. The user can be quite selective in specifying the particular subset he is

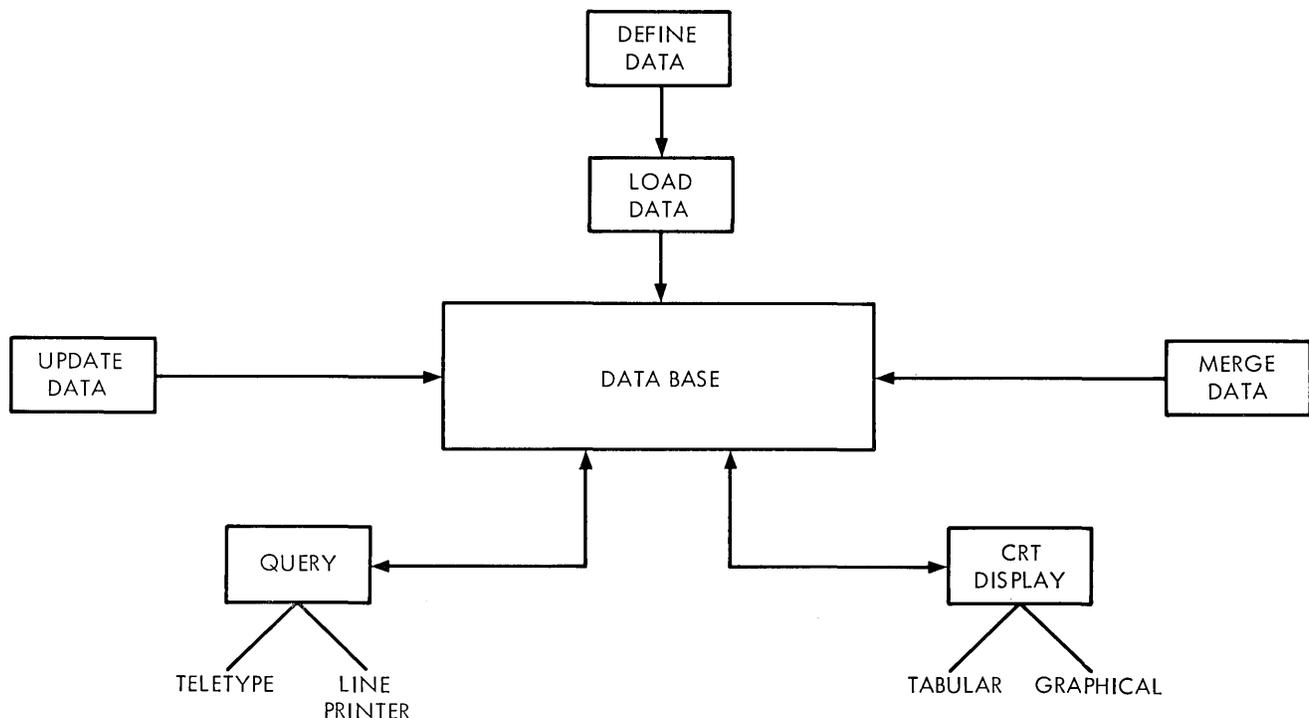


Figure 1. TSS-LUCID System Organization

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interested in; responses to his requests are usually received within a few seconds. Output is available on the teletype, off-line printer, and CRT display.

Eliminating the Need for Reprogramming

A major benefit of TSS-LUCID is its ability to operate on various kinds of data describing a diversity of objects without the need for costly reprogramming. Thus, the same set of programs can be used to manipulate data on: salaries; personnel; contract management; hospital patients; inventories; military status of forces; etc. Since the program makes no *a priori* assumptions about how the data should be organized, all elements of a given data base are equally retrievable. The user, therefore, pays no penalty for specifying any particular data element as a retrieval key.

The two most common uses of TSS-LUCID are: (1) for analyzing data in support of management decision-making; and (2) for manipulating data in support of what could be called "creative intellectual processes". Examples of these uses can be found in management information systems, where project management data must be continually gathered, analyzed, and disseminated, and in research studies where masses of data must be examined. In both of these cases, the user is often interested in two extremes: determining a single, isolated fact, or searching for a pattern in a huge mass of data. For either case, the help of a machine is almost a necessity.

A large Air Force organization, for example, is currently using TSS-LUCID to monitor expenditures on Air Force research projects. Using the TSS-LUCID data base, contract monitors can determine the rate of expenditure, the amount of funds available, the division of funds with respect to various project goals, etc. Overrun and underrun conditions can be anticipated and corrective action taken. The data base can be updated on-line, and a variety of financial reports can be produced. Requests for information on the projects (such as division of funds by state of the union—a common Congressional request) can be answered within minutes.

Information Retrieval

During the first few years that the TSS was in operation, several special-purpose information retrieval systems were developed. These were intended to provide on-line retrieval of such things as hospital patient records, police crime reports and personnel data. Such information retrieval systems proved to be suitable applications for a time-sharing environment in the early days of TSS. Since that time, however, the problem of retrieving information has come to be considered merely one aspect of the overall problem of data management. Furthermore, users have found that a general-purpose system such as TSS-LUCID saves them an enormous amount of development time, and provides sufficient power to accomplish most data management tasks. One further problem with special-purpose retrieval systems is that they tend to be oriented to programmer users, rather than toward the users who are actually responsible for managing the data.

Document Retrieval

The problem of retrieving bibliographic information on a large collection of documents may appear to be merely a special case of the more general information retrieval problem. Work in this area at SDC has shown, however, that the problems involved are sufficiently unique to require specialized retrieval systems. This is due in part to the fact that systems for retrieving bibliographic information make extensive use of specialized techniques for machine indexing, classification, and abstracting of documents.

Most of the work aimed at document retrieval on the Q-32 has centered around two systems: BOLD (Bibliographic On-Line Display) and ORBIT (On-Line Retrieval of Bibliographic Data). These systems attempt to combine the most attractive features of conventional libraries with the speed and convenience provided by computer-based systems. Thus, for example, the user can "browse" through computer-generated subject category lists much as he would through an ordinary card catalog, or he can ask the system for help in locating documents of interest as he would ask for help from a librarian. Both of these systems also provide a straightforward two-way dialogue between the user and the system, which eliminates the need for a programmer or other technician to act as intermediary. By providing remote access to large, centralized collections of documents, these systems reduce retrieval time and allow users to retrieve bibliographic information from larger collections than can be manually searched by most users in a reasonable amount of time.

BOLD and ORBIT have many features in common. BOLD—the earlier of the two systems—was originally intended as a research vehicle, and has been used experimentally at SDC to retrieve information on document holdings from the U.S. Geologic Survey, the Defense Documentation Center, the National Institutes of Health, and the Armed Forces Technical Information Agency¹. These collections ranged in size from a few thousand up to six thousand documents. Output from BOLD can be either CRT display image or teletype hard copy. Usually, the display is used to control the operation of the program; after the user has retrieved the information he wants, he can request that it be output on the teletype. This information consists of document numbers, titles, authors, index terms, and complete abstracts. (Naturally, the complete text of the document cannot be obtained on-line, since this is not the intended purpose of the system.)

ORBIT is currently being used by 12 military and governmental agencies to manage a collection of some 200,000 articles from the field of scientific and technical intelligence. Since these agencies are all remote from SDC, retrieval is accomplished via teletype or dataphone connected to the Q-32 in Santa Monica. Using ORBIT, the intelligence analyst can retrieve information on the basis of descriptors (terms used to index a document), authors' names, or topical subjects. In addition, retrieval requests can be qualified in terms of country of information, document type, subject area, or publication date. The retrieval program ranks the selected references based on their responsiveness to the query, and allows the analyst to have only the most relevant document references output. If the analyst wants more detailed information, he can obtain the abstracts, extracts, or tables of contents for the particular documents, which are stored on microfilm. (ORBIT provides the microfilm reel and frame reference numbers as part of its standard output for each document reference.)

Thus ORBIT saves the analyst from having to search through thousands of index cards or scan voluminous alphabetic bibliographies trying to find reference material that might tell him what he needs to know. In a few minutes at a terminal, he can acquire complete bibliographic information that otherwise would take him hours to discover and evaluate by conventional means.

Computer-Aided Instruction, Counseling, and School Administration

Over the past few years, a number of research workers at SDC have been investigating ways of applying computer technology to such educational problems as student instruction, counseling, and school administration. They have

developed a variety of automated procedures, instructional materials, and computer programs, the majority of which make use of the Q-32 Time-Sharing System.

One of the major results of this work was the development of PLANIT (Programming Language for Interactive Teaching), a user-oriented computer-assisted instruction (CAI) language². PLANIT allows nonprogrammers to write interactive programs—such as lessons or automated interviews—on-line, using a remotely located teletype. After the lesson or interview has been prepared, it can then be “played back” later by students, using the same remote terminal. Thus PLANIT allows school personnel (teachers, counselors, administrators, and students) to communicate easily with the computer, even though they may not understand how computers or programs work.

PLANIT operates in four modes: lesson building, editing, execution, and calculation. It allows the instructor or course designer to enter lesson material into the computer from his terminal, and to have that material stored in designated sequences. He can use a variety of lesson frame formats (e.g., text, questions or problems, and multiple-choice items). He can review, edit, and revise the course material, switching from one mode of operation to another in order to do this. Normally, after the lesson designer has written and tested a sequence using the lesson-building and editing modes, the lesson is presented to the student at a teletype terminal, using the execution mode. The calculation mode can be used by the teacher as an aid in constructing the lesson sequence, or it can be used by the student in solving problems presented to him.

	<u>Dialogue</u>	<u>Explanation</u>
† User:	*CO	Commence operation in the lesson-building mode. The asterisk is printed by PLANIT when a user input is required.
PLANIT:	P/Q/M/D/C	PLANIT is asking the user—in the concise form—to select the type of lesson frame he will build.
User:	*?	The user requests explanation of the above printout.
PLANIT:	(P)ROBLEM/(Q)UESTION/(M)ULTIPLE CHOICE/ (D)ECISION/(C)OPY	PLANIT lists the available lesson frame types.
User:	*Q	The user specifies the Question frame.
PLANIT:	1. FRAME 25.00 LABEL = * HISTORY	PLANIT assigns a number to the lesson frame (25). The user assigns a label (HISTORY).
PLANIT:	2. SQ.	Specify Question.
User:	*WHO INVENTED THE ELECTRIC LIGHT?	
PLANIT:	3. SA.	Specify anticipated student answers.
User:	*A+ EDISON *B MARCONI *C BELL	The + after A indicates to the program that this is the correct answer.
PLANIT:	4. SAT.	Specify Action to be Taken, depending on answer given by the student.
User:	*A+ F: GOOD WORK. B: 5 *B R: THAT WAS THE WIRELESS TELEGRAPH. TRY AGAIN. *C R: BELL WAS THE TELEPHONE MAN. TRY AGAIN. *- C: B: 1	The user specifies a Feedback message ("GOOD WORK") to be presented if the student answers correctly; then the program is instructed to Branch to Lesson Frame 5. A Repeat command is given in case student gives answer B or C. If student gives any other response, the program is instructed to print the Correct answer and to follow this by Branching back to Lesson Frame 1 for remedial instruction.

† The user is typically a teacher or lesson-designer.

Figure 2. Simple PLANIT Lesson-Building Sequence

Figure 2 shows a simple PLANIT lesson-building sequence, in which a teacher (or lesson designer) is building a single "frame" for later presentation to a student. As shown in the figure, PLANIT provides both a "concise" and a "verbose" form of communication with the user, and allows the user to determine which mode he wants. This permits experienced PLANIT users to move rapidly through the task of writing lessons, since they can respond to abbreviated messages. The novice, on the other hand, can receive a detailed explanation of system messages by simply typing in a question mark (shown in the third line of Figure 2).

PLANIT provides a number of other features that facilitate its use as a CAI language, including the capability to have the lesson designer specify conditions for branching based on a student's performance over any portion of the lesson; these conditions can include response latency, number of errors, and help received. PLANIT also provides optional functions for evaluating student answers by making: (1) phonetic comparisons between the correct answer and the student's response; (2) a key word search of the student's answer; or (3) an algebraic-equivalence analysis of his response.

PLANIT was originally developed for use in a study on the effectiveness of CAI for teaching undergraduate statistics courses. Thus, several early PLANIT lesson sequences dealt with probability and statistical inference; these were tested on students at the University of Southern California during 1966. During the following year, PLANIT was used to write a rather elaborate instructional sequence in on-line programming. This course, which was tested with students at San Fernando Valley State College, was administered completely by computer, without accompanying lectures or textbook readings. Some of the other applications of PLANIT as a CAI language include its use by the U.S. Naval Personnel Research Activity to write a CAI course in basic electricity and electronics; its use by the National Institutes of Health to write a programmed instruction guide to NIH information retrieval systems; and its use by the Southwest Regional Laboratory for Educational Research and Development to write lesson sequences in reading and spelling for grammar school children.

Natural Language Processing

One of the earliest uses of the Q-32 was to support studies in the area of natural language processing and linguistics. This work, which is continuing today, has potential application to problems in computer-aided instruction, library science, information retrieval, and the design of computer programming languages and compilers. Techniques developed in this area have, in fact, already been "spun off" for use in various other projects, including text-based retrieval systems such as TEXTIR, and bibliographic retrieval systems such as BOLD and ORBIT (described above).

Although the major emphasis of this work has been on gaining insight into some basic linguistic problems, considerable effort has also been devoted to developing computer programs that model various theories of language structure with respect to subsets of natural English. The ultimate goal of this work is to develop enough explicit understanding of English so that computers can read text with sufficient "understanding" to answer a wide range of natural language questions and generate free-form essays in response. Several programs now running on the Q-32 that attempt to approach this goal are described in the following paragraphs.

The Protosynthex system¹⁰, which was developed as part of an on-going project in question analysis and linguistic inference, attempts to answer natural language questions

from a large corpus of computer-stored text. Protosynthex is based on a model of human cognition expressed in a formal language of binary relations. In essence, the system permits a wide range of English sentence structures to be transformed into this formal language. When a given text and questions about that text have both been expressed in this formal language, question answering then becomes a special case of the general problems of theorem-providing and problem-solving.

In addition to the Protosynthex work, a number of other studies on the lexical, syntactic, semantic, and logical structures of English are being conducted at SDC, using the facilities of the Time-Sharing System. One of these is a lexicographic study⁵ aimed at developing a formal semantic description of English. Thus far, two dictionaries (Webster's Seventh New Collegiate Dictionary and The New Merriam-Webster Pocket Dictionary) have been transcribed onto computer-readable magnetic tapes. A variety of computational aids have been programmed that provide help for researchers in processing the huge quantities of semantic and lexical information contained in these dictionaries. The results of this processing are descriptions of word senses in terms of formal constructs that are based on the informal accounts of word senses given in the dictionaries. These formal descriptions of word senses are expected to provide basic linguistic data and theory that will provide insight into many language-processing problems.

A third project in this area—known as CONVERSE³—is concerned with providing a means for conducting on-line conversations with a structured data base using ordinary English sentences. Thus, users who are unfamiliar with the input language of a data management system can communicate with large data bases in a small but open subset of English. CONVERSE translates declarative and interrogative sentences, where possible, into a formal intermediate language. If an input sentence "makes sense" with respect to already-stored data, it is translated into explicit file storage or search procedures that can be directly executed by the machine. When a sentence cannot be so translated, the system enters into an interactive dialogue with the user, telling him why the sentence was unacceptable (e.g., for lexical, syntactic, semantic reasons, etc.), and asking him to furnish it more information.

Behavioral Gaming and Simulation

Another area to which time-sharing techniques have been applied at SDC concerns the simulation of various social and organizational structures in a computer-based laboratory, and the running of behavioral "games" in order to study human interaction and develop laboratory training tools. The insights and training techniques resulting from this work are applicable to such problem areas as military command and control, labor-management negotiations, governmental operations and political/military confrontations and conflicts.

One of the major applications of the initial TSS was that of supporting the Command Research Laboratory, under which a number of simulation exercises were run. These studies were generally intended to provide data on human decision processes in military settings. One of the largest projects in this program involved the simulation of an Air Force Alternate Mobile Command Post. The AMCP exercises allowed experimenters to test and evaluate command post requirements for data, display formats, computer programs, communications equipment, crew organization, operational procedures, and so on. A number of experimental subjects assumed the roles of military personnel in a command post concerned with such functions as bomb damage assessment, strike assessment, and re-strike planning. The subjects interacted with a single simulation

program (running under TSS, along with various other user's programs); communication with the system was via teletype and CRT displays. The responses of these subjects to requests from the program were automatically recorded for later evaluation.

More recent work in behavioral gaming at SDC has focused on studies of bargaining and negotiation behavior and the modeling of large organizational structures. In both of these areas, the computer is generally used as an experimental tool for on-line analysis of data, umpiring control, and recording of subject behavior, particularly the dynamic iteration processes that take place between game players.

Data Reduction and Analysis

A final problem area to which various tools operating under time-sharing have been applied is that of machine-aided reduction and analysis of large amounts of data. The need for such tools arises frequently in both the social and physical sciences because of the large quantities of experimental data that are gathered. The data analysis tools described below — TRACE and IDEA — were developed at SDC in order to deal with the volume of data generated during computer-based behavioral experiments, such as those on bargaining and negotiation (described above). In such experiments, as many as 1,000 items of information for each of hundreds of subjects are gathered. The single task of inter-correlating these items (even without considering combined indices) could generate about 500,000 correlation coefficients or cross-tabulations, which would produce several stacks of computer printouts and require excessive machine processing time. A more satisfactory approach — exemplified by TRACE and IDEA — is to allow the investigator to examine (on-line) the structure and relationships of his data from a number of different points of view, to test various hypotheses, and to direct the machine's manipulation of that data. Then, if he wishes, he can subject subsets of his data base to standard statistical tests and achieve more meaningful results.

TRACE (Time-Shared Routines for Analysis, Classification, and Evaluation) allows the data analyst to have the machine perform such clerical chores as counting, classifying, cross-tabulating, and summarizing data, leaving him free to concentrate on gaining intuitive insights into the meaning of the data⁹. TRACE differs from typical data management systems in that its primary objective is to allow the experimenter to derive new variables from existing ones, rather than being concerned with simply retrieving data. The system also differs from standard analysis programs in providing primarily logical and algebraic manipulation capabilities (as opposed to statistical ones), and in handling automatically the construction and maintenance of the user's data base.

TRACE was designed for use by data analysts who are not professional programmers. Thus, the analyst is guided by specific instructions or requests from TRACE during his use of the system. Since the user is in direct contact with the computer via teletype and CRT display, he receives immediate feedback from the machine, and can modify his analysis of the data as he proceeds. Consequently, the investigator's conjectural and judgmental skills are combined with the computer's capacity for rapid, accurate data processing. TRACE has been used to analyze data derived from educational records, surveys by the United Nations, U.S. Census Bureau information, and studies in clinical psychology.

Another data analysis tool that operates on the Q-32 is known as IDEA (Inductive Data Exploration and Analysis)⁶. This system is used on-line to discover and summarize

potentially interesting data models (in the form of restricted "tree" structures) for a multivariate data base. Like TRACE, IDEA permits a data analyst—often an experimental investigator—to collaborate with a library of programmed heuristics in the process of uncovering and representing the structure of his data. IDEA has been used to analyze numerous multivariate data bases, including ones containing information from sociological questionnaires, projective test responses, and a sociopolitical study of Colombia.

The approach to data analysis followed in TRACE and IDEA and made possible by the Time-Sharing System allows the investigator to explore relationships in large amounts of data directly, using the machine as a mediator between him and his data. This approach holds promise of more effective inductive analyses than either man or machine algorithm could produce alone.

Evaluation

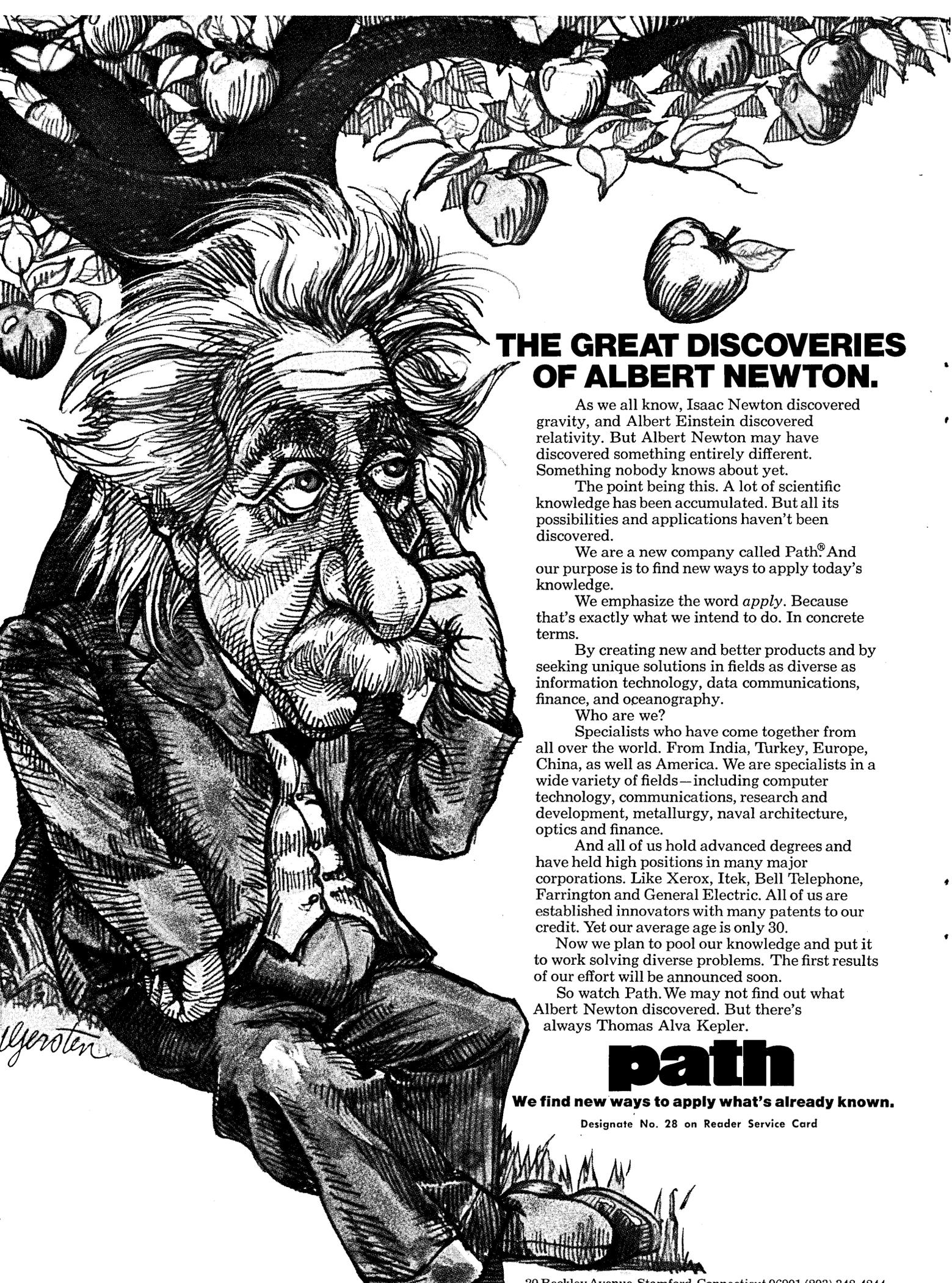
The effectiveness of application programs is highly dependent on the operating environment: different environments dictate different operational goals. In conventional (batch-processing) environments, an attempt is usually made to optimize machine efficiency (i.e., throughput), since these are essentially machine systems that limit human access as much as possible. In time-sharing environments, on the other hand, human factors are often considered to be of equal importance—since these are basically man-machine systems. Thus such factors as human productivity and user satisfaction are used to determine a time-sharing application program's effectiveness. This outlook can be seen in the emphasis placed on "human engineering" or "user orientation" evident in many of the Q-32 application programs.

In examining Q-32 application programs, one can observe several trends that may indicate the effectiveness of these programs. For one thing, the demand for access to the Q-32 has almost always exceeded the supply. Another indication can be found in the response of governmental and military users to ARPA's proposal in 1966 that the system be dismantled: they opposed the move quite strenuously. The continued heavy usage of the system seems all the more surprising in view of the fact that most of the current Q-32 application programs were originally written as experimental vehicles, and were not really intended for heavy operational use.

"The Customer Knows Best"

Most of the application programs described in this article have been in use for several years (and thus—by now—have been "shaken down"). Three-fourths of the programs described are currently in use, which indicates somewhat that their usefulness has "stood the test of time". Another similarity of these programs is that many of them were designed or developed by the users themselves, rather than by professional programmers. These users were often specialists in some "field" (such as linguistics, psychology, etc.). Although they did not always do the actual coding, they were frequently involved quite deeply in the functional design and development of the program. This suggests that perhaps the ultimate consumer of automated data-handling services is the best source of information on the design of application programs. (In everyday language, "the customer knows best".)

Two final traits that characterize most of these application programs are their transferability and their user-orientation. The general-purpose nature of these programs (which was mentioned earlier) is in some sense a functional requirement for many programs developed in a time-sharing environment, since some of them would not otherwise have



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been economically justifiable. The cost of developing a lesson-writing system such as PLANIT, for example, can only be justified on the basis of later cost sharing among a large number of users (which is only possible if the system is generalized).

Nonprogrammer Users

The need for time-sharing application programs to be oriented toward nonprogrammer users is likewise based on economic factors. In a time-sharing environment, one would like as broad a user population as possible. The degree of user orientation required obviously varies with the application area involved, and should be determined (ideally) based on empirical tests of user populations. Use of most of the Q-32 application programs described above (at least at some minimal level) can be learned in a few hours away from the console, combined with one or two sessions on-line. Naturally, learning to use the full capabilities of some of these programs takes time and practice. Many of the programs guide the user, step-by-step, through messages printed on-line. Commands accepted by these systems are often simple English words, and error messages are spelled out so the user knows how to recover. Many of the programs provide for both terse and verbose modes of input and output; thus the programs can accommodate the beginner as well as the experienced user.

The Future

The Q-32 Time-Sharing System has served its purpose in demonstrating the workability of general-purpose time-sharing. It has also provided a test bed for the development of a large class of application programs that are feasible only under time-sharing. Further efforts in developing Q-32 application programs have ceased, and many of the Q-32 users are now redirecting their work toward ADEPT—a more advanced time-sharing system that operates on IBM 360 computers.*

The ADEPT system^{4,11} like its predecessor, the Q-32 TSS—provides a general-purpose time-sharing executive, a set of on-line data management programs, and a package of programming tools. The data management component of ADEPT, which is known as the Time-Shared Data Management System, is similar to the TSS-LUCID system on the Q-32, but it provides more complex data structures, larger file capacities, and a more powerful command language.

The ADEPT programmer's package, similarly, provides many of the same kinds of programming tools available in the Q-32 system. A JOVIAL compiler, for example, is available for large-scale program development, and a version of TINT has been provided for writing small, one-shot programs. Here again, ADEPT accommodates programmers of varying skill levels. Also, programs can be written and debugged on-line without tying up all the resources of the system.

Problems

A number of problems uncovered in the operation of the Q-32 that were either unresolved or only partially resolved have been more thoroughly attacked in the ADEPT system. Some of these problems were resolved as a result of the hardware provided by the 360 computer—for example, the problems of overlapping input/output with processing, and allocating memory efficiently. Most of the problems, however, required the development of new software techniques. One of the major drawbacks of the Q-32 system, for example, was its lack of provision for running some kinds

of programs "in the background." ADEPT allows those jobs that require long processing times with little or no interaction to be "stacked" for execution in a first-in/first-out order, subject to priorities of the installation and the demands of "foreground" interactive users.

Another weakness of TSS is that the executive is a "closed" system, in that system functions cannot be easily changed or expanded without modifying the basic system. The ADEPT executive structure, on the other hand, provides for two levels: a basic executive (known as BASEX) and an extended executive (known as EXEX). It is relatively simple to add or change the functions available through EXEX, since it is an "open-ended" set of programs that perform user-input commands.

A third problem area connected with time-sharing operation concerns the creation and maintenance of numerous program and data files, and the problem of protecting those files from unauthorized access. A variety of both manual and automatic procedures have been used over the years for managing files in the Q-32 system. Under ADEPT, most of the responsibility for maintaining inventories of storage devices and descriptions of files, assigning file space to users, and controlling file access is undertaken by the system itself, and is relatively automated. Extensive security protection features are built into the system to protect sensitive or classified data from unauthorized access.

In conclusion, SDC's original Time-Sharing System continues in use today as a "veteran" in what is still a new and technically complex field of computer use. In operation for the past six years, TSS has provided a large community of on-line users with practical experience in solving real-life problems directly via computer. But perhaps more importantly, it has helped point the way toward improving the services available to computer users, making the machine more accessible to its users and more responsive to their needs for rapid, economical information handling. □

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*Development of ADEPT, like that of TSS, was sponsored by ARPA.

PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 69 10: CHRONIC COMPUTERITIS

"I think some of the people around here have computeritis. I'll bet, if faced with the problem of adding two and two, they'd write a program to do it." Al sounded more than usually querulous.

"What brought this on?", Bob asked.

"Look at this problem Pete wants solved—determining the rate of interest involved in this transaction. Why, I could work it out on my little old desk calculator before I could get the program for it written."

"What transaction is this?"

"Well, it involves semi-annual payments for 23 years and Pete wants it worked out for a range of interest rates."

"Why doesn't he just look it up in a table?", Bob seemed determined to be helpful. "I'm sure there are interest tables in existence that would give the answer."

"Yes, but not to the degree of accuracy he wants. Apparently a large sum is involved and unless the calculations are carried out to many decimal places the values won't be correct to dollars and cents."

"How do you propose to do it?"

"Well, the basic function is $(1+i)^n$. I could just raise the value of $1+i$ to higher and higher powers on my trusty calculator." Al sounded pretty confident.

"How would you calculate these powers, the 46th specifically?"

"I guess you can't do better than doubling. I'd get the values of $(1+i)^n$ for $n = 1, 2, 4, 8, 16, 32, 40, 44, 46$ —eight operations in all. I don't think you can beat that."

Can you?

Solution to Problem 699: Unchanging Time

(Contributed by Carl M. Wright)

(1) The subroutines compute the sums of squares of N consecutive integers beginning with X . This is based on $(X + 1)^2 = X^2 + 2X + 1$ so that successive squares are derived, in the first subroutine, by adding $S(2X + 1)$ to the value of the square in R . S is incremented by 2 for each step. The second subroutine is based on the fact that the sum of successive squares starting with X is equal to the sum of the squares starting with 1 up to $N - 1$ plus the factor $N X (X + N - 1)$.

(2) The average value of N is approximately 6.2; this is found by noting that the constant part of the first subroutine plus N times the number of loops equals the time of the second subroutine. Therefore $(104 + 40N) \mu\text{secs.} = 352 \mu\text{secs.}$ from which $N = 6.2$.

Readers are invited to submit problems (and their solutions) for publication in this column to: Problem Editor, Computers and Automation, 815 Washington St., Newtonville, Mass. 02160.

NUMBLES

NUMBER PUZZLES FOR NIMBLE MINDS
—AND COMPUTERS

Neil Macdonald
Assistant Editor
Computers and Automation

A "numble" is an arithmetical problem in which: digits have been replaced by capital letters; and there are two messages, one which can be read right away and a second one in the digit cipher. The problem is to solve for the digits.

Each capital letter in the arithmetical problem stands for just one digit 0 to 9. A digit may be represented by more than one letter. The second message, which is expressed in numerical digits, is to be translated (using the same key) into letters so that it may be read; but the spelling uses puns or is otherwise irregular, to discourage cryptanalytic methods of deciphering.

We invite our readers to send us solutions, together with human programs or computer programs which will produce the solutions.

NUMBLE 6910

T H E L E A S T	T
+ F O O L I S H	+ A
= T O E H A E H T	= 0

7752 7754

Solution to Numble 699

In Numble 699 in the September issue, the digits 0 through 9 are represented by letters as follows:

G = 0	O, S = 5
R = 1	F = 6
U, V, W = 2	N, T = 7
M, P = 3	C = 8
A = 4	E = 9

The full message is: A man of courage never wants weapons.

Our thanks to the following individuals for submitting their solutions: **Numble 698**: Louis A. Benton, Del Mar, Calif.; A. Sanford Brown, Dallas, Tex.; H. Royce Culpepper, Jr., Nashville, Tenn.; T. P. Finn, Indianapolis, Ind.; Philip R. Hollenbeck, San Leandro, Calif.; R. C. Jensen, Endicott, N.Y.; Joseph Rinaldo, Ozone Park, N.Y.; Carl D. Smeltz, Williamsport, Pa.; Dr. A. O. Varma, New York, N.Y.; Robert R. Weden, Edina, Minn.; and Dan Zenor, Downs, Ill. **Numble 697**: Geoffrey B. Findon, Claymont, Del.; Philetus R. Teachout, San Angelo, Tex.

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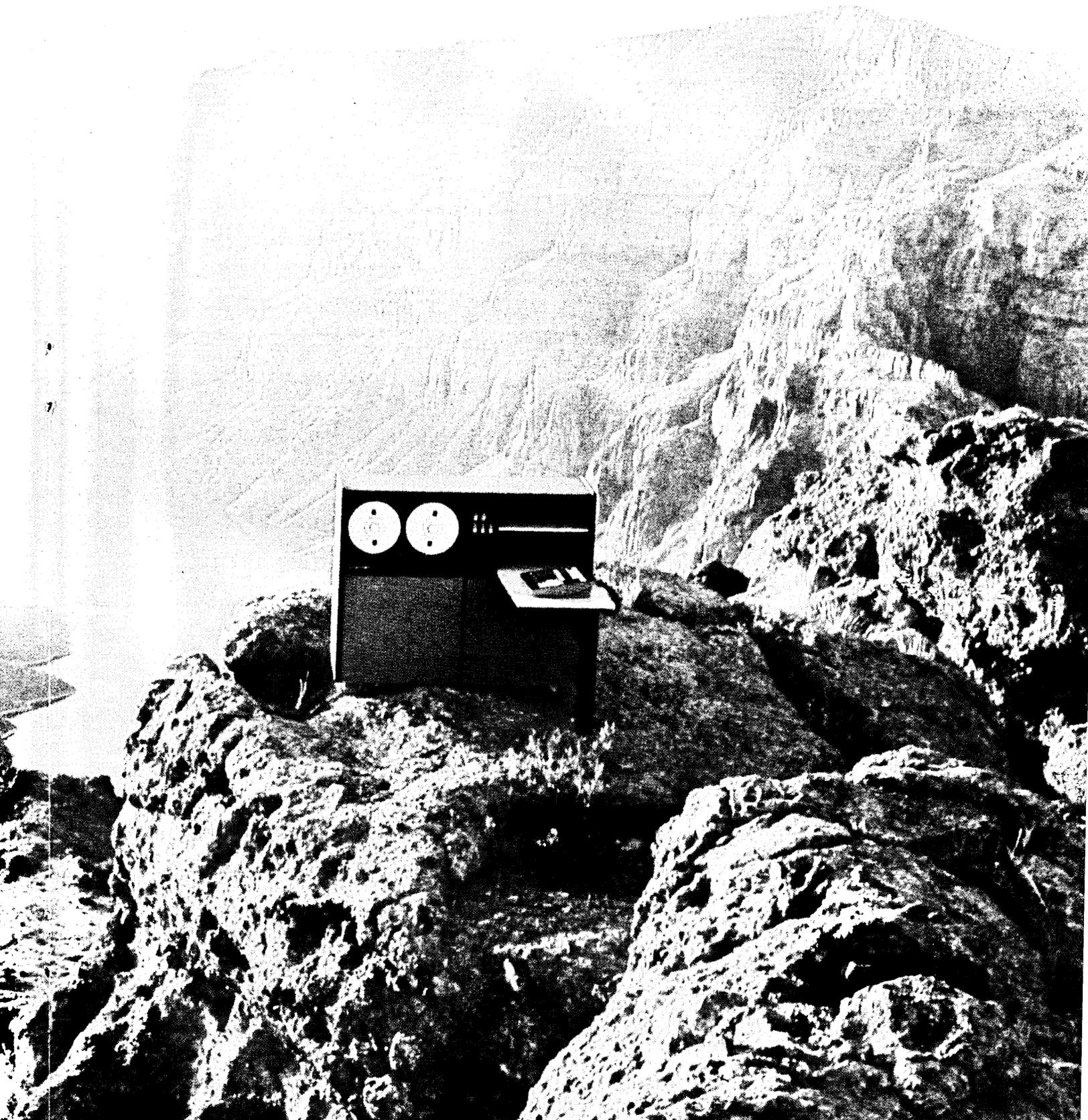
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TIME SHARING FOR VERY SMALL BUSINESSES

*Edward Yourdon, Director
Research and Development
E.L.I. Computer Time-Sharing Inc.
319 E. 54th St.
East Paterson, N.J. 07407*

"Many small businesses operate with two or three people, and their idea of automation is a new electric cash register. Yet there is growing evidence that during the next decade these small businesses will be forced to automate their operations in order to stay in business. Will time sharing or will the mini-computer best meet their needs?"



Mr. Yourdon is Director of Research and Development for E.L.I. Computer Time-Sharing, Inc., a firm specializing in the development of commercial time-sharing packages for specific industries. Prior to his current position, he was with General Electric and Digital Equipment Corporation. He also teaches courses in the design of on-line computer systems, and is the editor of the book *Real-Time Systems Design*. Mr. Yourdon has a B.S. in mathematics from the Massachusetts Institute of Technology.

Anyone who has the misfortune of living in New York City knows that the only tolerable way of passing time in a subway station is to read the posters and advertisements on the walls in the hopes of finding some interesting graffiti. Thus it was that I stumbled upon an intriguing Coca-Cola advertisement while waiting for the downtown IRT subway one sultry night last summer in Times Square. It proclaimed that "our town" had approximately 3,489 grocery stores, that each day it consumed some three million hot dogs, several tons of peanuts, and assorted quantities of other stomach-wrenching products of the American food industry — the implication being, of course, that it was all made more palatable when accompanied with vast oceans of dark, liquid bubbly.

Although I viewed the statistics on hot dogs with a jaundiced eye (for, if true, they imply that the average New Yorker's stomach manages to cope with one of the foul-smelling things every three days), the statistics on grocery stores seemed more reasonable, and, at the same time, staggering. For if there are three thousand grocery stores in New York City, how many small dress shops, hardware stores, barber shops, hand laundries, restaurants and luncheonettes are there? In short, how many businesses are there that are not only small, but *very* small? The number must be immense, not only in terms of number of businesses, but also in terms of their contribution to the gross national product.

This should be of great interest to time-sharing aficionados, especially when one considers that the computer industry has traditionally been associated with, or interested in, large businesses. The problems faced by these large companies are immense, and the money and manpower they have allocated to data processing has been equally immense. More recently, efforts have been made to invade "small" businesses — those companies whose gross sales are on the order of \$1-\$5 million per year. These companies could not afford the vast array of computing equipment and the armies of programmers that the large companies have, but they could usually find room in their budget for one small-to-medium computer, or for the services of a commercial service bureau, or for a time-sharing terminal.

What about the businesses that gross between \$100,000 and \$250,000 per year? Many of the small retail businesses that fall into this category operate with two or three people, and their idea of automation is a new electric cash register. For businesses this small, the idea of data processing is, at the moment, not only beyond comprehension, but totally impractical from an economical point of view. The electricity bill alone from most computer installations would be enough to drive some of these companies out of business.

Very Small Businesses' Problems

Nevertheless, these very small businesses have most of the same common business problems that the medium-sized and large-sized companies face. Some of the more critical problems that are amenable to data processing are:

1. Inventory management
2. Accounts receivable
3. Lack of adequate sales or production information
4. Order entry (or "sales" in the cases where orders are immediately filled).
5. Cost of manual bookkeeping and record-keeping

For businesses like travel agencies, where there is a tremendous amount of paperwork, the cost of bookkeeping equipment and personnel can be the major cost of operation. For other businesses with highly perishable inventories, such as grocery stores or fashion boutiques, inventory management may be a major problem.

Survival of the Fittest

There is a growing feeling among office equipment suppliers, computer manufacturers, and several impartial bystanders that the very small businesses will be *forced* to automate their operation during the next ten years. The feeling is that it will be an evolutionary change, one in which the law of survival of the fittest will take its toll. As the trend towards big business continues, the only small businesses that will survive will be those that minimize their inventory, minimize their accounts receivable, and maximize their use of available information about sales histories, etc. There will probably be a number of other factors—such as increased use of inter-bank credit cards, on-line credit systems and so forth—that will bring pressure on the small businessman to link up with a vast national information network.

It appears that the major question in the minds of the computer and office equipment manufacturers is whether this automation will take the direction of a time-sharing terminal or whether it will instead take the direction of a small, stand-alone, mini-computer (or "super-terminal"). This question will probably not be answered conclusively for several years, if at all, but we should at least have an

idea of the advantages and disadvantages of each approach. Let us first review some of the needs and problems of the very small businessman, then explore how these problems might be solved by a time-sharing system and by a stand-alone mini-computer.

Inventory Management

Inventory management, as mentioned before, is likely to be a major problem for the small businessman. In any kind of computerized system, the businessman needs the ability to make inquiries into the status of his inventory, with an immediate (i.e. less than five seconds) response. This type of inquiry is needed to help determine when and how many raw goods should be ordered (example: when the bakery truck stops at the corner grocery store every morning, the grocer must make an immediate decision as to how many loaves of bread he wants), and also to determine whether a customer's order can be filled. In addition to immediate response inquiries, the businessman obviously needs the ability to update his inventory files as he makes sales or receives new supplies. Finally, he may require complete inventory reports on a weekly or monthly basis for auditing purposes, or for his own peace of mind.

Accounts Receivable

In the area of accounts receivable, the businessman again needs the ability to make real-time inquiries to determine the credit worthiness of his customers. We must keep in mind that the businessman may eventually want the capability of making inquiries into, or feeding new information into, outside on-line credit-checking systems or credit card associations. The businessman will probably also require periodic reports of all accounts receivable for aging purposes.

Sales and Production Information

Sales and production information is probably an area that will most bedazzle the businessman, since in the previous two areas the computer merely plays the role of an expensive accounting machine. It will probably be rare that the small businessman would require sales reports to be produced on-line, and we can probably assume that reports of this nature can be processed on an overnight or weekly basis. Sales breakdowns by region, by state, by salesman, or by color of item are obviously useful for businesses large enough that the manager does not have a good "feel" for the minute-by-minute activities, but they can also be useful for the very small businessman. He may have a personal liking for one particular item that he is selling, and will so tend to remember only the sales of these items. The computer, on the other hand, is more impartial in its analysis, and may inform the businessman that the ugliest item in stock is moving the fastest. Even if the businessman does know which item is selling the best, a quantitative breakdown of sales can help him make decisions about the less popular items, or determine trends from year to year or season to season.

Fears of Time Sharing

While it is certainly possible for a time-sharing system to solve these common business problems, it is not clear that time-sharing is the best answer. The three major fears that the small businessman appears to have about time-sharing systems are:

1. Cost
2. Security
3. Reliability

The cost of a time-sharing service is, at the moment, prohibitively high for many of the types of small businesses that we have been talking about. Without getting into an elaborate discussion of the available terminals on the market, it is probably safe to assume that the businessman would have to spend between \$75 and \$100 per month for a simple teletypewriter terminal, and approximately \$200 per month for a CRT terminal. To this must be added his communications costs, which are a function of so many variables (time on the line, type of communication link, distance to the time-sharing computer, etc.) that it is difficult to make any estimate at all. These costs, though, are incurred before the businessman has had the chance of using a single microsecond of computer time.

It is difficult to estimate how much the small businessman, or the very small businessman, can afford to pay for a time-sharing service of this type. In many cases, the argument for utilizing a service of this type is an *intangible* argument — i.e., more information, lower inventory — that is difficult for the businessman to translate into dollars. In other cases, it may be possible to show the businessman that the installation of a time-sharing service can mean the elimination of one or more personnel in his bookkeeping department, or some other tangible savings in cost. Because of these factors, it appears that a number of these very small businesses are simply incapable of paying more than \$200-\$500 per month, *including all terminal and communications costs*.

Restructuring Time Sharing Costs

This poses somewhat of a problem for the time-sharing service bureau, which currently tends to charge its customers on the basis of central processor time, terminal connect time, and disk storage space. Since the notion of "central processor time" is meaningless to most businessmen, it will probably become necessary for the time-sharing service bureau to charge on a transaction basis, or perhaps a combination of transactions and terminal connect time. Even with this simplification, however, it may be difficult for the time-sharing service bureau to come up with a price structure that is profitable while still acceptable to the businessman.

The reason for this predicament is rather simple: the bottleneck in a system dedicated to applications of this sort will probably not be the central processor, but rather the amount of available on-line storage, the speed of the on-line storage, and the number of terminals that can be connected to the system. The activities that the businessman will carry on from his grocery store will, for the most part, involve a simple updating of inventory totals or accounts receivable files on a disk, and will not involve any significant amount of computing. On the other hand, his files could easily reach a size of 100 million characters, which would place a severe limit on the total number of users the system could accommodate. If it turns out that the average transaction requires ten disk accesses, the limiting factor may very well be the speed of the disk and the number of access paths to the disk.

The Need for Commercially-Oriented Service

Most current time-sharing service bureaus are not equipped to handle an application of this type in an optimal fashion. Most time-sharing systems have been aimed at the scientific/engineering user, who spent a great deal of time typing at his terminal, a fair amount of time executing programs, and generally had fairly small files. To cope with this type of user, most time-sharing systems were set up to accommodate 30-50 simultaneous users, and by charging exorbitant rates for terminal time, CPU time and

disk storage space, were able to generate between \$800 and \$2000 per month from each customer. This arrangement apparently satisfied everyone: the engineer got his problems solved, and the time-sharing service bureau made money.

Obviously, the arrangement will not be satisfactory for a commercially-oriented time-sharing system. What appears to be needed is a hardware configuration that will allow several hundred, if not several thousand, on-line terminals, with a vast amount of fast, cheap on-line storage. The central processor itself does not appear to be of much importance — one can almost imagine a PDP-8 serving all 3,489 grocery stores in New York City.

Reliability

As we mentioned above, another of the problems that face a commercially-oriented time-sharing system is the area of **reliability**. We can identify a number of common causes of system failures, such as CPU failures, memory parity errors, input-output errors, operator errors, program bugs, power failures and so on. Because of these hazards, the typical time-sharing service bureau "crashes" between one and five times a day, which, while annoying to the scientific/engineering user, is accepted as a necessary evil. For the businessman, who is being asked to place his vital business records on a computer that he can't see or touch with his own hands, the prospect of a system failure is enough to make his blood run cold. The cause of concern is not so much the fact that the time-sharing system can crash, but rather the length of time the system is out of service, and the amount of information that may have been lost as a result of the crash.

Security

Another problem associated with the fact that the time-sharing computer is located remotely is **security**. Whether rational or irrational, a good many businessmen are extremely concerned about the idea of somebody else gaining access to their files. The current approach of providing passwords to each time-sharing user does not seem to provide much psychological reassurance to the businessman, who worries that his competitors may somehow discover his password, that employees of the time-sharing service bureau might permit unauthorized access to the files, and so forth. In many cases, of course, these security problems are really no worse than the ones which the businessman has in his current mode of operation, but the idea of putting his books on a time-sharing system accentuates the problem.

The Small, Stand-Alone Computer

The alternative to using a time-sharing system for this type of business application is a small stand-alone computer. The basic configuration for a number of machines currently on the market consists of 4096 words of memory, a central processor and a console typewriter, all selling for \$8-\$10,000, and small enough to fit in the space currently occupied by the businessman's cash register. While this is certainly adequate for the businessman's processing needs, this type of configuration does not provide any file storage capabilities. On-line storage sufficient to meet his needs appear, at the present time, to be too expensive and too bulky. On the other hand, it is possible to conceive of a small business system operation with one or two "micro-tapes" or magnetic tape cassettes or possibly small, removable disk-packs. The on-line storage, whether tape or disk, would be sufficient to handle a day's transactions, but the businessman would be required to change tapes or disks to update his master files at the end of each day.

The Potomac Valley Test Facility : the Need for Direct, Personal Experience in Evaluating an Event and Its Consequences

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If we had had the foresight a few years ago to establish the Potomac Valley Test Facility, several recent national problems could have been handled more satisfactorily. An example was the problem of what to do with a large supply of unwanted poison gas in Colorado. The Army proposed to ship it by train to the East Coast and then to dump it at sea off the coast of New Jersey. Had the Potomac Valley Test Facility been in existence, several containers of the gas could have been dropped into the Potomac River, between the White House and the Pentagon, from an altitude calculated to give the impact velocity expected at sea bottom. Dropping a few containers into the Potomac River would have given congressmen, Army officials, and other interested persons an opportunity to observe at first hand whether the containers survived unharmed, and if they did not, the rate of leakage of the gas and its effects on the neighboring flora and fauna. Nothing quite takes the place of direct, personal experience in evaluating an event and its consequences. The nation's central decision makers should not be denied this experience.

More recently, the Edgewood Arsenal and Fort McClellan have suspended open-air testing of nerve gas until a team of scientists can determine whether such tests are as free from danger as they are reputed to be. The National Academy of Sciences, which is frequently asked to advise the government on difficult technical matters, has its headquarters in Washington. Also nearby are the National Bureau of Standards, the Food and Drug Administration,

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This brings up an obvious problem: would a stand-alone computer system be too difficult for the average small businessman to operate? Will he be forced to learn octal arithmetic? Will he be required to learn how to load paper tape programs into the machine? Will all of these procedures of changing tapes, starting up the machine, watching the blinking lights on the console prove to be so bothersome that the businessman will throw up his hands in despair and throw the computer out the door?

Summary

In summary, it seems fairly evident that American small businesses will be invaded by the forces of technology during the next decade. There will probably be room for

and other agencies that can provide much technical information and relevant expertise. If open-air tests of nerve gas were conducted in or near Washington, representatives of appropriate agencies and of interested congressional committees could easily obtain the firsthand information which they will no doubt wish to have in evaluating the possible hazards of testing such gases in or near inhabited areas.

Another use of the Potomac Valley Test Facility would be in conducting studies of the sonic boom. Sonic boom tests have already been carried out in several parts of the country, but the test sites have been remote from Washington, and there is still considerable disagreement over the extent of the disturbance and the willingness of the public to accept repeated sonic booms. Again, firsthand information would be useful to the decision makers. If repeated tests were conducted over Washington, members of Congress and officials of responsible Executive agencies could observe the effects on babies, pets, the sick and the elderly, on classrooms and conferences, and also on window panes and other fragile objects. They could learn for themselves just how much or little disturbance repeated sonic booms produce at various times of day and night.

There would be still other advantages of having a general-purpose test facility located in Washington. Studies of the time-zone effect indicate that physiological disturbances, loss of sleep, reduced effectiveness, and impaired judgment follow sudden transportation from a time zone to which a person is adapted to another, several time zones removed. However, there are individual differences in these effects, and the whole matter needs further study. Washington is full of people who make frequent trips to Europe, Africa, the West Coast, or Asia. Clearly they would be good subjects for studies of time-zone effects, and their number could readily be increased, for it would be easy to get nominations of politicians, bureaucrats, editorial writers, and others whose frequent or prolonged absence from Washington would be considered by many to be in the national interest. □

both the mini-computer and the time-sharing systems in such a huge market, and it appears that the major factors that will be taken into consideration by the businessman will be cost, security, and reliability.

Assuming that the time-sharing service bureaus can overcome these problems, they will probably be able to offer more application packages, and more computing power than the small stand-alone system. If, on the other hand, the small computer manufacturers can package a system that is adequate in terms of file storage requirements, and simple to operate and maintain, they will be able to offer the psychological reassurance of having all of the businessman's records under his own control. Who knows — maybe one of these systems will eventually help New York's 3,489 grocery stores sell *six* million hot dogs a day! □

THE LANGUAGE BASIC AND ITS ROLE IN TIME SHARING

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“Even in its infancy, BASIC was better suited for some on-line problems than its closest ‘competitor’, FORTRAN.”



Michael F. Lipp is the Technical Vice President at Rapidata. He has spent twelve years in various phases of the computer business, and has been actively involved with time-sharing since 1963. Prior to joining Rapidata he was a member of the senior staff at Informatics, Inc. He has a B.S. in mathematics from Polytechnic Institute of Brooklyn and an M.S. from Stanford University. He has numerous other technical publications to his credit.

It must be recognized from the start that commercial time-sharing has back-doored the computing community. While the cognoscenti were frustrating themselves experimenting with the *possibilities* of time-sharing, time-sharing was being used. While the elite philosophized about a time-sharing utility, they ignored or ridiculed the growing use of time-sharing. That use spread into thousands of offices—rarely touching the programmer, never touching the systems programmer. It is one of the great faits accomplis.

Is it any wonder that in the profusion of the publications on time-sharing, few, if any, have described what the user sees and deals with? The vast bulk of literature describes rate structures, the problems of communications, growth projections, and other equally pontifical subjects.

Where is there an article on BASIC? How can a language become a *de facto* standard in this paper-stuffed world without ever having seen the light of journal publication?

BASIC caused the revolution! This poor, simple, elegant, little language opened all the doors. Why is there still surprise when you find that in the company you just joined 30% of the time-sharing use is in BASIC; or 50% or 100%!? BASIC is now offered, in one way or another, by *every* major computer manufacturer and almost every independent supplier of time-sharing. CALL 360 wasn't an announcement, it was an admission. So let us fill the void.

The Beginning of BASIC

BASIC was developed back in 1963 by a small group of undergraduate students under the direction of Professor John Kemeny at Dartmouth College, Hanover, N.H. It was developed at a time when the interest in time-sharing, as great as it is now, was focused on large research-oriented, experimental systems. Those efforts were concerned with exploring the vast potential of on-line computer design and usage. The Dartmouth effort, however, was oriented to getting a working system that the students could use, and use regularly. The design goals were probably:

- Ease of implementation.
(The whole effort, BASIC and the operating system took under one year.)
- Ease of teaching, learning and use.
- Orientation to on-line use.

Every corner was cut. The idea was to get it to work — quickly and easily. Syntax? Every statement *had* to have a verb. Every statement *had* to be on a single line. Mnemonics? Variable names could only be a single letter or a letter followed by a digit; array names could only be a single letter. Input/Output? Too hard; let there be no files at all; let the data be stored in the program. The result was BASIC — very.

Fifteen Statements

There were really only 15 statements in the original BASIC. It could be learned and used in a matter of hours. The statements were:

LET	— to perform computations.
IF	— a simple two-way branch.
GOTO	— the universal statement.
GOSUB	— yes, Virginia, there is a subroutine.
RETURN	— and a way back.
FOR/NEXT	— to start and end loops.
READ/DATA	— with no files, these statements allow data to be stored and read in the program.
RESTORE	— to allow the data to be re-read.
INPUT	— to input data at execution time from the terminal.
PRINT	— the only output statement.
END	— to end it, the program.
REM	— (for "remark") you must be able to comment programs so that you can be chided for your failure to do so.
DIM	— (for "dimension") the only declarative (obviously, there was a DIM view of such statements). Even the word DIM isn't needed when arrays have ten or less elements.

No wonder BASIC was ignored. It could not even be called a subset of anything. Programmers were appalled — at the name BASIC, at the lack of mnemonics, at the need to write LET, at the lack of such files.

Simplicity

No wonder it was accepted! Nobody had to explain "data types" or "default conditions". There was no need to be confused about formatting; the PRINT statement had ingenious implicit formatting. Reports there could be — not pretty, but fast. Students could learn it quickly. Businessmen could use it immediately. People could solve problems using a computer without the trauma of dealing with programmers or computer rooms.

Simplicity and ease of learning were not its only merits. BASIC was integrated skillfully into the framework of an equally simple time-sharing system. Statement labels in BASIC are, in fact, sequence numbers. This makes it trivially easy to construct and correct programs — and hasn't everybody who has had his source deck scrambled wished for that kind of capability.

BASIC has come a long way since mid-1963; yet with all of the improvements made to it, it still retains its advantages of learning ease and usage ease. The language lends itself nicely to subset teaching. New statements and capabilities need not be introduced until the previous statements have been mastered. Frequently, the pace of teaching is

completely in step with the user's sense of language confinement.

"Standards"

If there is such a thing now as a "standard" BASIC — and rest assured there isn't — it includes:

- a function definition capability, albeit a primitive one.
- an expanded PRINT statement, including at least the ability to "tab" on output.
- a powerful set of built-in matrix operations, including multiplication, transposition and inversion.
- the ability to define and test strings (of characters).
- and, as a sop to programmers, the optional use of the word LET.

The continued growth of BASIC was, and is, inevitable. Any language at once so primitive and popular, is bound to grow. It will grow because of the strong feedback from its users and the competitive pressures this puts on its suppliers. Some independents have long recognized the importance of BASIC, its values and its flaws—and this has resulted in its steady upgrading. Those manufacturers now beginning to tout BASIC as part of their standard wares are often advertising an obsolescent product.

There are now many, many different BASICS, comparable to the surge in FORTRAN in the mid-50s. There is Basic BASIC and Advanced BASIC, Extended BASIC, Super BASIC. Surely KSBASIC (kitchen-sink BASIC) must be coming. And lo — there is at best subset compatibility.

Each extender has taken a different approach to improving BASIC — particularly in its file-handling abilities, but also on an across-the-board-basis.

- At least half a dozen different ways to manage stored data files now exist.
- At least four different methods of formatting output now exist (incidentally, all four are significantly easier to use than FORTRAN formatting).
- Various approaches to string manipulation have been implemented.
- Little goodies (that vary widely among the suppliers) have been added.

Growth and Change

Many of the improvements to BASIC have been in keeping with its development tenets. The manual may get thicker—but it really can be read one chapter at a time. Unfortunately, some vendors' changes have changed the face of the language; this is just another *caveat* to be included with all the rest that the new user of time-sharing must remember.

The growth will continue. Even in its infancy BASIC is better suited for some on-line problems than, say, FORTRAN (its closest "competitor"). Some BASICS today are better suited for a very wide class of problems — on-line or off-line; small or medium to large. The increased power is there and the language retains its flavor and simplicity.

The matrix manipulation increases its utility to the engineer. The various file-handling and output extensions increase its utility to the commercial world. The string manipulative abilities will make it well-suited to the programmer.

In a few years, the cry for a standard definition may arise. But it is doubtful if much beyond its second level of growth will ever be standardized. And so we will recognize a BASIC family: BASIC will beget BASIC — unto generation after generation. □



WORLDWIDE

REPORT FROM GREAT BRITAIN

ICL Lands Big Contract

For the first time in the history of computing in the United Kingdom, a purely British company has been given a big break to tackle an important systems job.

It is the LACES contract for the automation of cargo manifest, customs declaration, revenue demands and similar documentation for all the airlines which bring cargo to London Airport, now the busiest such terminal in the world in terms of the value of cargo handled. Volume is expanding at the rate of some 12 per cent annually until the million ton per year mark is reached in 1973.

There are a number of sore heads in London over the contract award, and not just among the U.S. opponents of International Computers, which took the \$7m (hopefully \$10m) contract, but also among the UK software houses.

The reason simply is that ICL chose to team up with Computer Sciences Corporation (Computer Sciences International in Britain) and entrusted to the latter the undoubtedly knotty problem of setting up the software packages required to handle this first real-time cargo system in the world. The system will start off fed from about 200 CRT display terminals, but will later have to handle some 400 of these terminals (Raytheon designs from Cossor) plus high-speed data links which will bring full details of cargo manifests from abroad at the time when a freighter leaves the runway at its departure point far away from London.

From all this mass of data, shipping and forwarding agents, customs officers, airport freight control staff and other interested persons will be able to draw a mass of information ranging from the time of arrival of a particular consignment to the time at which customs clearance can be expected and the exact position any consignment occupies in the cargo sheds.

Software Men Protest

Several of the software men have voiced strong protests, some even going so far as to say that it would have been far better to take the Univac hardware—until quite recently strongly favoured for the job—and entrust the software operations to Britain. Quite naturally they would say so, particularly as the job is worth about \$1.8m to CSC. But I understand that one of the demands for this particularly exacting job was that there must be absolutely no slippage on the software... the hardware is coming along quickly... because of the very tight time schedule on which users, including the airlines, are working. The inference was that if the largest software house in the United States could not do the job on time, no one could. What ICL has put up as hardware is something new from the System-4 range, a 72, which could be described as an "integrated circuit 65-type machine" with a 500 nanosecond core and a very considerable real-time capacity.

I asked a CSC man who was present at the press reception whether Univac had been mad at his company

because of its involvement. He simply said, "Well, we are buying about 20 of their 1108's; can they afford to get mad?"

Datafair '69

Meanwhile, by the time these lines go into print, the biggest European data processing event of the year—Datafair '69—will be over and done with, but, one would hope, not forgotten. Sponsored by the British Computer Society, it is a seven-day event with symposia, exhibitions of hardware, demonstrations and many other attractions for all types of computer men. In brief, it will have been an event in which terminals of all kinds, but many of them CRT displays, predominated. Many of the demonstrations will have been of the on-line processing capabilities of the bureaux and several manufacturers. It is not surprising therefore that a lot of people are coming away from the event saying that the day of the in-house computer is over.

But surely we have been here before. The appearance of the vast computer utility on-line to thousands of users, offering them a sophistication of software and hardware that no single company machine could ever deploy, has been predicted for many years. The prophets only quieted down when the computer builders began to realise that they had a tiger by the tail, for the software problems for such immense time-sharing, remote-batch jobs were an order of magnitude greater than anyone had ever thought.

GE's Software Homework Pays Off

Indeed, it is because General Electric of the U.S. went back and did its software homework all over again on the 600's that people from many large companies are beginning to show major interest in these extremely powerful machines, after a lapse of perhaps three years. Ford of Britain has just disclosed that it is to have a 615 for most of its engineering operations and that this big system (\$1.8m) will be shared by Ford of Germany which will rent a data link with it.

Since Burroughs lost out last year in a confrontation over certain benchmark tests between its 6500 and an IBM 65—tests which were also time-limited—I must add, Ford of Britain had been considered an IBM stronghold.

Survey of Computing in the UK

Late in September, one of the most thorough surveys of trends in UK computing so far carried out in Britain, with more than a passing glimpse of the U.S. and European markets, is to be published over here. It has been undertaken by the Hoskyns Group¹ of consultants and comput-

(Please turn to page 56)

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THE ECONOMIC PROMISE OF COMPUTER TIME SHARING

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"For the long term, the time sharing industry will achieve its best success if it looks to the cultivation of the markets where the computer is suspect, unknown, or misunderstood."

In the nineteenth century the first industrial revolution replaced manual labor by machines. We are now living in the *second industrial revolution* and every year we are replacing the labor of human brains by a new kind of machine—computers.¹

Within the past fifteen years the computer has matured from a laboratory curiosity to center stage of the world's fastest-growing industry—a pervasive force for change in other industries, and generally, a major influence in many levels of our society. And the future appears to hold greater promise since the maturity segment of the computer life cycle is not imminent, none of the traditional competition appears to be losing its taste for the game, and new participants abound. The industry continues to ride the waves of technological change, broadening user patterns, and accelerated growth.

Absence of Stabilizing Influence

Ten years ago, as second-generation (transistorized) computers began their exponential growth, the main-frame manufacturers totally dominated the field. Today, the industry base comprises the "Big 8", other main-frame vendors, peripheral equipment manufacturers, leasing companies, major computer users doubling as data-service vendors, and independent service bureaus. The field is a varied one with no indications of near-term quiescence. Indeed, the lack of any stabilizing influence is conspicuous:

- Although IBM still dominates the market, its traditional competition is battle-hardened and determined to remain in the arena; IBM's legal battles and the expected aftermath can only help their cause.
- The increasing overlap between computers and communications, even with the imposing frictions to be overcome, will open a relatively untouched market.

- Small computers, some under \$10,000, have been introduced by a block of manufacturers; the smaller computers perform specific narrowly-defined tasks (as differentiated from the versatility of their bigger counterparts) at lower costs.
- The appearance of computer time sharing will offer variations of presently-available service and probably (eventually) entice a whole new generation of users into the computer fold.

Limited Penetration of Computers

This last phenomenon, time-sharing, I believe, will exert the greatest impetus for change with resultant maximum impact. The reason: economics. Due to the nature of traditional computer costs, directly for the equipment itself and indirectly for the supporting structure, the computer's penetration has been limited, restricted to a small segment of the population, and conducive to making the strong even stronger than their weaker brethren—especially in the business field. *The revolution has strengthened the aristocracy but not the masses.* Time sharing may modify this historic pattern, and herein lies its greatest potential contribution. I differentiate sharply between old users buying (leasing) the newer generations of computers as they appear, e.g., the IBM 360 user who previously had a 1401, and the new customer who never owned or used the computer prior to the arrival of time sharing.

Consider this customer: The computer facilities of a particular multibillion dollar industrial giant offer a broad range of computer services. These facilities, whose annual rental probably runs in the range \$10 to \$20 million, include time sharing and a variation of batch-processing techniques. The company is savvy in the computer field, and its time-sharing capabilities offer another item in the computer grab-bag. If time sharing were not available, its computer bill would be relatively unchanged.

At most the time-sharing innovation offers *this* user a peripheral benefit; its influence is nominal. It may, however, open up the broad base of potential users who have had little or no dialogue with the computer world. The time-sharing vendors have been diligent in touting the universality of their wares. It has not been obvious, however, that the computer function has heretofore been restricted in its use. Has the computer to date truly been a selective instrument? If so, can time sharing overcome the rhetoric and broaden the computer-user base? Let us initially pursue the first question.

Computer Census

A recent computer census estimated that U.S. manufacturers have installed about 63,000 computers throughout the world.² Typically, about 25 percent of this total output is placed in other countries; IBM has a strong hold on the European market. Therefore, the U.S. computer population ranges from 45,000 to 50,000 installations. This number itself is probably fairly accurate (as of mid-1968) but no definite substantiation exists to confirm or refute it. Since IBM publishes no computer installation figures and does not comment on suggested estimates by others of its installation levels, all census opinions can be no more than intelligent guesswork.

Still in all, some sound judgments can be formulated as to who has bought these computers and how they are being used. In 1946, the first electronic computer became operational; it was the forerunner to the first commercial computer, the Univac I bought by the Census Bureau in 1951. Three years later, the first business computer was installed in a GE plant. These two pioneers were harbingers of the fledgling industry's direction: large institutions—industrial, government, academic—would be the prime customers. Consider the following:

- (a) The avowed IBM sales/marketing policy, as expressed by personnel from IBM and its competition, dictates an emphasis on the large institution. This philosophy transcends its computer line and appears to dominate the organization's thinking; its popular Selectric typewriters typify the policy at work. Originally the 360/30, the bottom of the IBM 360 line, rented at a monthly cost of \$9,000. The less expensive 360/20 and 360/25 models extended the line *after* other firms pioneered the market for this type of equipment. With about two-thirds of the total market, the thrust of the IBM effort supplies the bulk of the computer's success. The recent IBM announcement introducing its first "small" computer represents a major innovation in markets cultivated by others.
- (b) Control Data, one of a handful of profitable participants in the computer quest, cornered the supercomputer market. More than any other vendor, it has sought the very larger user. The company is moving toward a more balanced offering with several medium-priced models, as well as other hardware and services. Yet it appears that the CDC strength for the foreseeable future resides in areas where the company has previously enjoyed success.
- (c) The other major computer manufacturers—Univac, Burroughs, NCR, Honeywell, GE, RCA—have traditionally sought the same customer types as IBM. Although the variations exist, historically these six have vied for second place for the clientele so successfully cultivated by IBM.

- (d) Scientific Data Systems, now part of Xerox, geared its market to the user of medium-sized scientific computers.
- (e) Although Digital Equipment Corporation pioneered the small-computer market, its sales of under \$100 million for fiscal 1969 are a small share of the total multibillion dollar computer pie (although its impact by installation count may be a better indication of its success).
- (f) Computers are costly, both for the hardware and associated software. In a study performed by a major consulting firm³, a survey of 33 manufacturing companies indicated that —
 - the median company spent nearly \$1.2 million yearly for its entire computer operation, with about one-third of that amount allocated to equipment, mainly machine rental
 - total computer costs ranged from \$128,000 to \$50 million per year
 - the median company spent \$5.40 per thousand dollars of sales for its computer operation.

Costs

The implications of this last item are significant. If we hypothesize a computer installation renting at \$5,000 per month and each hardware dollar must be matched by \$2 for backup support—a conservative assumption—the total yearly bill runs \$180,000. To support this expense, yearly sales must approximate \$33 million. A realistic view of these figures indicates that the total computer operation, especially when competently run, is an expensive proposition. The small businessman or other low-income institution does not have the resources to reach a minimum threshold needed to justify computer usage, rental or purchase.

Of course, a user need not have his own computer. Three major alternatives exist: independent service bureaus, banks, or another company's machine. The first group served nearly 80,000 customers in 1966, although there are no definitive data on the types of users involved (big or small, business or non-business applications).⁴ A study of the nation's banks indicated a broad spectrum of services performed by the banks for their customers; no quantitative analysis was offered.⁵ And one knowledgeable industry observer notes that companies with excess computer capacity often market a service to other companies in need of such a capability, thereby benefiting both parties.

The Small Businessman

Circumstantial arguments notwithstanding, the existing evidence supports the lopsided usage pattern. The computer has sought the affluent user and he has responded accordingly, especially to the exclusion of the small businessman:

For the small businessman, several factors have been a deterrent to ready acceptance of the computer. Problems of initial investment costs, maintenance, recruitment and retention of skilled staff, education of management and line personnel, and integration into existing operations have caused many smaller entrepreneurs to avoid involvement with the new devices.⁶

This marriage of technological innovation to large institutions is by no means a universal characteristic:

- Henry Ford designed and priced his Model T for the average pocketbook, not the well-heeled customer.

- The radio, originally applied to government needs in ship-to-shore communications, sired a significant industry only when it emerged as an entertainment medium with broad popular appeal.
- The radio supplied the transistor's first volume application; government needs soon followed.

Whether the computer could have been directed to a less affluent market is debatable. It is also, at best, an academic point. The economics of computer innovation and manufacture dictated that a market be sought which could be persuaded to buy these new and expensive systems; it obviously follows that these users must also possess the finances to pay for their acquisition. The two together—desire to own and capability to pay—inevitably led the computer vendor to the large institution. The overwhelming IBM success in pursuing this course has, at least by hindsight, questioned the wisdom of others in pursuing this same path. Competitors have thrived only in markets where IBM has not massed its resources. And whatever the success attained by these rivals, one cannot slight IBM on its market choice and its singleness of purpose in implementation.

Altering the Usage Pattern

For the future this historical usage pattern may be altered; there will be transition pains. But herein lies the challenge, for time sharing can truly extend the computer's frontiers (although it will probably never reach the heights its press notices suggest). The low cost supplies the initial indispensable thrust; the breakthrough will be provided by the absence of the intermediary, the programmer who has kept user and computer apart. Now the user can interface directly—if only he can be convinced to make the first step. This is the industry's onus: to convince the skeptical, *not* the converts, that this computer variation can indeed offer benefits with a minimum of frustration. The temptation for an oversell is great, especially when one views the all-consuming and unquestioning acceptance with which Wall Street grasps any venture with a time-sharing ingredient.

In a more subtle way, time sharing marks a change in computer economics. Success is gained by many users spending small amounts on a high-priced relatively fixed-cost computer system. Such a situation almost dictates that the marketing effort per user be minimal which, in turn, orients the vendor *away* from the computer novice. Unfortunately, this aspect of time sharing may reinforce the user patterns described earlier. In the long term, the industry will achieve its best success if time sharing looks to the cultivation of the markets where the computer is suspect, unknown, or misunderstood. □

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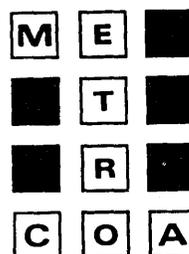
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COMPUTER-BASED STUDY OF MENTAL RETARDATION

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Mental retardation—two words that many people associate with mental illness. "Retarded" for too many people is synonymous with "crazy". Nevertheless, the differences between mental illness and mental retardation usually are clear.

Definition

Unlike mental illness, mental retardation is characterized by impaired mental ability or adaptability. The retarded learn less and more slowly than normal people and usually forget what they have learned more rapidly. Commonly, severe retardation is organically based, caused either by illness or injury. It is often detectable at or shortly after birth. The retarded are very often like young children, friendly and attention-seeking—unlike some victims of mental illness who suffer anxieties, fears and suspicion of fellow human beings.

Drugs are sometimes used in treating some of the retarded—but primarily for behavior problems due to damaged nervous systems rather than as any kind of "cure". Education and training are given to make them as self-reliant as possible. But complex tasks or abstract concepts can rarely be learned. Unlike mental illness, there has been no cure found for retardation, although in many cases it can be prevented.

Although it is estimated that there are more than five million people in the United States who are mentally retarded—from two to three per cent of the total population—recognition of the special needs of these people has only recently become widespread. However, public awareness of the problems of mental retardation has greatly increased over the last ten years. This awareness has provided momentum and legislation for research of a wider scope than ever before.

The retarded population is as heterogeneous as any other population segment. Thus, the scope of research in mental retardation is inherently broad. Researchers must investigate factors such as the efficiency of present institutional care, must predict future problems and needs of the institutionalized retarded, and must locate the retarded outside institutions and identify their modes of coping with life situations in their communities.

All these investigations have one prime goal: making it as easy as possible for the successful return of the retarded individual to society, and his continued adjustment to living in society.

Pacific State Hospital: A Pioneer

Research in mental retardation has now assumed an integral role in the everyday operation of many institutions. Pacific State Hospital, located in Pomona, Calif., has been a pioneer in this field. The Hospital is under the jurisdiction of the California State Department of Mental Hygiene. It was founded in 1927 and occupies 494 acres and 75 buildings, including a 379-bed acute hospital and receiving unit, a school, rehabilitation services building, beauty shop, canteen, central kitchen, laundry, research center and maintenance facilities.

All of the hospital's patients are mentally retarded; they are primarily young people. More than one-half of the patients are under 18 years of age and approximately one-third are younger than 13.

The hospital aims at greater self-sufficiency for the retarded. For the profoundly or severely retarded patient, this may mean simple habit-training. For the moderately retarded, it means efforts to aid him in acquiring skills which will make him independent. And for the mildly retarded, it means a variety of programs that supply educational, vocational and other types of training.

Socio-Behavioral Research

The study of ways to improve the care of retarded individuals is the special charter of the hospital's Research Department, under the direction of Dr. Arthur B. Silverstein, a psychologist, and the hospital's Socio-Behavioral Study Center for Mental Retardation, under the direction of Dr. Richard K. Eyman, also a psychologist.

The socio-behavioral program represents the diversified efforts of professionals in the areas of psychology, psychiatry, sociology, social work and computer operations in the area of mental retardation. The data processing section, centered on a Honeywell Model 1200 computer system, is an integral part of the hospital's research program. Virtually every one of the more than 100 research projects carried on by the Research Department makes use of data processing for selecting subjects or for analyzing results of studies.

Pacific State Hospital hopes that significant conclusions about mental retardation will evolve from this research. Their findings are being shared by 12 other western states as part of a program of the Western Interstate Commission for Higher Education. Much of the research work is carried out under federally funded grants.

A formal program of socio-behavioral research was first

“Based upon the analysis made by the computer, the incidence of death in one group of mentally retarded children dropped from 13% in 1962 to 2% in 1969.”

initiated at Pacific State Hospital in 1956 with a pilot study of population movement of patients in the hospital conducted by Morton Kramer, chief of the office of biometry in the National Institute of Mental Health, and by Dr. George Tarjan, then superintendent and medical director of the hospital. This study was expanded in 1957 and revealed that the probability of a patient being released alive, or dying while in the hospital, or being returned to the hospital after eventual discharge, was related to his age, IQ, diagnosis, and handicaps.

Death Prediction

Using the data file established in the population movement study, researchers at the Study Center in 1962 undertook a study of death and disease in the hospital.

The first studies, dealing with mortality, had the purpose of identifying the kinds of patients most in danger of death. First it was necessary to obtain relatively homogeneous groups of patients. To do this, a latent class analysis was carried out on patient variables such as sex, age, race, and IQ. Two major classes of patients were established using this method: Class I, severely retarded and under 10 years of age, and Class II, mildly retarded and over 10 years of age.

It was determined quickly that the death rate of Class I was far greater than that of Class II. Accordingly, lists of incoming patients identified by risk group were sent to the chief physician as a potentially helpful prognostic source.

This broad classification has been refined, with the help of the computer, to include more than 40 variables for each patient, thus making possible more homogeneous categories with fewer patients in each category. In this manner, predictions of patient mortality have been considerably sharpened.

The purpose, of course, is to tip off the hospital's medical staff as to which incoming patient runs a high risk of death and, accordingly, needs more specialized attention. In several cases, the death-prediction-by-computer technique has helped bring about a sharp reduction in patient deaths.

For example, the computer found the highest risk to be among children under five years of age with IQs of less than 30. A normal IQ, a measure of intelligence, is 100. The findings indicated that 13 per cent of these children died within six months of admission and that 20 per cent died within four years. Dr. Eyman believes that contributing causes to this high death rate are the sudden change in

environment coupled with the fact that the physical condition of the children is usually somewhat poor.

Based upon the information obtained from the computer, death predictions were sent to the hospital staff as the young, severely-retarded patients were admitted. The result has been dramatic: the incidence of death dropped from 13 per cent in 1962 to 2 per cent in 1969 for these children.

Dr. Eyman said the computer death prediction technique could be applied to hospitals other than those which handle the retarded. “The great advantage of the computer is that it does not miss anything,” he said. “In the course of admitting patients, a human could miss a relationship between symptoms. But the computer will not—if it gets all the facts.”

This approach has been applied more recently to predicting the incidence and prevalence of certain diseases in the hospital. A study of infectious diseases at Pacific State Hospital found that two forms of dysentery—shigellosis and amebiasis—were common among certain patients. The advance warning went with these patients as they were admitted and doctors ordered administration of specific medication—enterovioform—to ward off these diseases. “This advance treatment coupled with the use of new drugs has all but wiped out the two forms of dysentery in the hospital,” Dr. Eyman said.

Physiological Monitoring

Recently the linkage of an analog-digital converter to the computer system has been completed which allows for detailed analysis of recordings of patient brain waves. The project is under the direction of Dr. Gary Galbraith, assistant professor of psychology at the University of Southern California and a staff member at the Socio-Behavioral Study Center.

A basic tool in studying the human brain has been electroencephalograph (EEG) readings of brain waves, the electric charges put out by the activity of the brain. Electrodes—tiny pieces of metal which pick up the brain waves—are attached to the scalp of the patient. The EEG converts the electric charges into a series of wavy lines on a graph. Each line rises and falls according to the amount of electrical energy put out by each portion of the brain being monitored.

The standard clinical method has been to give an “eye-ball” reading to these wavy lines. However, as the study of mental retardation has progressed, this standard

method has become "no longer sufficient," according to Dr. Galbraith. "Instead," he said, "our research efforts have concentrated upon the extraction of both simple and more complex information by means of detailed computer analyses."

The physiological monitoring laboratory at Pacific State Hospital is a well-equipped, two-room complex. One room, in which the subject patient is placed, is electrostatically shielded and contains various visual display panels, loudspeakers, and devices for recording the subject's behavioral responses. An adjacent room contains a great variety of electronic apparatus, such as EEG amplifiers, oscilloscopes, multi-channel ink recorders and devices to control the stimuli which are presented to the patient.

The patient is placed in the subject's room and there given a series of stimuli. These stimuli include lights, sounds and such meaningful symbols as pictures of ice cream and candy for a child. As the patient reacts to the stimuli, the electric charges from his brain are recorded as wavy lines on the oscilloscope or ink recorder. The analog-digital (A-D) device is used to convert the lines into number charts produced by the computer on which high numbers represent peaks in the wavy lines and low numbers represent valleys.

Averaging Out "Noise"

One of the principal uses of the computer and its printout is a process known as averaging out the EEG "noise"—the distortion in the EEG reading caused by the conductive fluid surrounding the brain, the cerebrospinal fluid. This fluid sets up a sort of static that becomes part of the EEG reading and, like static on a radio, distorts the signal.

When a stimulus is presented to a patient—a light flash, for example—the brain registers what researchers call a Sensory Evoked Response (SER). This impulse is picked up by the electrode attached to the skull and registers as a peak on the EEG. However, the precise intensity of the impulse is clouded by the static set up by the cerebrospinal fluid.

In studying the activity of the brain, it is crucial for doctors to know what the precise response is to each stimulus. To do that, doctors must extract the relatively small evoked response (SER) signal from the ongoing static of the cerebrospinal fluid. Here the computer has proved to be a valuable tool.

Doctors present the same stimulus to the patient many times and the computer records the response and, after the series has been completed, comes up with an average. This average is, according to Dr. Galbraith, "a markedly enhanced representation of the brain's transient response to the stimulus and is termed the Average Evoked Response (AER)."

Pacific State Hospital currently is using the AER to study mental retardation in several ways. For example, retarded persons are deficient in their ability to see two brief flashes of light as really being two separate stimuli. Normal subjects will see two flashes while retarded persons will report seeing only one. By recording the brain's response as the two light flashes are given it is possible for the doctors to make judgements about the speed with which the retarded person's brain is able to accept and process stimuli.

Another application involves the testing of patients who in standard clinical tests have been judged to be deaf. In many cases, the attending doctor feels that these subjects are not deaf at all, but merely unable to understand the instructions and respond appropriately in the testing situation. By presenting a sound to the patient and recording the

AER it is possible to determine if the stimulus is actually reaching the auditory cortex, that portion of the brain which processes sound stimuli. Thus, even if the patient makes no response, doctors can determine if he is physically able to hear—that the stimulus does reach the proper point in the brain.

Thinking Like A Computer

The computer-generated AER also is being used to study the inter-relationships of the various parts of the brain. Several electrodes are attached to the patient's scalp and a series of EEG readings are produced. With this reading, doctors are able to follow a stimulus as it is processed through the brain.

One conclusion is that the retarded may think like a computer. "Their thought patterns appear as fixed and inflexible as a computer's program," Dr. Galbraith said. "Their minds appear to have difficulty adapting to new environments or to new stimuli."

Community Studies

A further use of the computer system has been a continuing analysis of a study of the retarded person in his home community. The study was conducted in 1963-4 in Riverside, Calif., a community of 85,000 persons approximately 60 miles east of Los Angeles. The mass of data collected on 10,000 subjects has been undergoing analysis by the computer since that time.

One conclusion—not new but reemphasized by the study—is that poverty and cultural deprivation are strong influences in producing mental retardation. According to Dr. Eyman, about 30 to 40 per cent of the 4,000 patients at Pacific State Hospital or on one of its aftercare programs have a diagnosis of cultural retardation. This implies that they were committed to a hospital for the mentally retarded "as a direct result of their environment."

"What was new and very interesting in the Riverside study," Dr. Eyman said, "is how the tag of mental retardation is placed on a child. It tends to follow a distinct socio-economic bias."

The researchers found that persons who are poor and members of minority groups are five times more likely to be called mentally retarded than are middle-class persons. The researchers found that this label of "retarded" is applied to the poor, culturally deprived child not only by his neighbors but also by his community agencies—the schools, churches, welfare department, police.

Dr. Eyman's conclusion: "It is quite obvious that communities must develop better ways of determining who is mentally retarded and who is not."

First results of the study, although only recently published, already have brought about changes in Riverside. For example, it has changed the city's philosophy of educating its retarded children. The study showed that special classes set up for the retarded were of questionable value. The children were learning no better in these special classes than they would in classes with normal children.

"Of course, the problem is that it is unfair to leave the mentally retarded child in the regular class because he would slow down the progress of the other children," Dr. Eyman said. "Riverside is seeking a balanced solution by leaving the mentally retarded children in the regular classes, but giving them special tutoring in an attempt to enable them to strive towards the progress of the normal children."

Hopefully other communities will soon be able to benefit from the computer-based research conducted by far-sighted organizations like the Pacific State Hospital. □

JOBS AND CAREERS IN DATA PROCESSING

People and Computers – Part 1*

*The Right Honourable Lord Robens
Chairman, National Coal Board
Woldingham, PC, England*

The National Coal Board had the great good fortune to have Dudley Hooper working for them for almost 20 years at the height of his powers. His training and experience before 1947, in mathematics, accountancy and in the use and development of office machinery were ideal for his later tasks: but his real and characteristic strengths lay in himself. He was a man of enormous originality, persuasiveness and energy. But he was more than this: he had the combination, so rare and so essential, of bounding vision with complete practicality; and he was also always able to see beyond the intoxicating technology of electronic data processing to its effects on ordinary men and women.

It is of some interest to cast our minds back to those early years. It will not only deepen our appreciation of Dudley Hooper, but it suggests some lessons for us today.

Dudley Hooper first set down his ideas on integrated data processing in 1948: hardly more than 20 years ago. It was another five years before computers were in fact available for office applications. This alone is a great tribute to him.

But technology was not the only obstacle to the accomplishment of Dudley Hooper's objectives. It was clear at that time that the first field in which computers should be used in the coal industry was the calculation of wages. It is now unfashionable to direct attention to the automating of this kind of work: the emphasis is rather on things called Total Management Information Systems. But in the early 1950's it would have seemed a little greedy to start at the end and work back towards the beginning, and, as I said, Dudley Hooper was a visionary with his feet firmly on the ground. At that time wages costs were two-thirds of the costs of coal, and in some places five men were being employed to pay

100 – an absurdly heavy burden. But even before the computer could be brought to bear, an immense work of rationalisation had to be done. The First Daywage Structure came into operation in 1955, after a process which had involved research to discover and document over 6,500 different job names, analysis to boil these down to 200 distinct jobs and to slot these into just 13 grades, and finally negotiation and planning to implement an agreement covering over 850 pits and many hundreds of thousands of men; and I must add that this dealt with only those jobs which were not paid on an incentive basis.

The lesson, I believe, is this: that the proper use of computers involves immense and delicate changes in matters of very direct importance to people, and in very old and complex solid structures. The brilliance of the computer professionals has proved itself capable of conquering any obstacles in their immediate fields of hardware and software. We no longer have to wait, as did Dudley Hooper, for the computer to be built. But our skills in dealing with social change have developed only slowly, and it is in the field of people that we find our most important constraints. This is why I feel the subject of *People and Computers* should be of very live and urgent interest to computer men, as it always was to Dudley Hooper.

Knowing vs. Believing

One of the most important things about people is that it is quite as important to know what they believe on a given subject, as to know what is in fact the truth about that subject. To take an example far removed from computers; nutritional scientists will assure you that white bread is in fact far more healthy than wholemeal – and yet the so-called health foods are a great growth business, basically because many people believe the opposite. So it is well worth standing back from electronic data processing itself, to discuss what ordinary people believe about computers.

Research at the Manchester Business School has shown that people's most important sources of information – or misinformation – about computers are TV and films. This means that the popular image is largely formed by a heady combination between the computer publicists and prophets; and the producers, directors and script writers. Now the men in the entertainment and communications industries are not scientists or managers, but artists and journalists, concerned with the dramatic and sensational, and feeling both awe and resentment at developments which they do not really understand. The result can be seen in the computer jokes and stories. You will know the types all too well: on one hand, the computerised gas bill for nought pounds nought shillings and nought pence (which is certainly a very strange idea); and, on the other, the computer which takes over the world. To the professional computer men I would say that, if you find the computer jokes a pain in the neck, it is the presentation

Dudley Hooper was a pioneer in the training of business users of computers. He was on the staff of the National Coal Board for nearly 20 years. He joined the staff of the Board in 1948, shortly after it was nationalized, as a technical specialist on the application of accounting machines. He was appointed Chief Organising Accountant of the Board in 1954, and served in that capacity until 1964 when he joined the Institute of Chartered Accountants as Technical Officer.

Dudley Hooper was one of the founders and the first chairman of the British Computer Society. He served the Society as a council member and on various committees for several years, and remained a member of the editorial board of the Society's publication, *The Computer Journal*, until his sudden death in January of 1968.

*This two-part article is based on the 1969 Dudley Hooper Memorial Lecture given by Lord Robens at London University on January 28, 1969. Part 2 will be published in this column next month.

of the computer as superhuman that you should fight. People can forgive honest error, but when something is presented to them as possessing superhuman powers of speed and accuracy, they feel threatened, and will rejoice in evidence of its fallibility.

In this context, I would like to suggest that it may sometimes be right for computer people to moderate their enthusiasm at some of the potential applications of their expertise. A systems analyst is a professional innovator, it is naturally difficult for him to remember that most people, regrettably perhaps, find radical innovation frightening. I can well understand the excitement which fills the management scientist at the idea of a manless factory; I can also appreciate that the prospect fills the worker or supervisor with a rather different excitement. We have often heard of self-fulfilling prophecies: in the field of automation there is a possible danger of running into self-falsifying prophecies. So when speaking of the potential of the computer we should recognise that other people's interpretations will differ from our own. For example, there is no reason to doubt that developments in data storage and transmission will enable us to have a 'cash-less society', in which every kind of payment and money transfer is done inside some control computer. But the reaction of the public at large to such suggestions is only partly a sharing in the enthusiasm at the neatness and elegance of such an idea: it is at least as much a feeling that this is a gross invasion of privacy. Irrational the reaction may be: but money is an extremely delicate subject, and the reaction might at least have been expected. There is much to be said for hastening slowly in these matters; because this is not an isolated example, and the total effect of all these computer prophecies is likely to be a feeling that all the old familiar landmarks are shifting, and that nothing is secure.

This total effect is also extremely misleading, because none of these changes will come about overnight. This is particularly important, because the popular image is not only the image held by the man on the Clapham omnibus: in this case, it is the image held by most politicians, top civil servants and top managers. They are not superhuman, any more than computers, and they get their views on these matters from the *Sunday Times Colour Supplement* and *Tomorrow's World*, just like anyone else.

We need to remind ourselves from time to time that our masters are, on the whole, no cleverer than many other people, and indeed are often rather busier, so they have little opportunity for study in depth. They need to be spoon-fed, and if this is not done by those who really know, there will be plenty of professional communicators and self-interested fanatics only too eager to fill the gap. It is really rather frightening to consider how so many of our rulers have acquired their mental furniture. Neither the universities nor the mass-media offer the key to the universe, it is just that they make their inmates believe they do. I would say that *one of the most important tasks, both of The British Computer Society, and of you as individuals working in this field, is to educate the laymen*, I am sure that wider understanding of the true uses of the computer will be of immense benefit to the computer profession, both in the short term and in the long term. We must recognise that the job is one of education, not selling. This field, above all, is one in which people must be treated as adults and equals: any slightest suggestion of self-interested manipulation would be fatal.

Prophecies

We should also remember that to see is to believe and to do is to understand. The best education in computers is in seeing a computer system being installed with good results and without a painful transition.

Let us spend a moment or two discussing the various prophecies about computers that are dinned into our ears.

The first prophecy is the one of limitless abundance: the working day will be of five hours, the working week will be of three days. This is a modest objective: one American has predicted a working week of half this by the end of the century. No one will start work before 25, and everyone will retire at 50. Every commodity will be freely available, and we shall spend our time writing poetry and painting one another's toenails.

The second prophecy in no way rejects any of this, but takes it further and appeals to those of less effervescent character. The productive capacity of society is still seen as illimitably vast, but the leisure is interpreted as unemployment. The distribution of wealth is foreseen as grossly irrational. People are totally unable to occupy their time, and the elimination of work results in unrest, neurosis and despair.

The third prophecy is still wilder than the other two. This has visions of the machine becoming independent of its maker, and with ability to reproduce itself and to exercise true creativity now allied to its mythical infallibility, the computer takes over the world and enslaves man.

I have in no way exaggerated the extremes to which some of these people go, as most of you will be aware. Put in this way, it would seem that we can just laugh this off, and a few more jokes about asking the computer 'Where is my father?' or 'Does God exist?' will be all to the good. It is only too clear that the world's problems will not quickly be those of limitless abundance, and that the contribution of the computer to the relief of the peasants in India or in China is, at best, limited. But it is these computer myths that shape the attitudes both of our rulers and of ordinary people: it is our task to dispel these illusions.

Limitless Abundance

It is worth examining in greater detail just what is wrong with these prophecies. Let us take the matter of the period of time spent at work. Presently a man might typically start work at the age of 20 and retire at 65, working during the intervening years, 40 hours a week and 50 weeks a year. In total he works for 90,000 hours during his lifetime. The prophecy I mentioned earlier implies that in the computerised future he might work in his lifetime just one-sixth of the present figure. On the assumption that half of all increases in productivity go to reducing the hours of work, as against improving the standard of living, and that productivity increases at 4 per cent. per year, it will take 90 years to reach the 15-hour working week. In other words, this is for our grandchildren's grandchildren. To address our minds to this problem would be like Disraeli worrying about supersonic booms.

And the assumptions used are in fact far too generous to the other side. This country, at least, has never during the whole of its history attained a 4 per cent. annual growth in productivity over an extended period of time: and during the period of greatest productivity increase that we have known – the last 20 years – the hours actually worked did not decrease at all. For workers in manufacturing industry, the actual hours worked per week have hovered between 44 hours and 46 hours since the First World War. And the same is true of the United States. In America, too, the drop since the First World War in hours worked is hardly perceptible: it is presently about 40 hours per week, and on present trends would be somewhere between 34 and 38 per week by the year 2000. Indeed it could well be argued their leisure has decreased since the First World War. Journeys to work have probably increased somewhat with the development between the wars of far-flung suburban estates on prairie planning scale. Working wives leave more housework in the evening for the husband to do. All this eats into leisure time. On top of this there has been a growth in moonlighting (the second job). So I do not share the view that leisure is a growing problem.

(To be continued)

CALENDAR OF COMING EVENTS

- Oct. 1-5, 1969: American Society for Information Science, 32nd Annual Meeting, San Francisco Hilton Hotel, San Francisco, Calif.; contact Charles P. Bourne, Programming Services, Inc., 999 Commercial St., Palo Alto, Calif. 94303.
- Oct. 6-10, 1969: Second International Congress on Project Planning by Network Analysis, INTERNET 1969, International Congress Centre RAI, Amsterdam, the Netherlands; contact Local Secretariat, c/o Holland Organizing Centre, 16 Lange Voorhout, The Hague, the Netherlands.
- Oct. 8-9, 1969: 2nd Annual Law of Software Conference, Statler Hilton Hotel, Washington, D.C.; contact Professors Irving Kayton or David Bender, Computers-In-Law Institute, The George Washington University, Washington, D.C. 20006
- Oct. 8-10, 1969: Cooperating Users of Burroughs Equipment (CUBE) Fall Meeting, Sheraton-Jefferson Hotel, St. Louis, Mo.; contact Thomas S. Grier, Burroughs Corporation, 6071 Second Ave., Detroit, Mich. 48232
- Oct. 9-11, 1969: DPMA Div. 3 Conference, Lafayette Hotel, Little Rock, Ark.; contact Robert Redus, 6901 Murray St., Little Rock, Ark.
- Oct. 13-16, 1969: Association for Computing Machinery (ACM) Symposium on Data Communications, Calloway Gardens, Pine Mountain, Ga.; contact Edward Fuchs, Room 2C-518, Bell Telephone Laboratories, Inc., Holmdel, N. J. 07735; Walter J. Kosinski, Interactive Computing Corp., P.O. Box 447, Santa Ana, Calif. 92702
- Oct. 13-16, 1969: 1969 International Visual Communications Congress, International Amphitheatre, Chicago, Ill.; contact Internat'l Assoc. of Visual Communications Management, Suite 610, 305 S. Andrews Ave., Fort Lauderdale, Fla. 33301
- Oct. 14-15, 1969: Symposium on Optical Character Recognition, sponsored by the National Archives and Records Service of the General Services Admn. and the National Bureau of Standards, at Dept. of State West Auditorium, Washington, D.C.; contact Mr. John DeMasi, International Business Forms Industries, 5223 River Rd., Washington, D.C. 20016
- Oct. 14-16, 1969: American Society for Cybernetics, Third Annual Symposium, National Bureau of Standards, Gaithersburg, Md.; contact Dr. Carl Hammer, UNIVAC Div., Sperry Rand Corp., 2121 Wisconsin Ave., N.W., Washington, D.C. 20007
- Oct. 15-17, 1969: IEEE Tenth Annual Symposium on Switching and Automata Theory, University of Waterloo, Waterloo, Ontario, Canada; contact Prof. J. A. Brzozowski, Dept. of Applied Analysis and Computer Science, University of Waterloo, Waterloo, Ontario, Canada
- Oct. 16-17, 1969: American Institute of Industrial Engineers (AIIE), Huntsville Chapter, 7th Annual Conference, Huntsville, Alabama; contact R. Trenkle, 2226 Matthews St., S.E., Huntsville, Alabama 35801
- Oct. 17-18, 1969: Northeastern Regional Conference of the Association for Computing Machinery, State Univ. of New York, Albany; contact Dr. E. D. Reilly, Jr., Computer Science Dept., State Univ. of New York at Albany, Albany, N.Y. 12203
- Oct. 22-23, 1969: National Academy of Engineering Symposium on "The Engineer and the City", Washington, D.C.; contact: Dorothy Weatherby, National Academy of Engineering, 2101 Constitution Ave., N.W., Washington, D.C. 20418
- Oct. 22-24, 1969: IEEE 1969 Systems Science and Cybernetics Conference, Philadelphia, Pa.; contact C. Nelson Dorny, Moore School of Electrical Engineering, Univ. of Pa., Philadelphia, Pa. 19104.
- Oct. 24, 1969: Fourth Annual Symposium on the Application of Computers to the Problems of Urban Society, sponsored by the Assoc. for Computing Machinery, Metropolitan N.Y. Chapters, New York Hilton Hotel, New York, N.Y.; contact Mrs. Jessica Hellwig, Computer Center, Columbia Univ., New York, N.Y. 10027
- Oct. 26-30, 1969: ACM/SIAM/IEEE Joint Conference on Mathematics and Computer Aided Design, Disneyland Hotel, Anaheim, Calif.; contact J. F. Traub, Program Chairman, Computing Science Research Center, Bell Telephone Laboratories, Inc., Murray Hill, N.J. 07974.
- Oct. 27-29, 1969: Electronics and Aerospace Systems' Convention and Exposition (EASCON '69), Sheraton Park Hotel, Washington, D.C.; contact Howard P. Gates, Jr., EASCON '69 Technical Program Chairman, P.O. Box 2347, Falls Church, Va. 22042.
- Oct. 27-29, 1969: Data Processing Supplies Assoc. Fall General Meeting, New York, N.Y.; contact Data Processing Supplies Assoc., 1116 Summer St., P.O. Box 1333, Stamford, Conn. 06904
- Oct. 27-29, 1969: Forum of Control Data Users (FOCUS) Regional Conference, Hilton Palacio del Rio, San Antonio, Texas; contact: William I. Rabkin, FOCUS Exec. Sec., c/o Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173
- Oct. 27-30, 1969: 24th Annual ISA Conference & Exhibit, Astrohall, Houston, Texas; contact H. Buntzel, Jr., Program Chairman, Bonner & Moore Assocs., Inc., Suite 1124, 500 Jefferson Bldg., Houston, Texas 77002.
- Oct. 27-31, 1969: Business Equipment Manufacturers Assoc. (BEMA) Annual Business Equipment Exposition and Management Conference, New York Coliseum, Columbus Circle, New York, N.Y. 10023; contact Laurance C. Messick, Business Equipment Manufacturers Assoc., 235 East 42nd St., New York, N.Y. 10017
- Oct. 30-31, 1969: Assoc. of Data Processing Service Organizations Management Conference, Regency Hyatt Hotel, Atlanta, Ga.; contact Jerome L. Dreyer, Assoc. of Data Processing Service Organizations, Inc., 551 5th Ave., New York, N.Y. 10017.
- Nov. 3-5, 1969: 5th Annual IEEE Symposium on Automatic Support Systems for Advanced Maintainability, Chase-Park Plaza Hotel, St. Louis, Mo.; contact Matthew F. Mayer, Program Chairman, P.O. Box 4124 Jennings Station, St. Louis, Mo. 63136
- Nov. 3-7, 1969: GUIDE International, Denver Hilton Hotel, Denver, Colorado; contact Jack Eggleston, GUIDE Secretary, Mgr., Programming R&D, Mutual of Omaha Insurance Co., P.O. Box 1298, Omaha, Nebraska 68101
- Nov. 5-7, 1969: IEEE Northeast Electronics Research and Engineering Meeting (NEREM), War Memorial Auditorium and Sheraton Boston Hotel, Boston, Mass.; contact NEREM, 31 Channing St., Newton, Mass. 02158.
- Nov. 6-7, 1969: First National Symposium on Industrial Robots, IIT Research Institute, Chicago, Ill.; contact Mr. Dennis W. Hanify, IIT Research Institute, 10 West 35 St., Chicago, Ill. 60616
- Nov. 10-11, 1969: Digitronics Users Assoc. (DUA), 4th Annual Conference, Barbizon-Plaza Hotel, New York City; contact Secretary, DUA, Box 113, Albertson, Long Island, New York, 11507
- Nov. 13-14, 1969: Conference on the Legal Protection of Computer Programs (sponsored by the Law Group of the British Computer Society), Bedford Hotel, Brighton, England; contact Conference Dept. of The British Computer Society, 21 Lamb's Conduit St., London, W.C.1, England
- Nov. 15-16, 1969: ACUTE (Accountants Computer Users Technical Exchange), Jack Tar, San Francisco, Calif.; contact ACUTE, 947 Old York Rd., Abington, Pa. 19001
- Nov. 17-19, 1969: IEEE Eighth Symposium on Adaptive Processes, The Pennsylvania State Univ., State College, Pa.; contact Dr. George J. McMurtry, Program Chairman IEEE 1969 (8th) Symposium on Adaptive Processes, Dept. of Electrical Engineering, The Pennsylvania State Univ., University Park, Pa. 16802
- Nov. 18-20, 1969: Fall Joint Computer Conference, Convention Hall, Las Vegas, Nev.; contact American Federation for Information Processing (AFIPS), 210 Summit Ave., Montvale, N.J. 07645.
- Nov. 20-21, 1969: Conference '69: 1969 Data Processing Conference sponsored by the Empire Div. (13) of the Data Processing Management Association (DPMA), Statler Hil-

ton Hotel, New York, N.Y.; contact Registrar, Conference '69, P.O. Box 1926, Grand Central Station, New York, N.Y. 10017

Nov. 25-27, 1969: Digital Satellite Communication Conference, Savoy Place, London, England; contact IEE Joint Conference Secretariat, Savoy Place, London WC2, England.

Dec. 1-3, 1969: Conference on Image Storage and Transmission for Libraries, National Bureau of Standards, Gaithersburg, Md.; contact: Madeline M. Henderson, Center for Computer Sciences and Technology, National Bureau of Standards, Room B226-Instr., Washington, D.C. 20234

Dec. 8-10, 1969: Third Conference on Applications of Simulation, International Hotel, Los Angeles, Calif.; contact Philip J. Kiviat, Program Chairman, Simulation Associates, Inc., 1263 Westwood Blvd., Los Angeles, Calif. 90024

Dec. 18-20, 1969: Third International Symposium on Computer and Information Science (COINS-69), Americana Hotel, Bal Harbour, Fla.; contact Dr. Julius T. Tou, COINS-69 Chairman, Graduate Research Professor, University of Florida, Gainesville, Fla. 32601.

Dec. 27-28, 1969: Annual Meeting of the Association for Symbolic Logic, Waldorf-Astoria Hotel, New York, N.Y.; contact: Prof. Jon Barwise, Program Chairman, Dept. of Mathematics, Yale University, New Haven, Conn. 06520

Jan. 14-16, 1970: Third Annual Simulation Symposium, Sheraton-Tampa Motor Hotel, Tampa, Fla.; contact: Annual Simulation Symposium, P.O. Box 1155, Tampa, Fla. 33601, 813-839-5201.

Jan. 14-16, 1970: 1970 International Conference on System Sciences (IEEE), Honolulu, Hawaii; contact: Dr. Richard H. Jones (HICSS), Information Sciences Program, 2565 The Mall, University of Hawaii, Honolulu, Hawaii 96822

Jan. 19-21, 1970: Computer Software & Peripherals Show & Conference, Eastern Region, New York Hilton, New York, N.Y.; contact Show World, Inc., 37 West 39th St., New York, N.Y. 10018.

Feb. 17-19, 1970: Computer Software & Peripherals Show & Conference, Midwest Region, Pick-Congress Hotel, Chicago, Ill.; contact Show World, Inc., 37 West 39th St., New York, N.Y. 10018.

Feb. 18-20, 1970: IEEE International Solid-State Circuits Conference, Sheraton Hotel, Philadelphia, Pa.; contact: Mr. L. D. Wechsler, Program Committee Secretary, General Electric Co., Electronics Park, Bldg. #3, Syracuse, N.Y. 13201

March 17-20, 1970: IEEE Management and Economics in the Electronics Industry Symposium, Appleton Tower, University of Edinburgh, Edinburgh, Scotland; contact Conference Secretariat, Institution of Electrical Engineers, Savoy Place, London, W.C.2, England.

Apr. 7-9, 1970: Computer Software & Peripherals Show & Conference, Western Region, Anaheim Convention Center, Los Angeles, Calif.; contact Show World, Inc., 37 West 39th St., New York, N.Y. 10018.

Apr. 14-16, 1970: Computer Graphics 70, Second Internat'l Symposium, Brunel Univ., Uxbridge, Middlesex, England; contact Prof. M. L. V. Pitteway, Computer Science Dept., Brunel Univ., Uxbridge, Middlesex, England.

Apr. 14-17, 1970: Conference on Automatic Test Systems (IEEE), Birmingham, Warwickshire, England; contact: Conference Registrar, The Institution of Electronic and Radio Engineers, 8-9, Bedford Square, London, WC1, England.

May 5-7, 1970: Spring Joint Computer Conference, Convention Hall, Atlantic City, N.J.; contact American Federation for Information Processing (AFIPS), 210 Summit Ave., Montvale, N.J. 07645

May 25-27, 1970: Forum of Control Data Users (FOCUS) Annual Conference, St. Paul Hilton, St. Paul, Minn.; contact: William I. Rabkin, FOCUS Exec. Sec., c/o Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173

June 15-16, 1970: Conference on Solid State in Industry, (IEEE), Statler-Hilton Hotel, Cleveland, Ohio; contact: A. J. Humphrey, Technical Program Chairman, The Reliance Electric & Engrg. Co., 24701 Euclid Ave., Cleveland, Ohio 44117

June 24-26, 1970: Annual Joint Automatic Control Conference (JACC), Georgia Tech, Atlanta, Ga.; contact: Prof. J. B.

REPORT FROM GREAT BRITAIN

(Continued from page 44)

ing entrepreneurs and it contains some extremely meaty facts and figures.

One series I will extract for C&A readers is that projecting U.S. and European expenditure on different aspects of data processing between 1970 and 1980.

For America the authors see total market in 1970 at \$16,263m, rising in ten years to \$52,240m, which means a growth rate of 12 per cent. In Europe, the total for 1970 is put at \$7680m, rising to \$25,200m, or an overall growth rate of 14 per cent, which is one reason why most of the larger U.S. data processing companies are moving into Europe.

U.S. hardware growth from \$4400m to \$12,000m is at 10% against the European 12% (\$2400m to \$7500m); with terminals advancing by 18% but 31% over here; data transmission at 20% against 31%; DP supplies at 10% against 12%; external software at 17% against 32% and service bureaux at 28% (\$2174m to \$24,900m) against 29% in Europe (\$456m to \$5596m).

Internal software growth is the lowest of the U.S. rates—9%, with spending going from \$5450m to \$13,000m. In Europe the corresponding figure is 11% with expenditure rising from \$2376m to \$6528m.

Ted Schoeters

*Ted Schoeters
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Lewis, Dept. of Electrical Engineering, Penn. State Univ., University Park, Penn. 16802

Aug. 24-28, 1970: IFIP World Conference on Computer Education, Amsterdam, Netherlands; contact: A. A. M. Veenhuis, Secretary-General, IFIP Conference Computer Education 1970, 6, Stadhouderskade Amsterdam 13, Netherlands

Aug. 31-Sept. 2, 1970: American Society of Civil Engineers, Fifth Conference on Electronic Computation, Purdue University, Lafayette, Ind.; contact Robert E. Fulton, Mail Stop 188-C Structures Research Division, NASA Langley Research Center, Hampton, Va. 23365

Sept. 1-3, 1970: 25th National Conference, Association for Computing Machinery, New York Hilton, New York, N.Y.; contact: Sam Matsa, ACM '70 General Chairman, IBM Corp., 410 E. 62nd St., New York, N.Y. 10021

Sept. 2-4, 1970: The Institution of Electrical Engineers (IEE) Conference on Man-Computer Interaction, UK National Physical Laboratory, Teddington, Middlesex, England; contact Roger Dence, IEE Press Office, Savoy Place, London WC2, England

Oct. 26-28, 1970: Forum of Control Data Users (FOCUS) Regional Conference, Statler Hilton Hotel, Washington, D.C.; contact: William I. Rabkin, FOCUS Exec. Sec., c/o Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173

May 24-26, 1971: Forum of Control Data Users (FOCUS) Annual Conference, St. Paul Hilton, St. Paul, Minn.; contact: William I. Rabkin, FOCUS Exec. Sec., c/o Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173

Oct. 25-27, 1971: Forum of Control Data Users (FOCUS) Regional Conference, Portland Hilton, Portland, Ore.; contact: William I. Rabkin, FOCUS Exec. Sec., c/o Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173

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APPLICATIONS

MAINE HIGHWAYS BEING MADE SAFER WITH AID OF IBM 1130

Figuring out why 40,000 highway accidents happened and how future accidents may be prevented, is the task of an IBM 1130 computing system being used by the Maine State Highway Commission. The small computer is pinpointing the locations of accidents of 4600 miles of highways in Maine and analyzing their characteristics.

Maine's new system is based on 10,000 numbered highway locations which enable police officers to locate accidents much more accurately than in the past. Details of every accident as well as descriptions of the highway sites where they occur (including location numbers) is fed into the 1130. A detailed analysis of accidents for each location is prepared periodically by the computer.

As of now, over 100 high-accident-rate sites have been identified. After examining these sites, engineers may recommend safety improvements ranging from warning signs to reconstruction. Subsequent computer reports enable the planner to assess the effect of the changes on accident rates. At some sites, that have been improved on the basis of computer information, accident rates already have shown a decline.

Additionally, computer analyses has given planners new insights into accident statistics. For example, while a site may have few total accidents, its accident rate, as calculated by the computer, may indicate a dangerous condition. In one such instance, an inspector recommended warning signs, removal of trees and a reduced speed limit. Since the improvements, there have been no accidents at the site.

MATCHING DONORS, RECIPIENTS FOR ORGAN TRANSPLANTS IS COMPUTER-ASSISTED AT UCLA

At the UCLA Medical Center, an IBM System/360 Model 91 is helping doctors match life-giving kidneys and other vital organs to desperately ill patients at transplant centers in California, Colorado, Oregon, Utah and Washington. Tissue typing for more than 500 kidney transplants and 45 heart transplants has been performed here.

As many as 200 blood samples — from potential donors and recipients — arrive each week at Dr. Paul Terasaki's laboratory at the UCLA

Medical Center. The blood's white cells are typed and classified (in 120 different tests), then "listed" with the computer. As donors become available and are typed, the computer searches its recipient "pool". Recipients whose white-cell classifications are similar enough to the donor's to minimize transplant rejection are selected from the pool. Thus a kidney in Denver may be matched in Los Angeles to a recipient in Oregon and flown directly to the hospital in Portland.

"The matching technique uses the white cells as a model of the genetic system," Dr. Terasaki said. "The genetic system determines the compatibility of the donor organ with the recipient's immune mechanism, which rejects most tissues. All cells, including those of the kidney, heart and liver, contain such genetic systems."

The UCLA computer does much more than simply match tissue for organ transplants. Its continuing study of hundreds of transplants has helped scientists understand how closely tissue characteristics must be matched to offer hope of transplant success. Drugs that suppress the immune mechanism often delay rejection of a transplant for as much as a year. After that, survival of the transplanted organ largely depends upon the closeness of the matching.

Recently the U.S. Public Health Service granted funds to UCLA for development of a communications system that would extend the program beyond the present five western states to other areas of the U.S. Dr. Terasaki foresees the day when a computer will serve as a national center for organ transplants, with the organs all tissue-typed ahead of time and prepared for air shipment to transplant centers anywhere in the country. Even today, Dr. Terasaki and his staff do this specialized work for hospitals as far away as Europe, South America and Japan.

HARNESS HORSES TO BE NAMED WITH AID OF COMPUTER

Researchers at the U.S. Trotting Association (USTA), Columbus, Ohio, are listing the names of all modern-era harness horses — both trotters and pacers — in an IBM System/360 Model 20 for the purpose of helping name the hundreds of thousands of colts foaled each year. Among the factors to be considered in naming harness horses are:

— There may be no more than three words in its name nor can it be longer than 18 units, including two spaces;

— There may be no similar sounding names whose differences are only in the spelling, such as "Night Flight" and "Nite Flite";

— A name previously used may not be used again for at least five years after the death of the original horse or about 20 years after registration;

— Names of horses who are world record holders cannot be used a second time. Also, names of horses whose records or performance distinguished them may be removed from the available category on a permanent basis by owner request; and

— Names of famous dams and sires cannot be incorporated into a name unless the horse was a blood-line offspring.

The computer is programmed to review all of these factors. The owner submits three choices when requesting a name. If none of the names are available, the computer will rearrange them and determine whether one of the combinations is available. If not, the computer may introduce names of the sire or dam of the young horse to find an available combination.

LEGAL RESEARCH SYSTEM IS INAUGURATED IN OHIO

Lawyers throughout Ohio are now able to obtain prompt answers to legal research questions — in plain English — using a new automated system called OBAR. OBAR is the result of a joint effort by the Ohio Bar Association and Data Corporation (a subsidiary of The Mead Corp.). Ohio Bar Automated Research (OBAR), a non-profit corporation, has been established by the Ohio Bar Association to operate the legal research system. Every state law on Ohio's books has been stored in a computer's memory banks at Data Corporation's computer center in Dayton. The full text or a summary of each case can be printed out. Full reports of all Ohio Supreme Court and Appellate Court cases also will be available.

The problem of operating the OBAR system is simplified since all questions and answers are framed in English rather than specialized computer "languages". Attorneys must, however, supervise the work of framing questions and interpreting answers. Every word of law entered in the computer can be used as a handle to retrieve information. Thus, the problem of indexing also is solved by the OBAR system. The system effectively scans the full text of each Ohio court case or statute; any word which appears in them serves as an index. Questions can be broadly stated at

first, then narrowed to fit the precise requirements of the case or problem involved.

OBAR officials estimate that over 100 terminals for access to the computer can be installed throughout the state. Even without access via the special terminals, lawyers will be able to telephone questions to the Ohio Bar Association to be relayed to the computer. Tests indicate that a properly programmed and instructed computer will locate about 90% of all case law bearing on the problem given it. The same tests indicate that experienced legal research attorneys will find about 80%. The computer system is more economical and faster than manned research.

BASKETBALL SCOUTING SYSTEM BEING COMPUTERIZED

COMSERV, a Philadelphia-based computer utility, and the Philadelphia 76'ers, have combined to design a computerized basketball scouting system. The idea was conceived for the purpose of giving the Philadelphia professional basketball team a modern, objective method of evaluating potential pro players. The computerized scouting system will rate the players in a variety of categories — such as shooting ability, defense, ball-handling, speed, etc. This information will be fed into the computer which will produce a composite evaluation that will enable the 76'ers to rank the available college players and draft according to the team's needs.

EDUCATION NEWS

ROME AIR DEVELOPMENT CENTER CONTRIBUTES TIME-SHARING FACILITIES TO AID EDUCATORS IN CENTRAL N.Y. STATE AREA

A multi-million dollar time-sharing computer complex located at the Rome Air Development Center (RADC), Griffiss AFB, N.Y., has been made available to colleges, universities and high schools in the central New York state area. This time-sharing program was launched for educational institutions in 1966, with a limited service made available in 1967 and extensive service in 1968. The program was designed in part to encourage the exploitation of computers by educational institutions in many disciplines. Advancements in computer technology at RADC are shared with the educational community through the time-sharing program on a General Electric 645 computer. (The

facilities are not available for normal or administrative functions of the institutions.)

In using the service, educational institutions can avail themselves of a vast computer resource at a nominal cost. The user is required to pay only the cost of the terminal located at the institution, telephone service, a teletype or visual display device with a keyboard. The time-sharing program is only one of three types of operations for RADC's computer and is available only during designated times for use by the more than 700 authorized subscribers.

At this time thirteen schools in New York state are served by the RADC facility, as well as 10 Department of Defense schools (which include the Air Force Academy, the Air University, the Air Force Institute of Technology and the Armed Forces Staff College). In addition to the educational institutions, other subscribers include Department of Defense agencies and RADC scientific and technical personnel.

EDUCATION PROGRAM FOR UNDERGRADUATES ESTABLISHED BY HONEYWELL

Honeywell Inc. has expanded its new education program with the establishment of a course in computer science for the high school graduate who has some business or college experience. The objective of the program is to educate each student soundly in the fundamentals of computer programming and computer-related systems analysis. This is Honeywell's second program since entering the education field last June (see *Computers and Automation*, July 1969, page 42).

The new course for high school graduates, like the course for college graduates, will be held in Honeywell's education center in Wellesley Hills (Mass.), near Honeywell's Electronic Data Processing Division headquarters. The course will begin in November and will have room for 25 students in the first class.

The undergraduate education program will require nine months to complete. It will be held three evenings a week and will comprise 475 hours of laboratory work, lectures and case studies. The students will have substantial "hands-on" contact with computers for problem solving. Graduates will receive a certificate qualifying them for programming or systems positions in the computer industry. (For more information, circle #41 on the Reader Service Card.)

NEW PRODUCTS

Digital

SPECTRA 70/61 TIME SHARING SYSTEM / RCA

The eighth computer in RCA's Spectra 70 line, the Spectra 70/61, offers local and remote multiple access for over 350 terminal users while at the same time providing concurrent facilities for production processing. While the price base is about 30% higher than the Spectra 70/46 Time Sharing System, the new 70/61 is more than three times faster, offers a three-fold increase in terminal handling capacity, has five times greater



input/output capacity and a larger main memory. The modular design of the system allows for different mixes of workloads, either predominantly batch, remote job entry, or interactive processing. The typical processor — containing over 500,000 bytes of memory and having a cycle time of 765 nanoseconds — may be field expanded in increments of 131K to over one million bytes.

The Spectra 70/61 Computing System provides: (1) a two million byte virtual memory; (2) failure tolerant operation for program and data protection in the event of power fluctuations; (3) 500,000 to one million bytes of main memory; (4) throughput rate of more than five million bytes per second; (5) support for all types of remote terminals; and (6) special software facilities for problem solvers and information seekers, as well as interactive program preparation and debugging aids for professional programmers.

The Spectra 70/61 Operating System (OS61) is designed to provide a large number of users with direct access to its hardware and software facilities, and to shared, integrated data bases. The program

compatibility presently within the Spectra 70 computer line is maintained by providing upward compatibility from the 70/46, and source level language compatibility with the IBM System/360.

Spectra 70/61 will be available for delivery beginning in the first quarter of 1971.
(For more information, circle #42 on the Reader Service Card.)

SIEMENS SYSTEM 300, MODEL 306 / Siemens

Siemens System 300 family has recently added a sixth model, the Model 306. The 306, the largest member of the series, is expected to be used in cases where large programs involve a high processor usage rate or where complicated automation processes are to be handled.

The new model, like the other System 300 processors, has fixed-length words of 24 bits each (plus 1 parity bit). The main memory may include 16,384; 32,768; 49,152 or 65,536 words. Main memory cycle time is 0.6 usec for each word. The 55 single-address instructions includes 12 floating-point instructions. Programming for the Model 306 is in the PROSA assembler language, in ALGOL or in FORTRAN — as with all System 300 models.

Unrestricted interface compatibility allows the connection of the whole range of System 300 equipment. The peripheral devices and the processor are largely capable of simultaneous operation. Apart from this priority-controlled simultaneous operation, the multiprogramming mode is possible: a maximum of 128 unrelated user programs can be executed simultaneously.
(For more information, circle #43 on the Reader Service Card.)

INTERDATA MODEL 15 / Interdata Corporation

The Model 15 high speed communications computer is a first in the small computer class. Interdata's Model 15, designed for "front end" teleprocessing needs of the large computer, will interface directly with the IBM System/360, Burroughs 5500 and Univac 1108 computers.

To balance the teleprocessing load on the system, two or more semi-autonomous processors operate in a foreground/background relationship. The foreground processor handles the data acquisition and control of a large number of communication lines. The background processor functions take care of

communication protocol and message processing. Communications between the two processors is accomplished via a common core memory.
(For more information, circle #44 on the Reader Service Card.)

Special Purpose Systems

CAL SYSTEMS COMPUTER / California Office Systems

A new, small computer, designed to fit into the regular office environment and function within the normal business routine, now is available for businesses of all sizes. The Cal Systems Computer, all contained in a normal-sized desk, is composed of a computer



interfaced with a tape-programming module and an electric typewriter which serves as both input and output device. A hard copy automatically is prepared for all input and output in the form of a normal office communication.

The Cal Systems Computer does not require new languages, forms, procedures, or skills. A library of programs covering almost every office routine and business operation is pre-recorded for use with the computer. Each of these is contained in a separate tape cassette. Because programs are stored outside the computer in the cassettes, the machine can accept an infinite number of programs. About 80% of the instructions in these programs apply to any business firm; the remaining 20% represents items such as format, headings, etc., and are tailored to the individual firm's needs.

In addition to being a self-contained work station, the computer can serve as a data terminal.
(For more information, circle #45 on the Reader Service Card.)

SERIES 3060C COMPUTERIZED CONTROLLER / Digital Systems, Inc.

Series 3060C Computerized Controller, for programming point-to-point NC machine operations such as

printed circuit board drilling, consists of a direct computer core package located in the data control module. The system offers interfacing to operate from punched tape with mode selections of tape to tape, machine to tape, tape to machine, dials to machine, and dials to tape. The computer, in addition to driving positioning systems, can be used to program tapes in a variety of code formats, providing a ready means of transferring work from one machine to another.

The user may handle operations such as repeatable patterns, translation, conversion, and interpolation almost instantly. Routines, such as hole patterns and step and repeat patterns, can be stored and recalled when desired. Or a grid in any increment from .001" to .999" can be selected by dial input switches. When operating in a selected grid, the computer controller will compensate for deviations from the closest grid intersection. An automatic restore feature (optional) prevents program loss arising from power failure.
(For more information, circle #46 on the Reader Service Card.)

Memories

MEMORY OPTION FOR PDP-10 / Digital Equipment Corp.

A lower cost per word core memory, with 1.8 usec. cycle time and 800 nanosecond read access time, has been added as an option to Digital's PDP-10 product line. The new memory, designated MD10, has 32,768 words of memory, associated mounting hardware, power supply, and interfacing; 32K-word MD10-E extension modules also will be available. The new MD10 memories will be available for delivery in early 1970.
(For more information, circle #47 on the Reader Service Card.)

ISS 714 DISK STORAGE DRIVE / Information Storage Systems

An eleven-high drive, with access times twice as fast as the previous industry standard, has been announced by this California firm. The second in its line of disk storage drives, the ISS 714 Disk Storage Drive has complete disk pack and data compatibility with the IBM 2314.

Access time of the ISS 714 ranges from a minimum of 10 milliseconds to a maximum of 60 milliseconds — average access time is 32 milli-

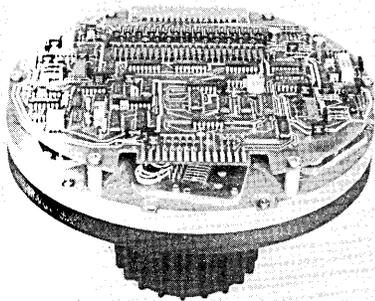
seconds. In comparison, average access time for the IBM 2314-1 is 75 milliseconds; the recently announced 2314-A1 has an access time of 60 milliseconds.

The ISS 714 provides storage of 29 million bytes at a data transfer rate of 312,000 bytes per second; the 20 recording surface IBM 2316 Disk Pack, or equivalent, is used. Deliveries will begin later this year.

(For more information, circle #48 on the Reader Service Card.)

DISC MEMORY SYSTEM / Librascope Products Division Singer-General Precision, Inc.

This new commercial disc-memory system, known as the Model L107-8-4, is an extension of the present Model L508 which was designed for military applications. Typical applications for the new Model L107-8-4 include small computers and calculators, automatic test and checkout systems, process controllers, buffer or display systems, and as an extension of core memory.



Storage capacity is 500,000 bits on 25 data tracks. A coded timing track provides the index clock, the sector clock and the master bit clock. Disc rotational speed is 2600 RPM. The L107-8-4, a compact 9 x 9 x 4.94 inches, weighs only 11 pounds.

(For more information, circle #49 on the Reader Service Card.)

PLUG-IN RANDOM ACCESS CORE MEMORY SYSTEM / Ferroxcube Corp.

Ferroxcube's new FI-23 Memory System has capacities of 80 or 160 words with up to 17 bits per word. The system has an access time of 2 microseconds and a full cycle time of 8 microseconds. DTL integrated circuits are used for logic, sense, timing and interface circuits. An interface line is provided to insure that stored data is not lost during power turn-on or turn-off. (For more information, circle #50 on the Reader Service Card.)

MESA 200 CORE MEMORY SYSTEMS / United Telecontrol Electronics

This single card coincident current memory, Model 5034, of the new MESA 200 Core Memory Systems is a compact 9.75 x 14 x 1.1 inch unit. Storage capacity is 1K x 8. It operates at 2 microseconds in a full cycle (read/restore or clear/write) random access mode. On-line operation is controlled by the signal interface with operation over a 15°-40°C temperature range (extended temperature range units in the MESA 200 series will be available). All interface signals derive from or connect to 7400 Series circuits which are compatible with TTL and DTL integrated circuits. (For more information, circle #51 on the Reader Service Card.)

Software

LOGIC DIAGRAMMING SYSTEM / KDI Automation Systems, Inc., Encino, Calif. / Automatically prepares well-organized logic diagrams from basic engineering design data to accepted drafting standards. The system will typically be used to produce fully detailed drawings, including hardware data such as component-pin and component ID information. Preliminary drawings also can be generated showing only circuit flow for use as a quick-turnaround design aid by the logician. The Logic Diagramming System is offered on a purchase basis and is available for operation on most medium-scale and larger computers. (For more information, circle #52 on the Reader Service Card.)

MARK IV/32 SYSTEM / Informatics Inc., Sherman Oaks, Calif. / Adapted particularly for the 32K memory capacity of the 360/25 and 30 (previous version was for business applications of IBM 360s with at least 65K). The MARK IV File Management System is available on a one-time basis. (For more information, circle #53 on the Reader Service Card.)

PLUS (a Program Library Update System) / Cullinane Corp., Boston, Mass. / Provides for storage and maintenance of source language programs on tape or disk; any program language may be stored or intermixed in the file; test data decks, object decks, and job control language decks may also be stored on the library. The program also will generate a job stream file with job control set-up to compile or assemble modified programs. PLUS, developed and used by Cullinane, is written for

the IBM/360, Model 30 and up, and other computers supporting COBOL. Price for the program is \$1500, including documentation, installation, and training. (For more information, circle #54 on the Reader Service Card.)

SSTPAC II — System Support Test Package / Programming Sciences Corp., Peripheral Sciences Div., New York, N.Y. / A troubleshooting system specifically developed to pinpoint the causes for incorrectly operating local or remote equipment attached to IBM System/360 computers, without utilizing IBM programs. The system is for sale or lease for periods as brief as one week. (For more information, circle #55 on the Reader Service Card.)

SLANG / TRW Inc., Redondo Beach, Calif. / A computer user's language that permits engineers to personally and easily solve highly sophisticated mathematical problems by avoiding numerical analysis. An engineer need only define the problem and the computer program generator provides the numerical means for solving it. SLANG, written in FORTRAN IV, is adaptable to most medium scale and large scale computers. (For more information, circle #56 on the Reader Service Card.)

STOCK TRANSFER SYSTEM / Financial Data Systems, St. Louis, Mo. / Performs the application functions of stockholder accounting, certificate preparation, and issuing of dividend checks and proxy materials. The online system will be marketed to banks which serve as stock transfer agents for others and to corporations which desire to act as their own stock transfer agents. (For more information, circle #57 on the Reader Service Card.)

WAMPUM / Hirsch Consulting, Cambridge, Mass. / Developed to solve simultaneous algebraic systems of equations in a new way, WAMPUM is not prone to inaccuracies that arise due to loss of calculating significance or round-off errors. It handles singular systems in an easy to interpret manner, and it may be used in work involving more unknowns than equations, as well as non-singular systems. The new software package is available for use on any digital computer. (For more information, circle #58 on the Reader Service Card.)

WORK TEN / National Computing Industries, Phoenix, Ariz. / A File Management Language designed to simplify programming, do file maintenance, produce its own documentation and increase program

reliability. A programmer first specifies what data he will work with, then what action he wants to take to manipulate the files and finally, what controls he wants. WORK TEN then validates the specifications, goes to the libraries for detailed record specifications, and produces a compiled COBOL program. Often a programmer has to write as few as ten lines of WORK TEN to generate what used to take him 200 lines of COBOL.

(For more information, circle #59 on the Reader Service Card.)

Peripheral Equipment

TIME SHARED PROGRAMMABLE CALCULATOR, MATHATRON®-III / Mathatronics Corporation

MATHATRON®-III, a time shared programmable calculator, is capable of servicing 1 to 16 remotely located terminals simultaneously. Terminals may be Mathwriter® keyboards, Model 33 teletypes, or customer's own input devices (any ASCII coded terminal). Remote terminals may be all of one type or any combination of all three. These may be direct wired for short distances (1000 ft.) or acoustically coupled for unlimited distances.

Each of the terminals may simultaneously perform the following functions (all operations performed in floating point arithmetic): add, subtract, multiply, divide, left and right parentheses, $1/2$ power square root, log base e, e^x , and N^x . Each has eight storage registers (128 in all) and a programmable memory bank with 128 formula steps in eight "addressable" sectors of 16 steps each. If Model 33 Teletypes are used, each has 96 program steps.

The system's administrative control switch allows restriction of writing into memory. Use of the three position switch, located at the MATHATRON®-III, will: (1) allow all terminals to use any portion of the memory in any desired way; (2) allow any terminal to assign its memory and storage registers to another terminal; and (3) restrict the assignment of memory or storage registers. The administrative control does not restrict the ability of the terminals to simultaneously read and execute stored programs of common interest.

A wide variety of optional peripheral equipment is available to increase the versatility of the system. (For more information, circle #60 on the Reader Service Card.)

BATCH DATA TERMINAL / Compat Corporation

The Compat 88-23 Stored-Program Data terminal includes a stored program digital computer which permits changes in operation without hardware modification. The terminal has complete send/receive capability in either on-line conversational, or unattended batch modes. Simultaneous hard copy is produced for all data sent or received.

The 88-23 has an interchangeable loop tape system with capacity for 50,000 characters; access time to any stored data is 0.5 seconds. Data can be transmitted (at 1200 baud, maximum time required is 6 minutes) using idle WATS lines and unattended operation, or over any telephone line of a public network. Data from the Central Processing Unit also is accepted, unattended at 1200 baud and recorded for next day printout, off-line and in any operator-directed order.

The computer, with 4K x 16 core memory with 1 microsecond access time, performs all operating controls. The computer also can be programmed to perform a number of tasks, including the simultaneous operations of parallel keyboards. Bulk storage may be expanded by 50K 8-bit characters through the insertion of an entire tape-loop.

Bell Telephone or other manufacturers modems may be used and the equipment is completely compatible with all major computer systems. Although ASCII is standard, any 8-level code may be used. (For more information, circle #61 on the Reader Service Card.)

STORE-DATA SYSTEM / RJ Communication Products, Inc.

Associated Grocers of Phoenix, Ariz., have contracted to buy the first RJ Store-Data System — a system for collecting data electronically on a magnetic tape cartridge. The RJ Store-Data System is a method of gathering information at a branch office or outlying store and transmitting it to a central location for processing.

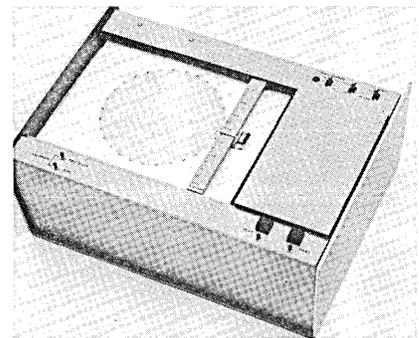
At the remote location, the system includes a mobile data entry keyboard, with hard copy printout, to digital magnetic cartridge recorder. The information collected is transmitted to the Central Office over a telephone line using either an acoustic coupler or a Data-Phone. At the central station the received information is recorded onto computer compatible 7 or 9 track magnetic tape.

Typical applications would allow a supermarket manager to put his order onto magnetic tape, transmit it to a central warehouse and receive delivery the next day. In addition to reducing delivery time by getting the order in earlier, the time to prepare the order also is reduced.

(For more information, circle #62 on the Reader Service Card.)

PORTABLE CONTROLLER/PLOTTER OPERATES WITH ALL TIME-SHARING COMPUTERS / Timeshare Devices, Inc.

This desk top device, the C/P 701 Controller/Plotter, combines an interface-controller and plotter in a single package and is connected to a remote computer terminal with a single cable. The C/P 701 shares the same narrow bandwidth telephone line at the user's terminal without affecting normal terminal operation. It operates in conjunction with all standard acoustic couplers and teletypewriters.



The model C/P 701 monitors the computer data, receives output data in digital form and converts it to analog signals which are fed to the X-Y recorder section. This produces a continuous and permanent graphic plot. The Controller/Plotter is compatible with all time-sharing computers and can be used in many applications including graphic computer output, interactive graphic display, teaching aid, engineering and medical analyses. (For more information, circle #65 on the Reader Service Card.)

TIME CLOCK STATION / Sealectro Corp., Programming Devices Div.

This Time Clock station, a self-contained device with a 14-digit hard-copy printout, automatically records employee number and time of punch-in. Another feature is an access-control terminal which can be used to unlock turnstiles and gates. The new Time Clock station has been designed so that it can be interfaced with a central time-keeping station or directly into an on-line computer.

The device includes the standard Sealectro badge reader, which reads standard plastic ID badges of either 10 or 12 digits, as well as a clock, logic circuitry and a hard-copy printer. A hinged, locked cover plate provides access for the removal of printed copy.

The Time Clock Station is enclosed in a stainless steel case measuring 16" W x 12" D x 9" H. It may be ordered with a weather-proof enclosure for use in parking lots and other outdoor applications. (For more information, circle #64 on the Reader Service Card.)

DATA INPUT SYSTEM FOR OFF-LINE OR ON-LINE USE / Hypertech Corporation

The portable desk-top terminal device, designated GTU-1 (Generalized Terminal Unit), is a completely self-contained unit for off-line or on-line use. GTU-1 has its own alpha-numeric keyboard, microprocessor, video display system, and two magnetic-tape cassette recorder/reproducers. The GTU-1 is compatible with virtually any electronic data processing system in use today.



— Data appears on the display screen for visual verification. Standard GTU-1 also includes an electronic verification procedure.

The keyboard of GTU-1 can be operated either as a modified typewriter keyboard or as a modified keypunch keyboard. One operator can enter and verify data. The two tape-cassette recorders built into the GTU-1 also can be used as inputs to and outputs from the system. An unlimited number of data and/or programs can be stored in the cassettes for future on-line or off-line use.

All material on the video screen appears as true characters (readable, not code). The video display screen is constantly refreshed by the GTU-1's built-in memory system. This memory system is capable of storing 400 characters plus the

equivalent of an additional 200 bits of information for automatic program utilization.

The GTU-1 is designed for "plug-in" connection to any computer for on-line use as a remote time-sharing or communication terminal. The built-in memory permits on-line use over regular voice band lines — e.g., the telephone system — and eliminates dependence on computer memory for CRT refreshment. (For more information, circle #66 on the Reader Service Card.)

TELEPHONE COMPUTER TERMINALS: TWO NEW MODELS / Metroprocessing Corporation of America

Two new models have been added to the FONE-TONE line of SPARTAN portable, acoustic-coupled Touch-Tone computer terminals (see Computers and Automation, February 1969, page 58). Both of these models, FT-1241 and FT-1248, use the "FONE-TONE" slip-on acoustic coupler which fits over the telephone handset mouthpiece. Both models work on any handset telephone manufactured in the United States since 1940, including the "Trim-Line" phones which have the dial in the middle of the handset itself.

The new FT-1241 portable terminal extends the coverage of the FONE-TONE line by handling computer systems having 401-J modems at their input ports, as well as those with the standard 403-D/E modems which were accommodated by the original FT-1240 model. The other new terminal, the FT-1248, is a more compact version of the old FT-1200. It provides a built-in inductively-coupled amplifier and speaker, allowing several people at a time to hear the voice responses from a computer.

An interesting feature of these terminals is that the user can converse normally by voice, when necessary, without removing the slip-on coupler from over the mouthpiece. The couplers are "transparent" to the sound waves of the voice. This allows coordination with the system operator at the receiving end, if required. (For more information, circle #63 on the Reader Service Card.)

COUPLER KIT CONVERTS TELETYPE TO ACOUSTIC TERMINALS / Omnifec Corporation

The Model 701C kit allows any Model 33 teletype to operate with a standard "office type" telephone. The fully asynchronous coupler kit converts audio tone from standard voice quality telephone line to

error-free digital signals. All operational hardware, supplied in the compact kit, fits within the standard teletype housing.

The teletype power cord is plugged into a standard outlet, the telephone receiver is placed into the coupler's cushions, power turned on, and the desired destination dialed. The unit is ready for two-way communication as soon as the carrier tone is received.



— Model 701C TTY kit shown installed

The operating mode is selected by a simple slide switch. The full duplex operation divorces the transmitter of the unit from its receiving circuit, and the teletype can be used simultaneously for receiving of one message and transmitting of another. In the half duplex mode, the transmission is identical with the terminal readout. (For more information, circle #67 on the Reader Service Card.)

Data Processing Accessories

MODEL 401A FORMSTACKER IS IBM, HONEYWELL, AND GE COMPATIBLE / Advanced Terminals Inc.

The introduction of the new Model 401A FORMSTACKER now provides complete compatibility with every existing line printer currently in use, according to Mr. Chris Pafort, Vice-President of Marketing for Advanced Terminals Inc. Model 401A, designed for use with the IBM 1403, Honeywell, and GE printers, measures 37" H x 30" W x 32" D and weighs 150 lbs. It is caster mounted for ease of mobility.

Model 401A, like Model 401, will accept printed output at rates up to 2000 lpm and high speed skipping rates up to 80 ips. In addition, all standard continuous fanfold forms (including 11 pound single part paper and six-part forms) are stacked automatically. Paper widths of 4 to 18 inches can be accommodated. (For more information, circle #68 on the Reader Service Card.)

THREE NEW CARBONLESS PAPERS / NCR

Three new lightweight CFB (coated front and back) papers — 12# imported, 12# domestic and 15# paper — have been introduced by NCR. The 15# CFB paper is designed to give forms users an extra part at no additional cost. Depending upon the printing or writing mechanism, up to four extra parts can be made with 12# domestic CFB paper and five extra parts can be provided with 12# imported CFB paper.

The new lightweight papers are available only in rolls. Yardage per roll is — 3500 for 15#, 3800 for 12# domestic and 4500 for 12# imported. Widths of the rolls range from 6" to 52". (For more information, circle #69 on the Reader Service Card.)

TTY ENCLOSURE REDUCES TELETYPE NOISE / Novation, Inc.

The Novation TE/33 is an enclosure especially designed for Model 32 and 33 ASR and KSR teletype-writers. Tests have shown it reduces the noise output of the teletype by 10 db or more. This means a 50% reduction in noise level to the human ear. By comparison, a teletype with the TE/33 enclosure is quieter than an office IBM Selectric.



The TE/33 includes a built-in fluorescent lamp which provides greater visibility for the teletype operator, and a noise-free fan which reduces the teletype motor temperature by 30°. The enclosure is available with a built-in acoustic coupler where the teletype is being used in a dial-up system. Any standard coupler can be specified. The TE/33 can be installed in the field in a matter of minutes, using just a screw driver. (For more information, circle #70 on the Reader Service Card.)

COMPUTING/TIME-SHARING CENTERS

OMNITAB LANGUAGE MADE AVAILABLE THROUGH INTERNATIONAL TELECOMPUTER NETWORK CORP.

A new computer language, developed for routine use by mathematicians, statisticians, research analysts, actuaries, and other related professionals — is being made available by International Telecomputer Network Corporation. Known as OMNITAB, the data manipulation language was designed to benefit those who currently spend numerous hours manipulating data on multi-column worksheets. Using OMNITAB, results can be produced at desk-side from a portable, inexpensive terminal keyboard after only a few hours of training.

The multi-column worksheet, arranged in 49 columns of 101 rows each, is the heart of OMNITAB. Data are entered in specified columns of the worksheet, following which mathematical and manipulative operations are automatically interpreted and performed by the ITN computer. Results may be printed seconds later at the keyboard terminal, punched into cards, or printed on a line printer at the ITN center. (For more information, circle #71 on the Reader Service Card.)

TIME-SHARED CIVIL ENGINEERING COMPUTER SERVICE OFFERED BY ITT DATA SERVICES

ITT Data Services has developed an advanced time-shared version of COGO, a computer program used by civil engineers in solving a wide variety of coordinate geometry problems. The new COGO program has a simple vocabulary of 69 terms commonly used by civil engineers to describe their problems. This vocabulary precludes the need for the engineers to have computer programming experience.

The advanced COGO enables civil engineers to utilize remote typewriter-like terminals linked to centrally located computers for automatic solution of problems involving complex calculations used in land and right-of-way surveys, highway design, bridge geometry, regional planning and subdivision analysis.

The "conversational" COGO is available now through the ITT Data Services' time-sharing computer system, designated Reactive Terminal Service and RTS. (For more information, circle #72 on the Reader Service Card.)

EUROPEAN TIME-SHARING COMPANY FORMED

Dr. Allen Waren, president of Com-Share, Ltd., of Canada and Robert F. Guise, Jr., president of Com-Share, Inc., of Ann Arbor, have announced the signing of a joint venture agreement to expand Com-Share's time-sharing service into Western Europe. The new company will be known as Com-Share Europe.

Initial plans call for the installation of two SDS 940 time-sharing systems in Western Europe before the close of 1969, with the first to be installed in London, England. Time-sharing services are expected to be available in Paris, Dusseldorf, the Hague, Brussels, and Milan no later than the end of the first quarter of 1970, and in other areas as soon as equipment and trained personnel can be made available.

COMPUTER-RELATED SERVICES

ASTRA ENGINEERING, INC. PROVIDES MINIMUM-COST, OPTIMUM DRILLING PROGRAM FOR OIL AND GAS WELLS

Use of a new totally integrated computer program can significantly improve both speed and economy of well drilling for the petroleum industry. Ronald R. Bush, president of Astra Engineering, Inc. (El Segundo, Calif.) said the new system determines the optimum drilling program for oil and gas wells.

Input data for a new well, based on records available from previous drilling operations in the area, is prepared and fed into a CDC 6400 computer with the Astra-developed program. The program then produces the optimum drilling schedule to enable the driller to complete the well in the shortest possible time at the minimum cost. The minimum-cost drilling program simultaneously considers not only the weight and RPM, but also the flow rate and mud properties. The program also selects the best bit and best combination of jets for a given bit run. Should the driller place other priorities above following the optimum schedule, the program has, in advance, prepared alternate schedules that maintain the optimum mode of drilling with any restrictions that the driller may have placed on the optimum set of values.

Once requirements and data for a job are in the hands of Astra, it is a matter of only a few days before the customer receives the

detailed schedules for drilling operations. "Cost for the service," Mr. Bush said, "is based on a percentage of the amount that Astra can prove the customer has actually saved by using its minimum cost drilling program, rather than a conventional plan of operation. If it results that there was no cost savings at the completion of a job, there is no charge to the customer." (For more information, circle #73 on the Reader Service Card.)

AUTOCODER-TO-COBOL TRANSLATION SERVICE FOR IBM 1401 AND 360 USERS

Computer Conversions, Inc., Jenkintown, Pa., has announced the commercial availability of ACTRAN, an Autocoder-to-COBOL Translation service. ACTRAN converts programs written in either the Autocoder or SPS assembly language for the IBM 1400 Series computers into COBOL. The resulting COBOL programs can be compiled and executed on an IBM System/360 (either DOS or OS), RCA Spectra 70, or Burroughs B5500 computer.

According to J. Burt Totaro, Vice President, ACTRAN normally achieves accurate translation of 85 to 98 percent of the instructions in Autocoder or SPS programs. The percentage depends upon the characteristics and peculiarities of each program. All non-translated statements are flagged with clear diagnostic messages on the ACTRAN listing. Thus, they can easily be coded in COBOL and inserted in the translated program before compilation. (For more information, circle #74 on the Reader Service Card.)

DELTA DATA SYSTEMS ANNOUNCES COMPUTER EVALUATION AND SELECTION SERVICE

Delta Data Systems' Facility Management Division has announced a new and specialized service for its clients — "Computer Evaluation and Selection". William R. Sinkinson, Delta's Vice President for Facility Management, noted that "The biggest and most costly mistakes in data processing are usually made by a company in the very first stages of equipment and software selection."

Based on a study of a client's requirements, the Facility Management Division will prepare a preliminary specification. All computer manufacturers are then invited to respond with a suitable proposal for equipment, systems and applications software. The division evaluates each manufacturer's

proposal based on: purchase prices and rental plans; manufacturer's understanding of client's applications; costs for program conversions; and many other pertinent facts. After selecting four or five manufacturers on the basis of their proposals, visits are made to several of their local installations, and negotiations are conducted with the manufacturer on behalf of the client.

On completion of the survey, a detailed computer comparison chart is prepared listing the features applicable to the client's requirements. (For more information, circle #75 on the Reader Service Card.)

NEW LITERATURE

DATAPRO 70, A HARDWARE/SOFTWARE REFERENCE PUBLICATION

Datapro Research, a newly formed division of Computer Conversion, Inc., Jenkintown, Pa., will evaluate computer equipment and software and publish the results of these evaluations in a series of looseleaf reference services. The first of these, an encyclopedic guide to EDP hardware and software, called DATAPRO 70, is scheduled for introduction this month.

President of Computer Conversions, Inc., John R. Hillegass, said that DATAPRO 70 is being designed for the purpose of giving computer users the facts they need to understand the hundreds of diverse hardware devices and software packages now on the market and select the ones that best meet their needs. As a result of the recent "unbundling" moves by IBM and other computer manufacturers, EDP users need reliable evaluations of the products of independent hardware and software suppliers as well as those of the major computer companies. (For more information, circle #76 on the Reader Service Card.)

1969 CATALOG FROM USA STANDARDS INSTITUTE IS NOW AVAILABLE

Some 600 USA Standards and 300 international recommendations have been added to Standards Institute's 1969 catalog. The new 112-page edition lists 3,600 USA Standards approved by the Institute and 1,350 international recommendations of the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC),

International Commission on Rules for the Approval of Electrical Equipment (CEE), and Pan American Standards Commission (COPANT).

The Standards Institute is the national clearinghouse and coordinating agency for voluntary standardization in the United States. It approves a standard when it receives evidence that all national groups concerned with the application of the standard have been given an opportunity to cooperate in the standard's development and these interests have reached substantial agreement on its provisions. The Institute also represents United States interests in international standardization work.

The standards listed in the catalog include dimensions, ratings, terminology and symbols, test methods, and other criteria applicable to the entire industrial economy. Among the many subjects covered are: civil engineering and construction; drawings, symbols, and abbreviations; electrical engineering; information processing; and office equipment. There is an index to the titles of all USA Standards and international recommendations. A special symbol is used to identify publications available on microfiche.

Copies of the 1969 catalog are available free from the USA Standards Institute, 10 East 40th Street, New York, N.Y. 10016

STANDARDS NEWS

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION ISSUES FIVE NEW STANDARDS

ECMA, European Computer Manufacturers Association, have issued five new Standards in June 1969:

- ECMA-19 — Coding of Character Sets for MICR and OCR
- ECMA-20 — Implementation of the ECMA 7 Bit Coded Character Set on Punched Cards
- ECMA-21 — Character Positioning on OCR Journal Tape
- ECMA-22 — Electrical Safety Requirements for Data Processing Machines
- ECMA-23 — Keyboards Generating the Code Combinations of the Characters of the ECMA 7 Bit Coded Character Set.

Standard ECMA-23 takes into account the present agreement in ISO (International Standards Organization), the requirements of different data processing applications;

as well as the needs of the different European Languages for which the ECMA 7 bit code provides. Acceptance of Standard ECMA-23 by the ECMA General Assembly (on which most of the leading Computer Manufacturers of the world are represented) is seen as a significant step towards full international agreement on Keyboards Standards.

Copies of the Standards are available free of charge from ECMA, Rue du Rhone 114, 1204 Geneva, Switzerland.

ORGANIZATION NEWS

NEW COMPANIES

COMPUTER DEVELOPMENT CORP., Dallas, Texas / Developing a general purpose digital computer in the \$1000 price range; aimed primarily at the original equipment market.

COMPUTER EQUIPMENT CORP., Dallas, Texas / Specializes in nationwide distribution of computer peripheral hardware; will make small quantities of major lines available to both original equipment manufacturers and end users at competitive prices.

GROUP 128, INC., Waltham, Mass. / Specialize in high-precision optics for computers, aerospace and controls; offer total optical systems engineering.

PIONEER DATA SCIENCES, INC., Wilbraham, Mass. / Development, marketing and maintenance of proprietary software products for the international EDP market.

PUBLIC SAFETY SYSTEMS INC., a subsidiary of General Research Corp., Santa Barbara, Calif. / Develop and install computer-based systems for control of municipal and state public safety emergency forces.

UNITED KINGDOM CHEMICAL INFORMATION SERVICE (UKCIS), Nottingham, England / Provide computer-based information services to scientists in the United Kingdom and Ireland from data supplied by the American Chemical Society's Chemical Abstracts Service.

ACQUISITIONS

APPLIED DATA RESEARCH, INC., Princeton, N.J., a computer software and service company, has acquired PROGRAMMATICS, INC., a Los Angeles-based (Calif.) computer software company.

CTC COMPUTER CORP., Palo Alto, Calif., specializing in computer services,

medical systems, data processing equipment, and management systems, has acquired the LEWISTOWN DIVISION of The Singer Co., Lewistown, Pa., a manufacturer of special systems and data processing equipment for commercial and governmental applications; the firm will operate under the new name — INTERNATIONAL PERIPHERAL SYSTEMS, or IPS.

CONRAC CORPORATION, New York, N.Y., a diversified manufacturer of precision instruments, controls, information display devices, and computer peripheral equipment, has acquired ELEKTRON COMPANY of Weikersheim, West Germany, which produces electronic teaching systems and also manufactures computer peripheral equipment.

CONTROL DATA CORP., Minneapolis, Minn., manufacturer of computing systems and related peripheral equipment, has acquired COMPUTING DEVICES OF CANADA, LTD., which designs, develops and manufactures aircraft electronic navigation and oceanic systems and instruments.

RESEARCH FRONTIER

TINY MAGNETIC "BUBBLES" MAY LEAD TO COMPACT, INEXPENSIVE DATA STORAGE AND PROCESSING

A new technology now in exploratory development at Bell Telephone Laboratories, Murray Hill, N.J., may make it possible for tiny computers and electronic telephone switching systems of the future to accomplish counting, switching, memory, and logic functions all within one solid magnetic material.

The new technology takes advantage of the magnetic alignment properties of crystals (orthoferrites) grown from mixtures of iron or lead oxides and rare-earth metals. When a magnetic field of a critical value is applied to an orthoferrite, bubbles — almost perfectly cylindrical magnetic domains — are formed. These bubbles can be moved at high speed in the plane of the sheet of the orthoferrite material. As they are moved into precisely defined positions, their presence or absence at different positions can represent binary numbers.

Devices made from the magnetic materials have no moving parts to wear out, generate little heat, operate on very low power, and need very little wiring to interconnect them. Once the crystals are grown, manufacture will be much simpler than making semiconductor devices. The potential is a vast reduction in the cost of storing and handling data.

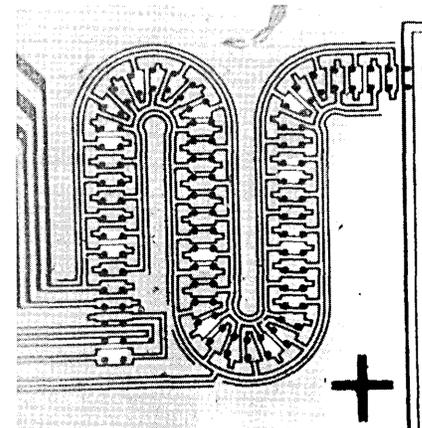
CYBERNETICS INTERNATIONAL CORP., New York, N.Y., a computer service organization, has acquired REALTRONICS, INC., New York, N.Y., developer and producer of the computerized data entry systems called the R 1.

DELTA COMPUTER CORP., Dallas, Texas, a recently formed computer service company, specializing in the fields of insurance and finance, has acquired AUTOMATED SYSTEMS, INC., Baton Rouge, La., which specializes in computer systems for use in physicians' offices.

EXECUTIVE COMPUTER SYSTEMS, INC., Oak Brook, Ill., a total service data processing firm, has acquired ABACUS, INC. of Janesville, Wis., specializing in data processing for the medical field.

INFORMATION AND COMPUTING CENTERS CORP., Dallas, Texas, specializing in computer services to the science industry, has acquired DATASTRAT, INC., Midland, Texas, specialists in computerization of geological and geophysical data.

One experimental device using the bubble technology is a shift register (a component widely used in data transmission equipment and computers for temporary storage of binary digits). Looking more like a block diagram or a flow chart, the actual circuit, a photolithographic pattern on the surface of a sheet of thulium orthoferrite (shown below), can move magnetic "bubbles" (large white dots) through a shift register. The magnetic



bubbles are 4/1000 of an inch in diameter. Data rates of 3,000,000 bits per second have been demonstrated with this technology.

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Control Data Corp., Minneapolis, Minn.	U. S. Army	Installation and maintenance of 13 CDC 3300 systems in Army Materiel Command (AMC) supply depots throughout the country	\$30 million
Univac Division of Sperry Rand Corp., St. Paul, Minn.	U. S. Air Force, Space and Missile Systems Organization	Design, development and delivery of 22 computers, which will form the heart of the Minuteman Integrated Command and Control System	\$16.7 million
	Federal Aviation Administration, Washington, D.C.	Modular add-on components to increase the capacity and reliability of the 64 automated radar terminal systems (ARTS III) currently on order from Univac	\$14.2 million
Varian Data Machines, Irvine, Calif.	Burroughs Corp., Detroit, Mich.	Delivery of a large number of modified Varian 520/i digital computers and related equipment through calendar 1971	\$8 million (approximate)
International Computers Ltd., London, England	National Data Processing Service, London, England	Providing Heathrow Airport with a computerized system to control imported cargo; system will be based on two System 4-72 central processors	\$7.2 million
Burroughs Corp., Defense, Space & Special Systems Group, Paoli, Pa.	Federal Aviation Administration, Washington, D.C.	58 Production Common Digitizers (PCD) which will further implement the nation's air traffic control system	\$6.9 million
Information Storage Systems, Inc., Cupertino, Calif.	Hewlett-Packard Co., Palo Alto, Calif.	An undisclosed number of disk storage drives and disk drive control units for use with Hewlett-Packard computer time sharing systems	\$5 million
Control Data Corp., Washington Space and Defense Systems Div., Bethesda, Md.	Department of the Navy Strategic Systems Project Office	Continued work in support of the Fleet Ballistic Missile Systems Training Program	\$3.9 million
CAE Industries Ltd., Montreal, Quebec, Canada	Air India, Bombay, India	A Boeing 747 digital flight simulator; delivery will be in the autumn of 1971	\$2.8 million
Univac Division of the Sperry Rand subsidiary company, Spain	Spanish Ministry of Education and Science, Spain	UNIVAC 1108 Computer System which will process: scientific information, student registration data, academic title and statistics of teaching personnel throughout Spain	\$2.8 million
Scientific Control Corp., Carrollton, Texas	Computer Terminal Leasing, Milwaukee, Wis.	100 DCT-132 remote data communications terminals	\$2.1 million
Tempo Computers, Inc., Anaheim, Calif.	Call-A-Computer, Inc., Minneapolis, Minn.	Concentrators for use with Call-A-Computer's Innovator 7000 Time Sharing System	\$1.6+ million
Planning Research Corp., Los Angeles, Calif.	Department of Defense, Navy Purchasing Office	Providing programming services in support of Navy type commanders (TYCOMS)	\$1,407,855
Docutel Corp., Dallas, Texas	City National Bank and Trust Co., Columbus, Ohio	Currency Dispensers (automated cash dispensing machines); the dispensers will extend the bank's present BankAmericard service to the bank's customers	\$1.2 million
Collins Radio Co., Dallas, Texas	Litton Data System Division, Van Nuys, Calif.	Microelectronic components (hybrid thin film circuit devices) for use in Litton's new airborne computer memory destined for use in the Navy's new E2C "Hawkeye" Airborne and Command Control System	\$1+ million
Ampex Corporation, Culver City, Calif.	Digital Equipment Corp., Maynard, Mass.	Extended core memories which will be offered as part of Digital's PDP-10 computer product line	\$1+ million
	Westinghouse Hagan Computer Systems Div., Pittsburgh, Pa.	Continuing to supply magnetic core memory stacks for use in Westinghouse P2000 computer systems	\$1 million
American Medical Computer Centers, a subsidiary of American Biomedical Corp.	University of Illinois Hospital, Chicago, Ill.	A complete patient accounting service on a computerized time sharing basis	\$250,000
System Development Corp., Santa Monica, Calif.	National Air Pollution Control Administration	Devising a complex mathematical model which will be used to simulate the chemical reactions that produce Los Angeles-type photochemical smog — part of an effort to control the spread of air pollution	\$150,000
General Dynamics' Electronics Division, San Diego, Calif.	U.S. Post Office Department	A new study to explore the feasibility of future electronic transmission of mail	\$147,046
Wyle Laboratories, El Segundo, Calif.	U.S. Dept. of Housing and Urban Development (HUD)	Research in building design and construction techniques toward developing defenses against acoustic pollution of residences	\$160,000
Computer Systems Engineering, Inc., Burlington, Mass.	City of Boston, Mass.	Demonstration of feasibility of using a computer and an all-electronic system to control traffic in downtown Boston	\$15,000
Siemens, Germany	World Alpine Skiing Championships 1970	A direct long distance (175 miles) data processing link between the slopes in Val Gardena (Italy) and Siemens Computer Center (Munich) for processing and printout of intermediate and final competition results	—
Computer Systems Technology, Inc., Jenkintown, Pa.	Pontiac Motor Div., General Motors Corp., Philadelphia, Pa.	Development of a system to provide immediate inventory of new cars, sold and in stock, for all Pontiac dealers in Philadelphia area	—

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B500 system	Southern Bank and Trust Co., Greenville, S.C.	Handling demand deposit accounting and proof and transit work (system valued at over \$300,000)
Burroughs B2500 system	Caesar's Palace, Las Vegas, Nev. Carnegie-Mellon University, Pittsburgh, Pa.	An automated on-line reservation and information system; also prepares guest history, gaming analysis reports, payroll, and other accounting operations (system valued at about \$500,000) Development of a total data management system which will centralize the university's accounting, payroll, admissions, registrar, treasurer, development and alumni data handling operations (system valued at over \$530,000)
Control Data 3150 system	National Taiwan University (NTU), Taipei, Taiwan	General research in the physical sciences, student instruction in the computer sciences and university administrative data processing
Control Data 3200	PRAKLA, Hannover, Germany	Analyzing vibrations recorded on magnetic tape from underground and undersea explosions; also provides mineral research industries with information on the mineral content and earth strata structure
Control Data 3500 system	Swedish State Power Board (SSPB) Stockholm, Sweden	Planning, designing new power stations, determining transmission routes, monitoring line loading and stabilizing, develop reactor programming; also administrative functions
Control Data 6600 system	Environmental Science Services Administration, World Weather Center, Suitland, Md.	Processing and analyzing weather data from hundreds of locations on or over the earth's surface
Digital Equipment PDP-10	Applied Data Research, Inc., Princeton, N.J. Computer Center Corp., Seattle, Wash.	Customer software development and for time-sharing proprietary software services Providing more computing power for CCC's expanding customer base
GE-425 system	Jones & Laughlin Steel Corp., Pittsburgh, Pa.	Corporate sales analysis, sales planning, payroll, accounts receivable and payable, and Steel Service Center billing applications
Honeywell Model 120 system	Holden Industries, Inc., Minneapolis, Minn.	Customer services as well as internal business needs
Honeywell Model 8200 system	Australian Department of Defence, Computer Center, Canberra, Australia	Increasing data processing ability (replaces an H-800); principal work of center is development and support of large-scale dp system for Australian Armed Services and Department of Defence (system valued at \$1.3 million)
IBM System/360 Model 20	Irwin Memorial Blood Bank of the San Francisco Medical Society, San Francisco, Calif.	Helping to maintain inventories of blood, recruiting voluntary blood donors and aid in research and technical services
ICL 1901A system	Ndola City Council, Zambia, Africa	Electricity and water billing, for rating assessment and notices, rent advice collection and the City's electoral roll during normal working hours; the remaining hours International Computers (Zambia) Ltd. will provide a bureau service for various government departments and commercial organizations
ICL 1904E	Carreras Ltd., Basildon	Sales order processing and PERT applications; also for advanced linear programming and company model applications, payroll, and the control of leaf and cigarette and cigar stocks
ICL System 4-50 system	South Western Gas Board, Sydney Wharf, Bath, England	Customer billing; network analysis work; other applications will be added later
NCR Century 100 system	Maine Medical Center, Portland, Maine Nottingham Cooperative Society Ltd., Nottingham, England	In-patient accounting, post-discharge accounts receivable, and payroll for about 1200 employees A wide range of accounting and stock control applications such as share accounting, trade ledger and departmental transfers, rental accounts, payroll
NCR Century 200 system	Kentucky Fried Chicken, Louisville, Ky.	Helping assure that chain's famous Colonel Sanders recipe reaches the public uniformly, wherever the chicken is sold — Six Century 100's will be used as satellite systems in regional offices
SDS Sigma 2 system	CENDAC Data Centre, Calgary, Alberta, Canada	Processing of marine data
SDS Sigma 5 system	DBA Systems Inc., Melbourne, Fla.	Use in providing computer services to the aerial mapping industry and applications in the space sciences; will be used for time-sharing services as well as general purpose scientific computing (system valued at over \$800,000)
UNIVAC 494 system	University of Graz, Austria	Scientific applications and commercial service center work (system valued at \$1.5 million)
UNIVAC 9200 system	Institute of Technology Trenton, N.J. and Alexandria, Va.	Providing practical experience to students taking operator and programmer courses
UNIVAC 9300 system	Svenska Renault AB, Halsingborg, Sweden	Spare parts inventory control, sales statistics and accounting warranty

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL (\$'000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILLED ORDERS	
				In U.S.A.	Outside U.S.A.	In World		
International Computers, Ltd. (ICL) (cont.)	System 4-40	5/69	7-24	0	1	1	C	
	System 4-50	5/67	8-29	0	9	9	C	
	System 4-70	1/68	10-36	0	2	2	C	
	System 4-72	5/67	5-48	0	88	88	C	
	System 4-75	9/68	10-41	0	1	1	C	
Total:							484	
Japanese Mfrs. (N) (May 1969)	Various models	-	-	-	-	2500 E	800 E	
Marconi Co., Ltd. Chelmsford, Essex, England (A) (Sept. 1969)	Myriad I	3/66	436.0-466.0 (S)	0	35	35	10	
	Myriad II	10/67	422.0-442.5 (S)	0	14	14	12	
Saab Aktiebolag Linköping, Sweden (A) (Sept. 1969)	D21	12/62	7.6	0	37	37	-	
	D22	5/68	13.4	0	12	12	13	
	D220	4/69	9.8	0	1	1	7	
Siemens Munich, Germany (A) (Sept. 1969)	301	11/68	0.75	-	-	5	C	
	302	9/67	1.3	-	-	18	C	
	303	4/65	2.0	-	-	68	C	
	304	5/68	2.8	-	-	31	C	
	305	11/67	4.5	-	-	33	C	
	306	-	6.5	-	-	-	C	
	2002	6/59	13.5	-	-	41	C	
	3003	12/63	13.0	-	-	37	C	
	4004S	-	4.0	-	-	-	C	
	4004/15/16	10/65	5.0	-	-	83	C	
	4004/25/26	1/66	8.3	-	-	32	C	
	4004/35	2/67	11.8	-	-	108	C	
	4004/45	7/66	19.8	-	-	99	C	
	4004/46	4/69	34.0	-	-	1	C	
	4004/55	12/66	25.8	-	-	11	C	
Total:							234	
USSR (N) (May 1969)	BESM 4	-	-	-	-	C	C	
	BESM 6	-	-	-	-	C	C	
	MINSK 2	-	-	-	-	C	C	
	MINSK 22	-	-	-	-	C	C	
	MIR	-	-	-	-	C	C	
	NAIR 1	-	-	-	-	C	C	
	ONEGA 1	-	-	-	-	C	C	
	ONEGA 2	-	-	-	-	C	C	
	URAL 11/14/16 and others	-	-	-	-	C	C	
Total:							6000 E	Total: 2000 E

CLASSIFIED ADVERTISEMENTS

COMPUTERS WANTED

360/30's, 40's, 50's. Also /360 peripherals. 1401's and 1440's wanted. Leasing arrangements are also available.

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785 Springfield Avenue
Summit, NJ 07901 (201) 273-6900

COMPUTERS FOR SALE

System 360/30's, 40's and 50's. IBM 1401's and 1440's. Components and peripherals also available. Leasing arrangements available.

GEORGE S. McLAUGHLIN
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785 Springfield Avenue
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ADVERTISING INDEX

Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

APL-Manhattan, Div. of Industrial Computer Systems, Inc., 254-6 W. 31 St., New York, NY 10001 / Page 72 / -

COMPOSO - Regional Computer Software and Peripheral Show, 37 W. 39 St., New York, NY 10018 / Page 10 / -

Computer Industries, Inc., Graphic Systems Div., 14761 Califa St., Van Nuys, CA 91401 / Page 9 / Management Communication Consultants Computers and Automation, 815 Washington St., Newtonville, MA 02160 / Page 21 / -

General Electric, 1 River Rd., Schenectady, NY 12305 / Page 25 / Robert S. Cragin, Inc.

Honeywell Inc., EDP Div., 60 Walnut St., Wellesley Hills, MA 02181 / Pages 36 and 37 / Batten, Barton, Durstine & Osborn, Inc.

Information International Inc., 89 Brighton Ave., Boston, MA 02134 / Pages 6 and 7 / Kalb & Schneider Keyboard Training, 292 Madison Ave., New York, NY 10017 / Page 29 / Nachman & Shaffran, Inc. Management Information Service,

P. O. Box 252, Stony Point, NY 10980 / Page 7 / Nachman & Shaffran, Inc.

Metroprocessing Corporation of America, 64 Prospect St., White Plains, NY 10606 / Page 49 / Elmer L. Cline Inc.

Path, 20 Beckley Ave., Stamford, CT 06901 / Page 32 / Nachman & Shaffran, Inc.

RCA, Information Systems Div., Cherry Hill, NJ 08034 / Page 2 / J. Walter Thompson Co.

Sangamo Electric Co., P. O. Box 359, Springfield, IL 62705 / Page 35 / Winus-Brandon Co.

Scientific Data Systems, 701 S. Aviation Blvd., El Segundo, CA 90245 / Page 3 / Doyle, Dane, Bernbach, Inc.

Typagraph Corp., 7525 Convoy Court, San Diego, CA 92111 / Page 17 / Arnold J. Lipman Assoc.

United Teletrol Electronics, Inc., 3500 Sunset Blvd., Asbury Park, NJ 07712 / Page 4 / Thomas Leggett Associates

Xerox Data Systems, see Scientific Data Systems

7 of Fortune's top 10 companies have one thing in common. They all have better keyboard operators than you.

Companies like General Motors, AT & T, and Mobil Oil. So do 4 of the top 5 banks. And 8 of the 10 leading insurance companies. Why?

KTI is responsible.

We specialize in increasing the productivity and accuracy of computer input equipment operators—experienced employees as well as new operators.

Computerworld concluded, in an independent study, that the average productivity increase is 22%.

We do it by reducing operator errors 50% to 80%. And increasing speed 15% to 40% with corresponding expense savings.

We train for whatever type of keyboard-operated equipment you have. Key punch, magnetic tape, typewriting, CRT, calculating, etc.

How we do it.

First of all, we have the specialized talent, techniques, and materials. Also, our training is "operator-oriented" instead of "machine-oriented."

Where we do it.

KTI is unique. We do not operate schools or conduct classes in the usual sense. We work only with employers.

KTI trains on-the-job or off-the-job. Our professional instructor will work with your operators on

your own equipment, and primarily on your own documents.

What it costs.

The amount varies. But savings in the first year usually exceed five times the investment. So the service pays for itself in 9-13 weeks.

Free consultation or appraisal.

For a free consultation about KTI, or a brief appraisal of your present operators, write or call us.

Unless, of course, you like the idea of other companies having better keyboard operators than you.

Keyboard Training Incorporated

**We make your operators
as good as your equipment.**

292 Madison Ave., N.Y., N.Y. 10017. (212) 889-2430.
Boston (617) 742-3522. Chicago (312) 298-4170.
Cleveland (216) 762-4431. Detroit (313) 352-1133.
Hartford (203) 249-9309. Los Angeles (213) 386-5650.
Philadelphia (215) WA 2-8651. San Francisco (415) 552-3980.
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"INTERACTIVE" means HANDS-ON-TIME, always available.

AND, instead of working on the "raw machine," you have the finest general language IBM ever developed, APL.

AND, you don't pay \$500/hr., you only pay \$12/hr., because others "time-share" the same machine.

BUT, you get the same instantaneous response as with HANDS-ON-TIME.

AND, you get immediate diagnostics.

Therefore, SCHEDULES CAN BE MET, AND BEATEN, with APL.

CHECK THAT WE'RE ON-LINE! DIAL (212) 554-9011

Not for sale for unethical or destructive purposes

APL- T.M.