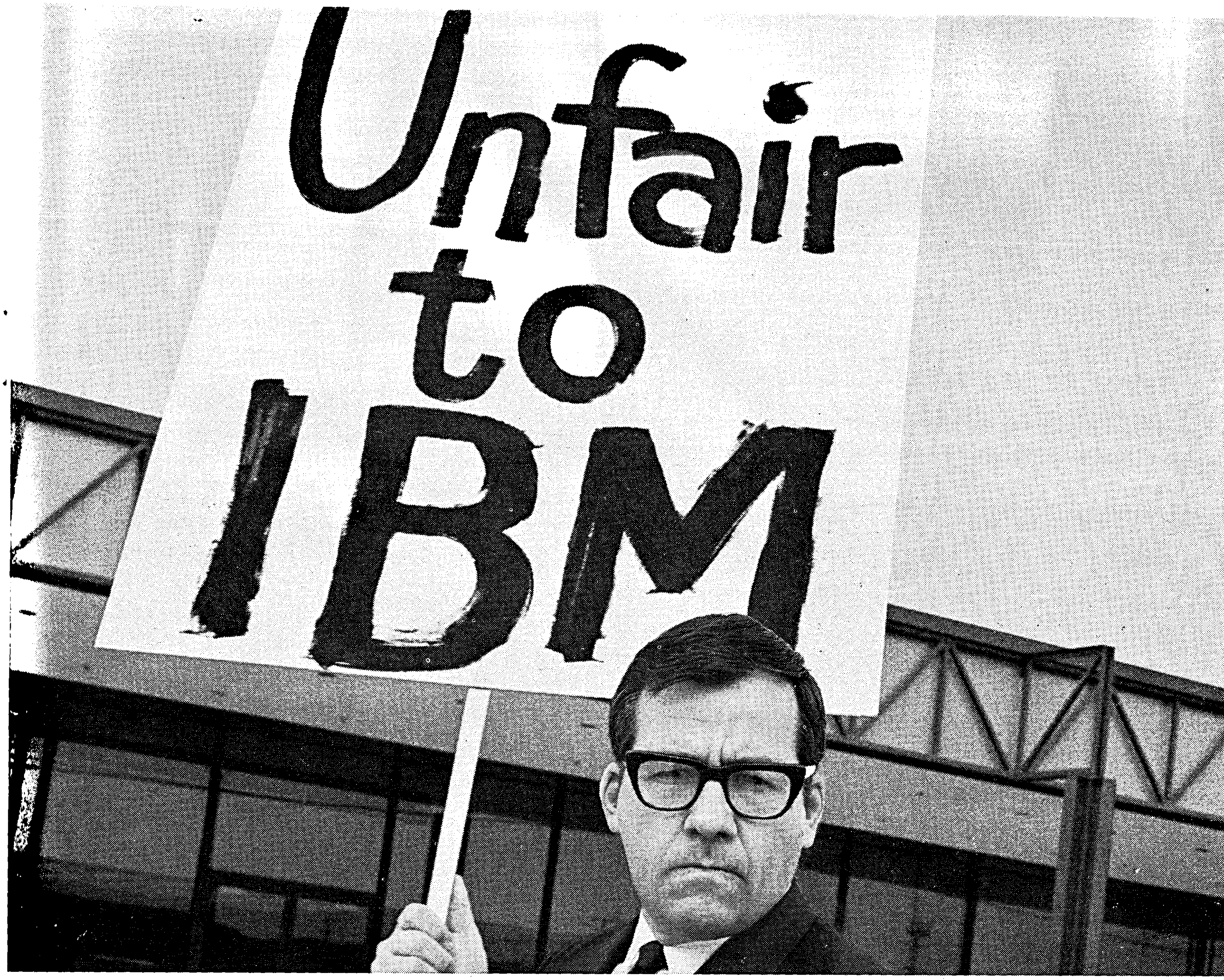
March, 1968

computers and automation

Computers and Education



Sigma 7 does everything a 360/50 does. At a fraction of the cost.

Sigma 7 is a little cheaper than the 360/50 and a good deal faster. The combination gives Sigma a 25 to 65 percent edge in cost/performance.

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Next we took a floating square root program. Also scientific, but less dependent on arithmetic capability. It was pretty easy for both machines. Still, we came in 30% under. ($7.11 vs. $10.44)

Finally we compared a field scan routine. Since that's a more or less typical data processing application, it frankly had us scared. That's supposed to be what the 360/50 is good at. But we needn't have worried. We did the job for less than 75% of their cost. ($68.36 vs. $95.64)

The three examples came out of a published study. We computed the cost figures ourselves because the published ones gave us the best of it. Any of our salesmen will be happy to go into the details. Or, we'll send you our complete figures and references in return for your name, address and a good reason for your curiosity.

But you must realize that in the final analysis the two machines aren't entirely comparable. Sigma 7 has time-sharing capability built-in. The 360/50 doesn't.

So before you buy your next 360/50 think twice. You may be getting only half as much for your money.

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Scientific Data Systems, Santa Monica, California

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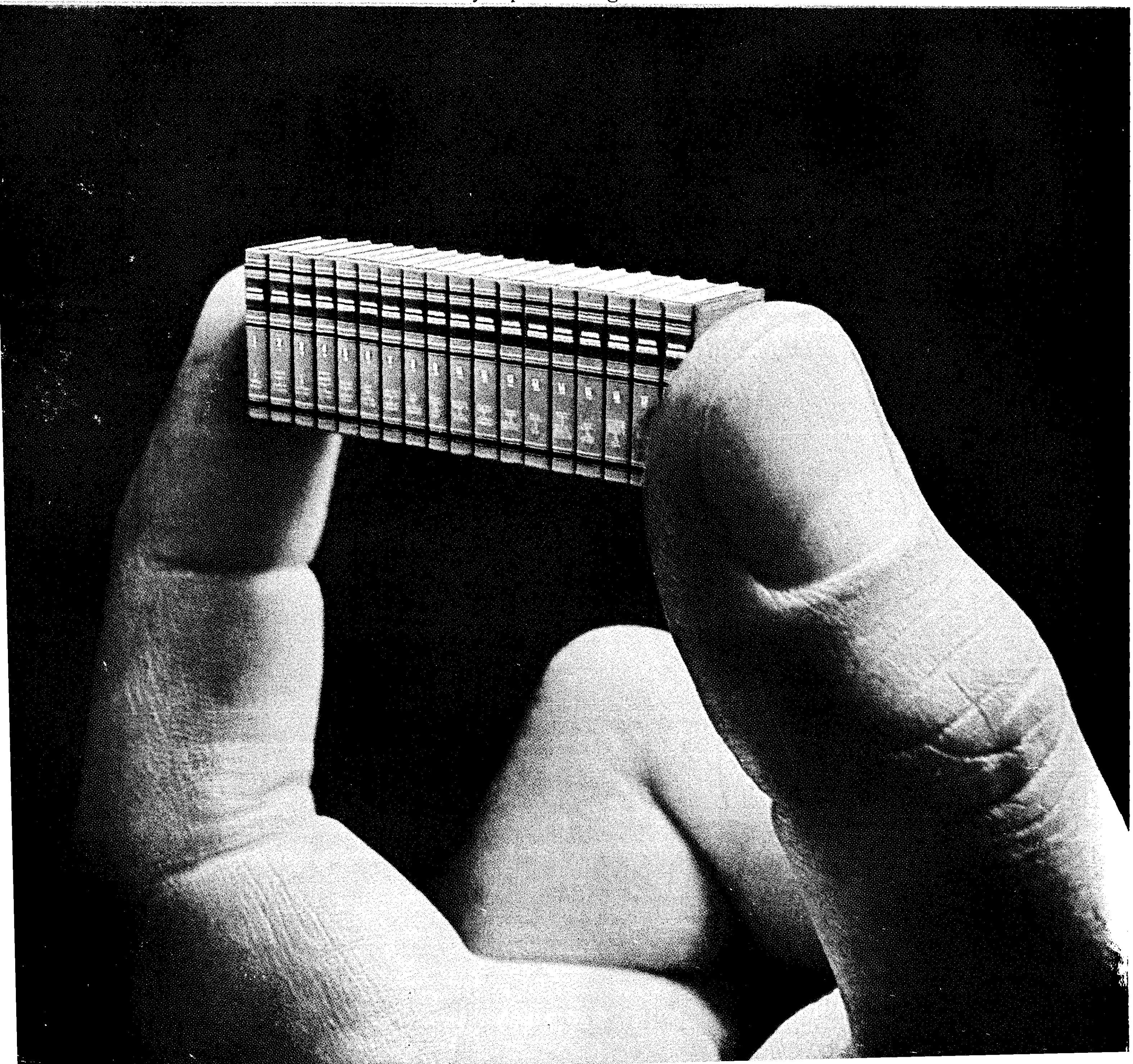

computers and automation

MARCH, 1968, Vol. 17, No. 3

The front cover shows students at three graphic display terminals at the University of Georgia Computer Center. The students are using light pens to alter the material displayed on the television-like screens. For more information, see "Education Through Remote Terminals — The University of Georgia Computer Network," beginning on page 18.

Special Feature: Computers and Education

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C.a

EDITORIAL

Computers and Moral Questions

For over ten years, the pages of *Computers and Automation* have devoted space and discussion to the question:

> Should computer people discuss and argue the social responsibilities of computer people?

In March 1967, we published an editorial "Computers and Some Moral Questions", and a ballot. The results of the balloting were published in the July 1967 issue, and showed, by a vote of 90% or more of the responses received, that many computer people are deeply concerned with the social implications of computers, with computers and moral questions, with the social responsibilities of computer people.

Because of the many facets of this subject, we have made a survey of the twelve issues of *Computers and Automation* published in 1967 to determine:

1. What were the pieces we published during the year related to these questions?
2. How many such pieces were published?
3. What facets of the subject were discussed?
4. How many different authors were represented?

The results are rather interesting:

1. During 1967 *Computers and Automation* published 58 articles, editorials, letters, short reports, etc., bearing on computers and moral questions, the social implications of computers, etc., (including certain parts of the topic of computers and education, i.e., those parts which raise some moral issue). For the full list of these pieces, see page 46 in this issue.
2. The number of different authors contributing to the discussion with comments, letters, reports, articles, quotations, etc., was 60 (including 6 instances of "anonymous", and excluding the staff of *Computers and Automation*). They were:

Sen. Howard H. Baker, Jr.
M. Bailey
Dick H. Brandon
William F. Breitmayer
Sherman C. Blumenthal
Vernon M. Danielson
Sheldon J. Dansiger
James L. Donnellan
Ralph R. Dunhower
Martin Edgeton
R. Calvin Elliott
Patrick F. Gallagher
W. C. Haueison
Jack H. Hazlehurst
S. D. Irwin
Ronald D. Jones
E. J. Karchmar
A. L. Kilinski
Richard Kobler
Charles R. Koffman
H. Kugel
Jerome Laulicht
Paul J. Livers
Ronald E. Medei
Father Thomas Merton
Emmanuel G. Mesthene
Leslie Mezei
David Moses
David L. Neblett
Anthony G. Oettinger
Donn B. Parker
John F. Paugstat
H. F. W. Perk
J. T. Powers, Jr.
Stephen M. Rosenthal
Fred V. Rubenstein
George Sadowsky
Miss E. R. Seidman
F. R. Shute
Helen Solem
Ronald Spriesterbach
Senter Stuart
Norman P. Teich
Richard E. Utman
Peter Warburton
Edward Webster
Joseph W. Lowell, Jr.
Hans Lutke
J. Don Madden
G. McPhillips
Michael Weisbard
Craig C. Wier
Michael Winnick
Clifford A. Woodbury, Jr.

We express our thanks to all these contributors — even though some may not be aware that they did contribute!

3. The inventory of subjects discussed, or alluded to, and the number of articles or pieces of articles, etc., in which they were discussed, is approximately as shown in the following table:

Subject	*Number*
1. Political issues	
In general	3
War and peace	4
2. Social issues	
In general	2
Disadvantaged persons	4
Freedom of the press	1
Future effects of computers on society	2
3. Ethical issues	
In general	11
Professional conduct of computer people	13
Dishonesty	2
Lying	5
4. Legal (and semilegal) issues	
The right to privacy	5
The right of access to employment	1
The right of access to knowledge	3
The right to discuss freely	11
5. Philosophical issues	3
Total,	70

This tallying, of course, appears to be more exact than it really is — actually there is much leeway in the classification.

There are essentially four first steps to substantial progress in the computer field's dealing with the social implications and the moral questions associated with computers:

1. That a computer person should see and admit these questions exist, are important, and deserve his own study and attention;
2. That he should devote at least some time in each week (a few out of the 168 hours that each person has) to becoming informed about these questions;
3. That he should actually discuss these subjects with his friends and associates from time to time. For they truly are worth conversation, more so than the weather and other trivial subjects, even if they are "uncomfortable", even if they interfere with a feeling of "togetherness".
4. That he should take at least some actions in the directions of expressing his moral judgments in the computer field. Of these the simplest perhaps is the

(Please turn to page 46)

Letters To The Editor

Simulation

Congratulations to Mr. Cremeans for his well written article ("The Trend in Simulation", *Computers and Automation* for January, 1968). Indeed, he has collected and described a good number of points regarding simulation.

Hopefully, a great amount of work is underway in helping to make simulation more of a science than an art. If not, I believe that Mr. Cremeans' article should provide a stimulus.

R. A. HURTUBISE, Lt.
Quebec, Canada

Reprints for Authors

My article in your February, 1967 issue ("Multi-Programming: Who Needs It?") elicited a number of requests for copies, mostly from technical libraries. Being both busy and not mindful of the copyright laws, I simply ignored them for the most part. I wonder now if you make available reprints for such requests and/or extend permission to authors to make a limited number of copies for such purposes. Your permission in this respect is solicited.

I was quite intrigued with your November, 1967 issue on graphic data processing, but was disappointed not to find a full-length article on the cover application ("Computer Visualizes Aircraft Landing"). It would appear to offer a technical base for a variety of application areas, and I hope someone at Syracuse can be encouraged to reveal more details soon.

BROOKE W. BOERING, Mgr.
Chicago, Ill. 60620

(Ed. Note — *Upon request, an author may receive 100 reprints free of his article appearing in C&A. Also, an author is regularly given permission to reprint his article, subject to including our regular clause: "Reprinted with permission from . . . ."*)

New Installations

I have been a reader of your magazine for over two years, and I have often pondered on the source of your information regarding "New Contracts" and "New Installations".

Does your magazine publish *every* new installation, or only those of which you are informed by the companies (or manufacturers) in question? If it is the former, then your magazine, along with its many other benefits, is an accurate guide of whose machines are going where and for what purpose.

D. PROTTI
Winnipeg, Manitoba, Canada

(Ed. Note — *It is not possible for us to publish news of every new installation because of the amount of space that would take in the magazine. But we try to report most major installations.*)

Computer Art Contest

The creative artists, engineers and graduate students in Japan are much interested in your Annual Computer Art Contest. Our group, Computer Technique Group (CTG) is earnestly seeking new ways of applying computers to the arts. I was pleased to read your editorial, "Computer Art: Turning Point", and found your comments about the future of computer art interesting.

CTG wants to participate in the Sixth Annual Computer Art Contest in 1968. Can you send me your entry requirements?

KUNIO YAMANAKA
University of Tokyo
Bunkyo-Ku, Tokyo, Japan

(Ed. Note — *Thank you for your interest in our contest. An announcement of our August 1968 Computer Art Contest appears in "Multi-Access Forum" in this issue.*)

C&A Production

I am a Journalism major at Oklahoma State University. I am working on a paper centered on computers and automation in the field of Journalism.

In understand that your publication is handled by computers. I wonder if you would be so kind as to tell me of your operation. How does the computer run various equipment, do layout, typesetting, photographs, press runs, etc.?

RONALD COCHRANE
Shawnee, Okla. 74801

(Ed. Note — *Only the preparation of up-to-date mailing labels for sending each issue of C&A to subscribers is produced by a computer. All the rest of the publishing work is done by human beings, printing presses, etc.*)

the student motivators

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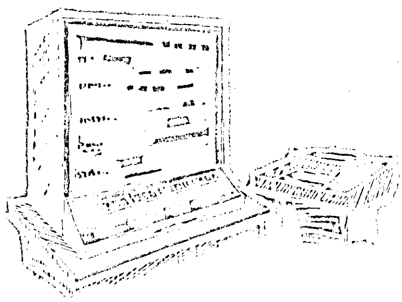

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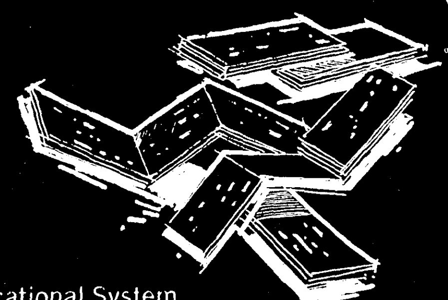

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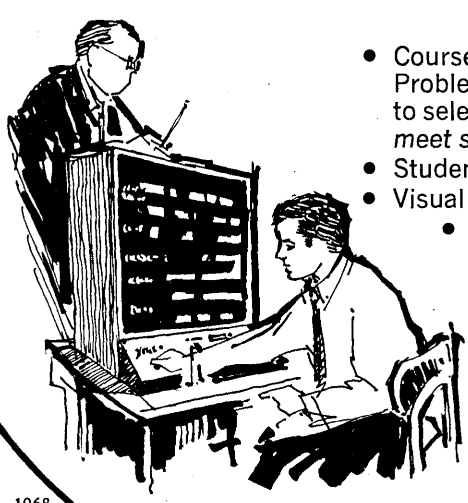

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MULTI-ACCESS FORUM

HOW TO CHOOSE AND USE AN EDP SERVICE BUREAU

**The Research Institute of America, Inc.
589 Fifth Ave.
New York, N.Y. 10017**

Electronic data processing service bureaus vary so significantly in quality and capability, that selecting the right one is a difficult and risky task. While the right choice can bring valuable advantages in terms of costs, capabilities, added services and production scheduling, the wrong choice can bring unexpected expenses and can seriously affect operations.

Generally, EDP service bureaus provide the following major services: (1) complete data processing services for firms whose size does not justify in-house EDP operations; (2) overflow processing for companies whose needs for data processing exceed the capacity of their existing in-house installations; (3) program testing and debugging for companies about to install their own data processing equipment; and (4) special periodic and one-time jobs, such as handling W2 tax information, dynamic marketing, or solving engineering and scientific problems.

There are five major types of service bureau set-ups, each with its own unique characteristics. They are:

1. *Equipment manufacturers' affiliates* — Nearly all the major computer manufacturers maintain EDP centers which provide a complete range of data processing services to the general public. All are extremely well-equipped and have highly competent staffs. The chief criticism that has been made against them is that there is sometimes a lack of liaison (between the aggressive, highly motivated salesmen, and the staff personnel operating in a routine fashion) and this affects the performance of the service center.

2. *The major independents* — There are several large independent service bureau organizations whose equipment and personnel resources equal those of the manufacturers' affiliates, and sometimes surpass them. The chief differences between the manufacturers' affiliates and the large, independent service bureaus lie in the fact that the independents enjoy greater equipment flexibility because they are not limited to computers from a single source.

3. *The other independents* — The majority of service center organizations are firms which are smaller than either the manufacturers' affiliates or the major independent companies, but which compete with them either locally or regionally, and often rival them. Many of these firms are as well equipped as their bigger competitors in terms of men and equipment, and differ from them largely in that they operate only in a single location or region rather than nationally. At their best, they are extremely responsive to the needs of local customers, and their services are priced very competitively. The chief drawback to using local service centers is the difficulty of evaluating them. Before deciding on any local bureau, make certain it has sufficient back-up equipment to run your job without delay in case of breakdown of an operating machine. Reputable service organizations will usually give you a list of their clients from whom you can obtain references as to the quality of their services and personnel.

4. *The "dedicated" bureaus* — These service centers specialize in serving a particular industry or business function, such as payroll processing, inventory control services, etc. This specialization cuts down on one of the biggest expenses that bureaus have — programming, and it frequently permits them to offer lower prices with greater production efficiency.

5. *Banks and time sellers* — Data processing services are also sold by banks and time sellers — firms which have unused time available on their computers. The work provided by banks can be very good, but their capabilities should be examined very carefully. Banks are often short of qualified personnel, and their equipment is geared to their main business, banking, and may not always be suitable for other applications. When dealing with a bank, insist that machine time be guaranteed. Time sellers include both private firms and universities. They sell machine time at rates which can be substantially lower than those of service bureaus, but they usually provide no other services. Programming and data conversion are generally the customer's own responsibility. Purchase of spare machine time for routine business applications is advisable only when speed is not an important factor, since the availability of machine time cannot always be relied on. However, the purchase of spare time can be advantageous for advanced computation such as for dynamic market research, or engineering and scientific research. The likeliest time sources for this purpose are the universities, which often have large, powerful machines of a type seldom found in commercial installations.

Most EDP centers are prepared to provide three basic types of help:

1. Conversion of your data, your original information, into input media that computers can read and handle.
2. Machine processing of your converted data to produce the required information and documents.
3. Systems analysis and programming for efficient internal operations and processing of your information.

Before engaging the services of an EDP center, a company should undertake a feasibility study, and determine comparative cost figures for in-house facilities, as opposed to the cost of the facilities of a service bureau. Once a decision is made to use a service bureau, there are three main factors that should govern your selection: price, delivery guarantees, and performance guarantees.

The need for careful selection is emphasized by the high mortality rate of the service bureau industry. As an example, the Chicago classified telephone directory listed 32 service firms in 1963. Four years later, less than 20 were still in business. And since 1963, over 60 new service firms have begun business in Chicago. Many are undercapitalized, understaffed, and underequipped. They can use only low prices to attract business.

There are three types of firms to avoid: (1) the "one-man" bureau where the salesman is not just a salesman, but also estimates, programs and controls your job on a continuous basis. If he leaves the firm, so does all knowledge about your job. (2) The one-machine operation, even if it claims back-up on someone else's machine. Back-up equipment has a way of not being available when needed, and your job will be delayed. (3) The bureau whose salesman offers you a "free survey" of your information system. This is a gimmick — adequate surveys require the services of expensive specialists. In the case of a "free" survey, you will probably get just what you pay for — nothing.

The best way to begin your evaluation is to select a limited number of service firms from which you will request preliminary presentations and bids. Have each salesman make a full presentation of his bureau's range of services, find out what equipment the bureau has available, and get customer references from him — and check them.

After the preliminary meetings, you can compare the services offered. You will know how well each company can serve your needs; whether it can do so by itself, or whether it must subcontract some of the work; and if it will be able to meet your future needs for expanded service. You will be able to eliminate the organizations which do not look as though they are in business to stay. The two or three firms which seem best qualified can then be asked to submit detailed, formal proposals.

Once you have entered into an agreement for EDP services, the degree of care you have taken to evaluate your needs, select a bureau, and work out a formal written contract should bring your company substantial return in cost savings and administrative efficiency. There are two final things which your company can do to see that these benefits are obtained: The first is to maintain control over the service bureau performance, and the second is to make your company personnel fully aware of automation's role within your firm, and how they are individually affected.

In the last analysis, no automated data handling system is any stronger or more potent that the people who run it.

PROGRAMS AND SOFTWARE SHOULD BE PATENTABLE — Statement Submitted February 1, 1968, to the Senate Subcommittee on Patents and Copyrights

Richard C. Jones, President
Applied Data Research, Inc.
Route 206 Center
Princeton, N.J. 08540

My testimony is directed toward Section 106 of the Proposed Patent Legislation and the question of Patent Protection for Computer Programs, which states that:

> "A plan of action or set of operating instructions, in whatever form presented, to cause a controllable data processor or computer to perform selected operations shall not be patentable."

I am opposed to this proposed section on the grounds that there is no basis for the legislation historically, theoretically, or practically. I feel each of these perspectives merits individual treatment:

Historical Opposition

Historically, the proposed legislation overturns two actions which had been previously taken:

1. In November, 1965, the British Patent Office held that a computer program invention could be patented.
2. In August, 1966, the U.S. Patent Office published a set of proposed guidelines that set forth some bases for patentability of computer program inventions.

Theoretical Opposition

Theoretically, there is no basis for differentiating a computer program from any number of other devices which are currently held to be patentable and for which patents have been issued.

In April, 1967, at a meeting which I attended at the Office of Science and Technology, a representative of the Patent Office explained a new theme regarding embodiment of inventive concepts. It was stated that, if an invention passed the other tests of the patent system, a distinction is made between a computer system invention embodied in hardware and the same invention embodied in a program. Technical experts present explained that a machine containing a programmed control system is the same in all features as that containing special purpose hardware controls; the engineering differences are merely those that relate to a choice of the more practical or economical embodiment. Consequently, there should be no legal difference since the two forms of the invention are engineering equivalents.

A computer program at work in a digital computing machine is a complex set of coded electrical impulses. It tells the machine what to be. A computer program transfers a set of building blocks, called a computer, into a useful device. It is not proposed that patents be granted on scientific principles or abstract theorems, only the truly inventive *modus operandi* used to arrive at the solution. The principle of leverage is not patentable, but a pair of pliers is.

Practical Opposition

Practically, there is little doubt that the arbitrary exclusion of computer programs from patentability would seriously impair the goals of the patent system to further the useful arts.

These goals were concisely summarized in the December 1966 report of the President's Commission on Patents which stated:

> "The patent system has in the past performed well its *Constitutional mandate to promote the progress of useful arts.* The members of the commission unanimously agreed that a patent system today is capable of continuing to provide an incentive to research, development

and innovation. They have discovered no practical substitute for the unique service it renders."

The computer industry is looked upon as one with unlimited growth potential. It is expected to make important contributions to every aspect of our lives in the years to come. But the Achilles Heel of computers is the programming problem. Pick up any newspaper and look at the want-ads for programmers. All forecasts indicate that the demand is increasing at a rate many times in excess of all efforts to train new personnel. Dr. Fubini, an IBM Vice President, (quoted in *Computerworld* — August 30, 1967) called for a radical change in the techniques of programming, "Programming must become a science," he told his audience, but went on to admit that presently so little was known about the programming process that large-scale research would be needed before we even knew what to measure.

This "large-scale research" is presently restricted to the computer manufacturers because under the interpretation of the existing patent system only such companies can gain economic benefits from computer-program inventions. The computer manufacturer has, as it were, a captive market for his programs; namely, the users of his machines. The computer manufacturer inflates the price of his machines and claims to give a limited set of programs away "free" to his customers (*Electronic News* 4/10/67; *EDP Industry* 3/15/67; *EDP Analyzer* 7/66, p. 9; *Datamation* 6/66, p. 12, 12/66, p. 17, 10/67, pp. 23-24, 205; *Data Processing,* pp. 26-27; *EDP Analyzer* 11/67, pp. 5-7). Under these circumstances, the manufacturer has no need of patent protection for his programs. The very absence of protection, in fact, is of the greatest assistance to him in perpetuating a lucrative "tie-in" business and extending the economic advantages of his hardware into the systems programming business.

The "Value Added" contribution of "TIE-IN" Software enables the computer manufacturer to mask the price of hardware in the sale of a total system in the hope that he can realize a larger than normal profit. If patent protection were possible for qualified Software Inventions, many Software companies would be encouraged to develop competitive systems without fear of the manufacturers or others taking their inventive concepts and using them with impunity.

The Debate

The justification of the Presidential Commission for proposed Section 106 and a rebuttal follow:

1. Commission: "Uncertainty now exists as to whether the statute permits a valid patent to be granted on programs."

   Rebuttal: If an invention passes the other tests of the patent system and is reduced to practice in the form of a computer program, is it any less an invention than a more expensive embodiment in electronic circuits? There is no necessary reason why this should be so.

2. Commission: "The Patent Office now cannot examine applications for programs because of the lack of a classification technique and the requisite search files. Even if these were available, reliable searches would not be feasible or economic because of the tremendous volume of prior art being generated. Without this search, the patenting of programs would be tantamount to mere registration and the presumption of validity would be all but nonexistent."

   Rebuttal: The April 1967 issue of *Datamation* magazine (p. 85) on the above stated position reports that the American Inventors Association disagrees with all these contentions. The advantages claimed of the "first-to-file" system of the proposed bill are applicable to computer programming technology. The computing equipment requested by the Patent Office for searches in other areas of technology could provide meaningful assistance in the area of computer programming. The classification and prior art considerations have been overcome when other new areas of technology were afforded patent protection and they can be overcome in this one.

3. Commission: "It is noted that the creation of programs has undergone substantial and satisfactory growth in the absence of patent protection and that copyright protection for programs is presently available."

   Rebuttal: Even if copyright protection for programs is available, and there is strong disagreement among legal people concerning this, it does not afford protection for research and development. Because of the nature of computer software, an opportunistic company or individual could readily gain substantial economic advantage from the inventor and actually compete with him without violation of any copyright protection.

   It is not true that the creation of programs has undergone substantial and satisfactory growth in the absence of patent protection. There is a mountain of evidence that the problems in this area have retarded the growth and application of computers since they were invented. It should be noted that this situation continues to worsen and has been the subject of criticism in many business and technical publications (*Fortune* 3/67, pp. 141-142, 10/66 entire article; *EDP Industry* 1/25/67, 3/22/67; *Datamation* 6/66, pp. 17 & 19, 3/67, pp. 17 & 91; *Computerworld* 10/18/67, p. 2 — Profit Is Not Progress).

   The economic burden of this stagnation is born by every taxpayer, most corporation shareholders, and is passed on to the customer in the pricing of almost every type of product. The requirement for the involvement of the computer in virtually every new area of technology, as predicted by *Fortune* (pp. 97, 185, 186, 190) in January of 1967, will never come to pass unless innovation is encouraged in this complex technology.

It is difficult to believe that deliberate Patent Office policy has been established which would be discriminatory in favoring one segment of an industry over another. Isn't the purpose of the Patent System to encourage invention? And, if the preferred embodiment is a computer program and more economical, isn't that in the public interest?

WHAT THE UNITED STATES GOVERNMENT KNOWS ABOUT ITS CITIZENS

Senator Edward V. Long, Chairman
Subcommittee on Administrative Practice and Procedure
Committee on the Judiciary
United States Senate
Washington, D.C.

This Subcommittee released, on February 5, 1968, a report showing how much information the Federal government maintains on individual American citizens. The report, a Committee Print, is entitled: "Government Dossier: Survey of Information Contained in Government Files", 605 pp.

Big Brother is not only watching us these days; he is also storing what he sees in more and more government files. Our name is recorded almost 3 billion times, our age is recorded more than 2 billion times, marital status 1½ billion times, and our income more than 1¼ billion times. To my knowledge, this is the first inventory ever prepared showing the amount of government information on American citizens.

A careful reading of this report shows that there is very little that some agency of the Federal government does not know about each of us from the cradle on.

Hearings before my Subcommittee have convinced me that whatever privacy remains for the American citizen, remains because the Federal government is presently too inefficient to pull all its personal information files together. Thank goodness it is now extremely time-consuming and expensive to put your finger on any one individual!

But the proposed computerized Federal data bank will make it easier and cheaper to put your whole life history no further away than the push of a button.

We recognize that computer data banks are but another result of the fantastic technical progress our Nation has made in recent years. But, what good will all this progress be if we fail to preserve our privacy at the same time?

The accompanying table is derived from the report. The information should be considered as estimates (*not* precise counts) of the quantity and type of information in the records of Federal agencies.

GOVERNMENT DOSSIER

(Survey of Information Contained in Government Files)
Issued by

Senate Subcommittee on Administrative Practice and Procedure

Extract from Table 4-B. -- Type of information by number of responses on each type, by confidentiality restriction and mandatory or compulsory basis of reporting

(in billions)

Total (includes nonresponse cases on confidentiality restriction)

Type of information in files (responses are counted once for each type)	Total	Data obtained under express or implied compulsion	Data obtained through voluntary cooperation of the respondent	Data required as a condition for an application, for participation in a program for the award of a contract, etc., or basis of reporting unknown
Total	27.27	18.22	1.36	7.69
Name	2.93	2.15	.13	.64
Social Security Number	1.52	1.12	.03	.38
Age	2.06	1.48	.12	.46
Birthplace of parents	0.60	0.47	.04	.08
Marital status	1.59	1.19	.08	.32
Number of children	0.74	0.41	.04	.28
Race	1.57	1.39	.09	.09
Religious affiliation	0.15	0.06	.02	.07
Citizenship and national origin	1.16	0.84	.07	.25
Physical characteristics	0.50	0.29	.04	.17
Addresses, current and past	2.35	1.66	.12	.57
Military service	1.05	0.63	.05	.37
Military serial number	0.57	0.25	.04	.28
VA claim number	0.22	0.02	.02	.17
Welfare status and history	0.12	0.04	0	.07
Income, total and/or by sources	1.25	1.01	.01	.23
Assets	0.25	0.17	0	.07
Debts	0.25	0.16	0	.08
Expenditures	0.14	0.06	0	.07
Credit rating	0.07	0.01	0	.06
Checking and savings accounts	0.19	0.12	0	.07
Home ownership	0.98	0.92	0	.06
Public housing occupancy	0.04	0	0	.04
Mortgage delinquency history	0.05	0	0	.05
Condition of living quarters	0.28	0.23	0	.05
Highest grade completed or degree(s) earned	0.61	0.40	.02	.18
Grade average or class standing	0.17	0.06	.01	.10
Knowledge of foreign languages	0.19	0.06	.01	.12
Occupation, current and/or past	1.36	1.00	.08	.28
Employment status and history	1.07	0.82	.03	.22
Occupational licenses and certifications held	0.22	0.06	.02	.14
Employer	0.89	0.58	.02	.29
Recommendations and references	0.15	0.01	.01	.13
Police record	0.26	0.07	.01	.18
Security or other investigative reports	0.19	0.04	.01	.14
Involvement in civil or criminal court action	0.28	0.09	.01	.18
Medical history	0.34	0.08	.05	.22
Dental history	0.18	0.06	.03	.09
Psychiatric history	0.28	0.07	.04	.17
Personality inventory	0.16	0.05	.04	.07
Alcoholism or drug addiction	0.92 [sic]	0.06	.04	.10
Food purchases and consumption	0.04	0	0	.03
Consumer preferences	0.03	0	0	.03

COMPUTERS ARE PENETRATING ALL FUNCTIONAL AREAS OF BUSINESS

Booz, Allen & Hamilton, Inc.
135 So. LaSalle St.
Chicago, Ill. 60603

The computer is no longer relegated to the finance and administration functions of a company. Instead, the computer is penetrating other functional areas of business — marketing, manufacturing, distribution, research and development, engineering, and management planning.

This was revealed in a recent survey covering the use of computers by 108 leading manufacturing firms, whose experience with computers ranged from one to 18 years.

Other important trends and conclusions which the survey revealed include:

- A "Top Computer Executive", who is responsible for all of the computer activities of a firm, is found at the corporate level of most firms. He coordinates the activities of other computer managers. He is responsible for overall quality, performance, and forward planning in the company's computer effort.
- The best computer operation is achieved when computers are located where they can directly support company operations. This was found to be true for both decentralized firms (with divisional, branch, and plant locations), and centralized firms.
- In many firms, computers are used for specialized purposes, other than processing business information. Separate systems and programming staffs for research, development and engineering were found in 65% of the firms surveyed.
- The longer a company has been using the computer, the more money it spends on its operation. The median spent for all firms in the study was $5,600 per million dollars of sales volume.
- The computer budgets of all firms surveyed showed an average expenditure of 29% for systems planning and programming, 38% for equipment rental, and 33% for other computer operating costs.
- Companies in the survey expect to direct over half of their total computer effort in the next three to five years toward serving operating areas — marketing, production, and distribution — rather than the finance and administration areas of business.
- The formal short-range plan is considered to be a significant control device for the management of computer performance. The short-range plan is used by 90% of the companies studied.
- The larger firms are more likely to audit their computer operations than the smaller firms. Most audits are confined to critical computer applications.

THE GROWING CRISIS IN TECHNICAL MANPOWER IN THE UNITED STATES

Arnold R. Deutsch
Deutsch & Shea, Inc.
49 East 53rd St.
New York, N.Y. 10022

The gap between the number of technical people required to keep the United States economy viable, and the number of technical people that are being trained, is critical and growing.

Engineering enrollments have inched up barely 1% in the past 10 years; yet total male college enrollments have climbed 52%.

Though a record-breaking 1,478,000 freshmen entered college last Fall, fewer than 50,000 will receive engineering degrees when commencement arrives in the '70's . . . . at least 30,000 short of our annual needs.

Engineers, physicists, computer programmers, engineering technicians — almost every type of technical personnel — are in short supply, with still greater shortages to come.

The technical manpower crisis the United States faces is the dangerous disparity between the numbers of technical people we need and the numbers we are able to produce.

In 1967, for example, the average technical organization was able to recruit only 75% of the experienced technical people it sought. And last Spring, on one campus, 250 organizations were lined up to compete for 231 engineering and science graduates.

Almost every serious approach to meeting today's economic and social problems and tomorrow's vital needs centers around continued and accelerated technical progress; new jobs, new approaches to education, higher rates of production, urban renewal, pollution control, improved public transport, increased food production, competing in the world market, maintaining adequate defense capabilities, exploring new areas of science and technology.

But, without an adequate supply of technical manpower, our capacity to achieve these goals will be crippled.

The Russians graduate 138,000 engineers a year; one third of them are women. The Japanese graduated 201,983 engineers and scientists in 1966, 17% of their total college graduating classes. But the U.S., in 1967, awarded only 36,000 bachelor degrees in engineering.

One organization, the Engineering Manpower Commission of the Engineers Joint Council, is taking a significant first step. The EMC is planning a national symposium on the problem of technical manpower. This symposium will represent the business, technical, governmental, and academic communities. Its goal is to understand the problems better and to develop specific recommendations to increase engineering and technological manpower resources of the United States.

The symposium, planned for May, will cover such issues as:

- Improving public understanding of engineering and technology and their vital relationship to the national welfare;
- Creating programs to attract minority groups, and women, to careers in technology;
- Developing fresh approaches to attract and keep young people in engineering and technical occupations;
- Improving the utilization of technical people;
- Developing better information on technical manpower to assist in planning.

COMPETITIVE MARKET FOR COMPUTER TECHNOLOGY

American Institute of Industrial Engineers
345 East 47th St.
New York, N.Y. 10017

The American Institute of Industrial Engineers (AIIE) has replied to the Federal Communications Commission inquiry regarding regulations on computer technology (FCC Docket #16979). AIIE is the world's largest professional society for practicing Industrial Engineers, with more than 16,000 members.

The Institute has taken the following position regarding regulations on computer technology:

1. In the public interest a competitive market should function freely in the development and offering of information systems, equipment, and services, whether or not these offerings are independent of, are attached to, or utilize a communication network.
2. Users of communication-common-carrier facilities and services should be free from arbitrary or artificial technical and economic restrictions which limit flexibility in system design and which may increase investment requirements for facilities and services.
3. Systems designers and users are responsible for maintaining integrity of systems and privacy of files, although suppliers of data processing and communications equipment are responsible for offering desired safeguard capabilities at reasonable cost.
4. It is necessary and desirable that regulation of common carrier facilities continue, but that boundaries of the regulated activities be redefined in keeping with changing technologies and industry standardization efforts.
5. Information systems, within which communications activity is an integral part but incidental to system objectives, should not be restricted or discriminated against in relation to: foreign attachments, interconnection of private and common carriers, resale of system services, or capacity and variety of common carrier facilities.

Elio R. Rotolo, president of AIIE, commented: "We share the concern of the FCC on problems presented by the interdependence of computer and communication services and facilities. The AIIE and its Board of Trustees also reflects its obligation and that of all professional industrial engineers to achieve economical and effective use of the resources of industry, service and government."

COMPUTERS — AND WORLD LAW

(Based on a report in Law and Computer Technology, January, 1968, (Vol. 1, No. 1), 40 pages, published by the Section on Law and Computer Technology, World Peace Through Law Center, 839 17th St. N.W., Washington, D.C. 20006.)

More than 2500 lawyers and high court judges from over 100 nations attended the third World Conference on World Peace Through Law and the first World Assembly of Judges in Geneva, Switzerland, last summer. The purpose of the Conference was to work toward the development of international law for future world peace.

The Conference was opened at the Palais des Nations (Peace Palace) with an impressive procession of more than 250 supreme court judges from around the world, dressed in their ceremonial attire.

During the Conference, delegates endorsed a proposal for the establishment of a Center for the Computerization of Law Internationally. The Center, to be located in Geneva, will house a computer whose memory store will eventually include the legal codes and laws of every nation. Utilizing such a computer, a lawyer from anywhere in the world could dial a set of digits on a telex or other communication device linked to the computer and obtain all the references needed on a case involving international law within a matter of seconds.

Besides its uses in day-to-day legal cases, such a computer could be used to help mediate disputes between nations by providing the precedents and information relating to such matters. The computer could also help developing countries or newly-independent nations to find a law code best suited to their needs.

Is it not possible that such a proposal could expand today's information explosion into a law explosion? Perhaps the groundwork has been laid for the establishment of a world law system so useful and credible as to eliminate today's reliance upon force as the ultimate factor in international relations.

425 COMPUTER PROGRAMS AVAILABLE

International Computer Programs
5704 N. Guilford Ave.
Indianapolis, Ind. 46220

Vol. 2, No. 1, the January 1968 issue, of I.C.P. Quarterly (which contains no advertising), catalogs more than 425 fully operational, documented and/or supported computer programs. These programs are offered for sale, lease, franchise, or at a nominal cost by private corporations, individuals, or government agencies throughout the United States and Canada.

The catalog contains separate indexes for commercial, utility, and scientific/engineering computer programs. Pages 41 to 62 list programs available from COSMIC, the Computer Software Management and Information Center, established through a contract with the National Aeronautics and Space Administration. The center is located at the Computer Center, University of Georgia, Athens, Ga. 30601.

Copies and additional information can be obtained from the above address.

REFUND OF OVERPAYMENT OF SOCIAL SECURITY TAX BY MUTLIPLE EMPLOYERS

Mrs. Helen Solem, Accountant
666 E. Main
Hillsboro, Ore. 97123

At present there is an unfair extra Social Security tax imposed upon some employers who hire individuals who have worked for more than one employer during the year.

The employee, according to present income tax law, who overcontributes to Social Security through payroll withholding, can apply for the refund in his income tax return. There is no provision made for a refund to the employer, who, of course, has contributed a like amount into Social Security.

This is more important to some industries than others. The construction industry is perhaps the largest single over-contributor with Longshoremen a close second. The majority of construction workers are hired from a union hall to work on a specific job. This could mean several jobs during the year and several employers.

Conceivably the employer's refund could be difficult to administer. However, it would seem that with computers auditing tax returns so effectively, it would be relatively simple to select employee returns which show an overpayment of Social Security tax. Then from them compute the amount of credit due each employer on the basis of the portion of his total contribution. At present $290.40 is the maximum contribution required. Suppose exactly double that amount had actually been contributed, $580.80, by three employers. Therefore, a $290.40 refund should be given to employers as follows:

Employer	*Social Security Paid as Shown on W-2 Form*	*% of Overpayment*	*Refund due Employer*
1st Employer	$ 60.40	10% of $290.40 =	$ 29.04
2nd Employer	230.00	40% of 290.40 =	116:16
3rd Employer	290.40	50% of 290.40 =	145.20

Also another possible solution would be for employers to determine their own credit by simply requiring employees to give them copies of their W-2 forms and then compute and apply for their own credit. We roughly performed such a computation for one contractor who does about $1,500,000 worth of business here in the Northwest each year and found he'd overpaid approximately $1,200, a sum he very much desires to have refunded to him.

Anything you and your readers can do to help solve this problem will be greatly appreciated.

1968 FALL JOINT COMPUTER CONFERENCE — CALL FOR PAPERS

Robert H. Glaser
Technical Program Committee Chairman
1968 Fall Joint Computer Conference
P.O. Box 2309
Stanford, Calif. 94305

The 1968 Fall Joint Computer Conference will be held in San Francisco, Calif. December 9-11. Papers are invited on all aspects of the state-of-the-art in hardware, software, systems, and applications.

Only new papers which have not been published are eligible. Five draft copies of the entire paper (up to 7500 words) and 100-150 word abstracts are due by May 12, 1968. Rough illustrations should also be included.

Papers should be submitted to the above address.

CONTRIBUTIONS WELCOME TO "WHO'S WHO IN THE COMPUTER FIELD"

The Fifth Edition of *Who's Who in the Computer Field* will be published by *Computers and Automation* during 1968. We plan to include over 10,000 capsule biographies of persons who have distinguished themselves in the field of computers and data processing. If you wish to be considered for inclusion in *Who's Who,* please complete the following form (which may be copied on any piece of paper):

1. Name? (Please print) ______
2. Home Address? ______
3. Organization? ______
4. Its Address? ______
5. Your Title? ______
6. Your Main Interests?

Applications	( )	Mathematics	( )
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 Information? ______

(attach paper if needed)

12. Associates or friends who should be sent "Who's Who" entry forms?

Name and Address

______

When completed, please send to:
Who's Who Editor, Computers and Automation,
815 Washington St., Newtonville. Mass. 02160

SHOULD YOUR ORGANIZATION BE IN "THE COMPUTER DIRECTORY AND BUYERS' GUIDE, 1968"?

The 14th Annual Edition of the *Computer Directory and Buyers' Guide, 1968* (the regular June issue of *Computers and Automation*) is being prepared. If your organization is a new one in the field of computers and data processing, please ask for forms for your free entries: write to Directory Editor, Computers and Automation, 815 Washington St., Newtonville, Mass. 02160.

Closing date for receipt of information is March 20, 1968.

ANNOUNCEMENT

The proposed acquisition of Berkeley Enterprises, Inc., (publisher of Computers and Automation) as a wholly-owned independent subsidiary of Brandon Applied Systems, Inc., has been cancelled by mutual consent.

(Please turn to page 46)

Education Through Remote Terminals –

THE UNIVERSITY OF GEORGIA COMPUTER NETWORK

James L. Carmon, Ph.D.
Professor of Statistics and Director of the Computer Center
Univ. of Georgia
Athens, Ga.

"The purpose of the system is to make the computer an extension of the researcher's intelligence, intuition, and creativity — and, as a result, make him more productive than ever before."

Today, the Computer Center at the University of Georgia has a very powerful central computer and more than two dozen remote terminals of various types in various locations for time-shared access. These terminals make available to researchers, administrators, and students a time-shared computing system which provides each user with as much functional freedom as he would have at the main console of the computer all to himself.

Whatever may be his discipline or applications, the user is not forced to modify them because of equipment or programming limitations.

As a result, we are not simply making the computer terminal "as handy as a desk calculator". We are, hopefully, developing a degree of excellence in the service we offer the user. By not imposing limitations, the terminal becomes an extension of the user's thought processes, enabling him to better bring his intuition into use.

The power of the computer system — an IBM System/360 Model 65 — appears to the user to be entirely his, and solely at his disposal. Where it is located, or how it works, is of no importance to him. Nor is the fact that his terminal is just one of the many linked to the system, which — in addition to the real-time network — is simultaneously processing about 14 production programs.

An unusual situation at the University of Georgia further increases the computing capacity available to users. Many large computer centers are located at engineering schools, where applications are concentrated, and a considerable amount of computer time is required for student use on homework problems. But the University of Georgia has no engineering school, and so applications spread across a very broad spectrum and generally do not include heavy homework loads for students.

Simulation Programs

With more computer time available, a greater number and variety of applications can be handled — particularly complex simulation programs. While simulation programs are most demanding of computer time and power, they are also one of the researcher's most valuable tools. Simulation, or mathematical modeling, cuts development costs and time, and makes possible research and experimentation that would otherwise be impractical.

Terminal Locations

Indicative of the broad areas the Computing Center serves, are the terminal locations. They include:

- *Nineteen typewriter-like terminals.* Two in the Business School; eight in the Computer Center; four in the library; and one each in the Departments of Chemistry, Ecology, Psychology, School of Forestry, and in the Department of Physiology of the School of Veterinary Medicine.

Dr. James L. Carmon graduated from the University of Georgia with a Bachelor of Science degree in 1948. He received an M.S. at the University of Maryland in 1950, and a Ph.D. at North Carolina State in 1955. He became Director of the Computer Center at the University of Georgia in 1958. He is a member of Phi Kappa Phi, Sigma Xi, the Biometric Society, the Association for Computing Machinery, and the American Genetic Association.

- *Five graphic display terminals.* Two terminals located in the Department of Statistics and another in the Computer Center are equipped with "light pens" which can be used to alter the material displayed. The Computer Center also has two graphic display units without pens.
- *Three more typewriter-like terminals.* These terminals, which can also transmit punched cards, are located in the Department of Political Science, at the Georgia State Fire Laboratory in Macon, and at Georgia Tech.
- *A satellite computer.* A smaller computer, a 360/30, is located in the Registrar's Office and serves as the remote terminal for the administrative offices.

Ultimately, we expect about 200 terminals, in a state-wide network linking every small college in Georgia with the System/360. Agricultural experiment stations up to 250 miles away will also be connected. All of these remote terminals will be provided with the same type of service as the terminal users on campus. The terminals will permit the researcher to utilize additional data for simulation programs, to enter research data for instantaneous analysis, to handle administrative tasks, to engage in computer assisted instruction (CAI), and the like.

Modes of Operation

To make this possible, the terminals operate in three "modes":

(1) As interpretive compilers;
(2) As remote job-entry facilities; and
(3) For problem-program-researcher conversation.

Languages

In some systems, terminals are restricted to a specific language. At the University of Georgia, the languages available at the terminals include FORTRAN, COBOL, PL/1, and an assembly language. The user also has conversational capacity.

We have also developed a simple, cognate vocabulary to inform the system of the researcher's needs. This control language tells the input-output devices what compilation is necessary and when, and generates machine language.

Consultants

To make the best use of the time-shared system, we have assembled a diverse consulting staff who work with various departments in developing applications. Included are a chemist, physicist, mathematician, statistician, accountant, physiologist, forester, and educator — eight people who do consulting, their own private research, and nothing else. Another four or five people also assist in consulting. Some of these are accomplished computer people, and all of them thoroughly understand the computing system.

Variety of Jobs

The Computer Center currently processes a wide variety of jobs. Here are some of them:

- *Real-time experimentation,* in the School of Veterinary Medicine, with the animal "patient" linked directly to the computer to measure physiological functions.
- Experiments in *simulation of the learning process* at the College of Education, to develop CAI, and also to assist the college's Department on Special Education in studying the learning processes of the retarded.
- Several types of simulation of biological systems. For example, *simulation in genetic research* is slow by other means because the change of generations is slow. But we can simulate 20 generations in 20 minutes on the computer, and can study the effects of various genetic hypotheses that we couldn't test practically in real life because of time.

Using a typewriter-like time-sharing terminal in the Department of Physiology of the School of Veterinary Medicine, a research associate has as much functional freedom as he would have at the main console of the computer.

- In one project, we have *modeled the blood system of the body* to study oxygen-carrying activities. By inserting various parameters of oxygen saturation, we can calculate the effect on various cells, such as brain cells.
- In related work, we have conducted *heart-modeling studies.* We produce a simulated electrocardiogram on the computer, with variations we could not create with a live patient, to get insight into how the patient would react. As a further step, we can combine the blood system model and the heart model to calculate how long a person could be "dead" without irreparable brain damage.

Forestry Simulation

- Using a Forestry Operations Simulator, we *simulate a forest,* and do inventory and cutting projections as part of a complete forestry management system. This system was developed jointly by the Computer Center and the School of Forestry.
- Also under study are the *ecological effects* which might be caused by the construction of a new Atlantic-Pacific Canal by nuclear explosives. Eight employees are on the Isthmus of Panama gathering data from which we will analyze potential radiation hazards.
- We have developed a national model to *determine the minimum land required to provide food and fiber* for the projected population of the United States. This simulation

program was developed by the Department of Agricultural Economics.

• Simulation is used in school administration in the *design and construction of all junior colleges in Georgia.* We simulate the curriculum, projected student growth, and needs for structures, based on student load at the end of five years, ten years, etc. This simulation includes specific figures, such as the space required for laboratories, administration, class rooms, etc.

• Plans are underway to *automate the University Library* to include: real-time remote inquiry for index information; computer-produced lists of publications; abstracts of their contents; etc.

Weather Modification

• Under contract from the U.S. Navy, we are studying statistics regarding *weather modification.* Ultimately, this will involve 40 automatic weather recording stations in the Savannah area, collecting 16 weather parameters. These statistics will be used to determine the most opportune time to seed clouds to produce rain for that particular environment. Weather-pattern studies are also involved.

• *Rainfall probability studies* have been run for vegetable growers in southern Georgia, as a guide to planting various crops so that they will receive rain at the optimum point in the growing cycle.

• Our *sawmill simulation* program, now used in several mills, considers the location of knots and their shapes in determining the way a trunk should be sawed to get the greatest quantity of high-quality lumber.

• The Modern Foreign Language Department utilizes the Computer Center for many projects, such as analyzing changes in Spanish over the years, and conversion of new French to old French, to ease translation of ancient documents.

• A somewhat similar project, in the Department of Humanities, involves studies how verbs, participles, gerunds, and infinitives were introduced into the English language.

Student Scheduling

• We handle *student scheduling* for 20 to 30 high schools in Georgia, Tennessee, and Florida. Included are modular scheduling, class rolls, etc., utilizing a program called Generalized Academic Simulation Program.

• The program and sensors for *automating a modern textile mill* have just been developed here. Essentially this is a process-control application, with looms, carding equipment, and winders linked to the mill's computer.

• Our own student records, student admissions, budgetary matters, and space utilization are processed through the satellite computer in the administrative EDP center. Later, student registration, inventory control, and personnel processing will be added.

• A *Sales Management Organization Game* (SMOG) is used: with all undergraduate sales management courses; for seminars for professional sales managers; and for aiding other colleges and business organizations. SMOG simulates a national sales force: to determine if a sales representative is profitable; to indicate how to select a top sales rep; to determine the breakeven points on territories; to select territories; and to forecast sales based on seasonal and cyclical factors.

COSMIC

• The *Computer Software Management and Information Center* (COSMIC) is funded by the National Aeronautics and Space Administration (NASA) and co-sponsored by the University of Georgia to make space-effort programs available to industry. For instance, we disseminated one program, which cost a NASA contractor $5 million to develop, to industry, just for the handling cost. This is part of NASA's function to make new space-age technology available to American industry. Several information centers have been set up under this program, ours being the only one for software. During the first year under COSMIC, we distributed about 1000 separate programs, or 10,000 documents, with universities ordering about 25 percent. We also serve as informational liaison to help the user make the program operational in a minimal environment; this requires us to maintain a highly-diverse staff.

Football Scouting

• *SCOUT,* a program we wrote for the Athletic Association, is one of the few programs which we do not make available to other computer centers. Under SCOUT, football, scouts look over next week's opponents and enter scouting reports. The system prints a report on the strengths and weaknesses of the offensive and defensive maneuvers of the opposition, including the frequency and relationship to positions on the field, for example. SCOUT gives our coaches much more information by Sunday than was previously available by mid-week. To date, we have had more than 300 inquiries in regard to this system from universities and professional football teams.

Our future plans include the automation of all information on research grants and contracts, so that the Director of Research can find out anything he wants to know about any grant including a summary of the dollars available from the granting agencies. We also plan a linked publications program to show where the research material is being printed.

The terminals with light pens which we now have will be used shortly: in electrical circuit design, for research in physiology; and for curve-fitting by the Statistics Department, in actual classroom lectures.

The Computer Center is currently handling many other projects, including helping to evaluate missile flights at Redstone Arsenal, working on a steel mill inventory in Florida, planning for commercial uses of nuclear power in New York City, simulating traffic flow on the highways of four states, and conducting war games for the military. We look upon the center as a regional resource, and offer assistance not only to the university, but to outside agencies ranging from the very small to the very large in government, education, industry, and business.

Master's Degree in Computer Science

To continue this assistance requires not only broad systems design, but a research capability to further that design. To build the capability, we will offer a Master's Degree program in Computer Science this year so that we can start training systematically our own research specialists.

The center is under the direction of the university's Vice President of Research, Dr. R. C. Anderson, and is operated three shifts a day, seven days a week. Our overall staff is 120 people — a considerable growth since the establishment of the center in 1958, when we had two keypunches and two operators.

Despite an array of equipment valued at $8 to $10 million, we realize that our capacity is limited. But we hope that our potential is unlimited, particularly with the big increment from the time-shared terminal system.

COMPUTER TRAINING IN PRIVATE SCHOOLS

Swen A. Larsen
Vice President for Education Centers
Computer Learning Corp.
6201 Leesburg Pike
Falls Church, Va. 22044

Much has been written on the subject of the remarkable growth of the computer industry over the past decade. One of the most perplexing problems brought about by this growth is the shortage of well-trained people for entry level jobs, for professional level jobs, and for managerial level positions where the executive has a computer center within his organization. While our public education institutions from the high school through the university have made progress in the development and presentation of training programs, the fact of the matter is they are not training enough people to meet the needs of the industry.

The gap that exists between the ability of our public educational system and the personnel needs of the industry is an ever-widening one. It is perhaps a truism that when such gaps have developed in our society in the past, our economic system is so organized that private enterprise has moved in to close the gap. This gap then accounts for the proliferation of privately owned computer training facilities over the past five to ten years. As one might expect, the quality of these schools will vary from the highest to the lowest. Professional societies such as the Association for Computing Machinery (ACM) and the Data Processing Management Association (DPMA) recognize that they have a certain degree of responsibility in that they must concern themselves with this divergence in quality. Some of these societies are now taking steps to educate the public with relation to the things to look for in the selection of a good school. An example of such a step is the action taken by ACM in January of this year to establish their new ACM Accreditation Committee under the able leadership of Dr. Carl Hammer of UNIVAC. The Federal Trade Commission and Better Business Bureaus have also taken an active interest in this situation.

Antipathy Between Education and Industry

Another factor which causes concern over the very existence of these private training establishments is the long-standing antipathy that exists between the educational community and the world of commerce. This distrust is typified by several recent statements made by spokesmen for industry and education. In the first instance, FORTUNE magazine, which can perhaps be considered a spokesman for industry, recently commented on educational programs provided by industry on the one hand, and by the schools on the other hand. FORTUNE said,

> "Now we can see how special government and corporation educational programs, using methods different from those of the school system, are producing astonishingly good results among Negro dropouts. Thus we acquire a comparative basis for judging how inflexible, unimaginative, unenterprising, and ineffective our bureaucratically ossified school system, in toto, has become."[1]

In the second instance, consider the following testimony given last August to the Education Sub-committee of the U.S. Senate by a major national educational association:

> ". . . direct contracts between the U.S. Office of Education and profit-making agencies are inherently wrong . . . the constant effort on the part of the Office of Education to secure authority for the Commissioner to bypass the public and private nonprofit education agencies and deal with profit-makers is in our opinion, the most dangerous educational proposal ever to come before the Congress."[2]

These two opinions, which are poles apart, illustrate the distrust with which private educational endeavors are viewed by members of the educational community. The American Council on Education recently suggested that perhaps the time has come for the educational community and industry to re-examine their long-standing antipathy toward involvement in mutual problems.

The Need In Numbers

Regardless of which side of the fence one happens to be on, the simple fact is that an urgent need exists for well-trained people for the computer industry. Further, the personnel officer, charged with the responsibility for hiring computer personnel, will turn to any source that provides well-trained people. Moody's Computer Industry Survey forecasts that by 1970, we will require a total of 220,000 programmers, 190,000 analysts, 85,000 EDP managers and supervisors to staff 55,000 installations. If, as some experts suggest, there are 75,000 computer installations by that date, the need for people will be correspondingly more acute. If we stay with the more conservative figure, this is a recap of the numbers of additional people that will have to be trained in the next couple of years: 100,000 programmers, 130,000 analysts, and over 50,000 EDP managers and supervisors. Of these 50,000

"Our greatest need in the future will be for 'information middlemen' . . . who perform the tasks of information collection, processing, analysis and distribution; who design the various new applications; and who serve as the interpreters of the needs of the physician, the teacher, the lawyer, and the businessman."

EDP managers and supervisors, 10,000 are needed to replace an estimated 25% of the ones now holding these positions, but who are not fully qualified.

Recognizing this monumental training task, there can be little doubt that quality computer training schools will play an ever-expanding role in supplementing the training now provided by computer manufacturers and computer users. The use of the term "quality" schools is intended to describe those schools which fully recognize that, in the final analysis, the only schools that can hope to prosper are those that offer quality training. These schools — and there are many of them — have made a fine reputation for themselves over the years.

Having described some of the forces that brought private computer schools into existence, let us now consider the areas in which training will be needed over the years. If we look at this from a vertical standpoint with the entry-level worker at the bottom of the scale and the executive at top, we can certainly say that the greatest need in numbers exists at the entry and technician levels followed in close succession by the need for workers at the professional and executive levels. A definition of terms would perhaps clarify what is meant by these expressions:

> *Entry Level:* These positions are normally filled by people with a minimum of a high school education and no previous experience in the field of data handling. At this level we envision a wide variety of jobs beginning with such titles as Program Librarian, Data Indexer, Data Coder, Data Control Clerk, Production Coordinator, Computer Operator and Data Processing Technical Writer.
>
> *Technician Level:* These jobs include Programmers, Quality Assurance Technicians and Installation and Maintenance Technicians. Training at this level is more intensive than at the entry level. In many instances, people working at the technician level will have had related work experience or a year or two of post high school education or training prior to embarking on the training required to qualify for this level of work.
>
> *Professional Level:* These jobs include experienced Programmers, Systems Analysts, Customer Engineers, Application Analysts, and supervisory people also working in these skill areas. Training at this level is generally intended to keep the professional abreast of the state-of-the-art, to familiarize him with new technological advances, or to expand his field of proficiency from programming into that of systems analysis and design. The people who fill these positions are generally the operating personnel working for the computer manufacturer, or the computer user.
>
> *Executive Level:* Top administrators, general managers, vice presidents, and presidents are included at this level. Training at this level is non-technical and is intended to familiarize the executive with the capabilities and limitations of the computer as a tool of management. Training courses here should also be concerned with the costs of the computer center: the cost of recruiting and training computer personnel, the cost of personnel turnover, the cost of both software and hardware, and the cost of system development and design. Other courses at the executive level would be oriented toward such areas as the evaluation and selection of computers. The intent of these courses, generally, is to provide the executive with a clear understanding of what efficient use he can make of his computer system so that he is not completely at the mercy of his technical staff.

Viewed from a more horizontal perspective, James H. Binger, Chairman of the Board of Honeywell, Inc., looks at the problem this way. In an address before the Executive Club of Chicago, Mr. Binger suggested that our greatest need in the future will be for "information middlemen". These he describes as the specialists of information technology who perform the tasks of information collection, processing, analysis and distribution; who design the various new applications; and who serve as the interpreters of the needs of the physician, the teacher, the lawyer and the businessman. He went on to suggest that the present number of 200,000 information middlemen will swell to more than a million by 1975.

TIME magazine describes this shortage of talent as a

> "scramble for manpower in which want ads bulge with invitations to housewives and high school graduates to take up programming. Corporations shamelessly pirate

each other's help, then pump captured employees for names of more candidates for raiding. Specialized recruiting firms have sprung up collecting bonuses of up to $2,000 per programmer. The competition has put programming among the U.S.'s best paid technical occupations. Qualified person's with computer training can land $7,000 a year jobs; the pay goes to $10,000 after two years, and a five-year veteran (at age 25 or so) will often draw $14,000. Top creative experts may earn $22,000 and up."[3]

Training programs for the entry-level jobs described above are normally of short duration, from a couple of weeks to a few months. Many computer users train their own clerical staffs for these tasks, and the training that is provided is often of the on-the-job variety. These tasks generally do not demand a high degree of aptitude other than a careful attention to detail and accuracy. There are a sizable number of professional programmers in the industry today who got their start at this level with unit record systems or as data coders.

Training for Technicians

From the standpoint of numbers, the greatest need for well-trained people is at the technician level. These programming and computer maintenance tasks do require a degree of aptitude which any good school will determine through the use of entrance tests. These tests are normally given at no cost to the prospective student. In spite of this requirement for aptitude, experience indicates that a high degree of motivation often compensates for a marginal level of aptitude. There are still a few people in the computer industry — intellectual snobs if you will — who insist that one must be a college graduate to be a successful programmer. Everyone is ready to admit, however, that the customer engineer (concerned with installation, maintenance or quality assurance) needs only some good technical training beyond high school. Training for technician level tasks may be obtained from computer manufacturers and private computer schools, but is difficult to find very much of this level of training in the public schools. Where data processing courses are included in the post-high school curriculum, considerable attention is often paid to unit record systems at the expense of computer systems. For this reason, the graduate of these post high school courses is not very well equipped to begin work as a technician level programmer or maintenance man.

Training programs for the professional are slowly expanding, but the preponderance of this level of training is available at colleges and universities or in the training departments of corporations concerned with the manufacture or use of computers. A limited number of private computer schools now offer training for the computer professional and it is expected that the quality and variety of these courses taught by proprietary schools will grow to meet the expanding need for professionals. The need for experienced programmers, analysts, and customer engineers at the professional level is so acute that the expansion of the computer industry is actually impaired by this shortage.

The need for training at the management level was highlighted in a recent Presidential memorandum which began as follows:

> "I want the head of every Federal agency to explore and apply all possible means to use the electronic computer to do a better job (and) manage computer activity at the lowest possible cost.
>
> I want my administration to give priority emphasis to both of these objectives — nothing less will suffice.
>
> The electronic computer is having a greater impact on what the government does and how it does it than any other product of modern technology."[4]

The Manager's Plight

A similar situation exists in industry: The top operating executive — the one who makes the key decisions — came into this position of responsibility before the computer revolution. Of all of the men on the organization chart, he is probably the one in the greatest need of knowledge of the computer. Two computer experts describe the manager's plight in this way.

> "The executive is likely to be baffled, or confused, or snowed. He has confidence in his firms EDP manager, but he doesn't understand the jargon that he hears, nor does he comprehend what can be effected from the tools he controls. It is a natural human trait to want to confess ignorance of something that one feels one should know."[5]

Fortunately, progress is being made in the quality and quantity of courses available at the managerial level. A number of private EDP training concerns now offers seminars in major cities around the world. These seminars or workshops range from a one to a five-day period and are designed to teach the executive how to use his computer as a tool of management.

Evaluating Schools

When a young man or woman contemplates a career which calls for training outside of the public school system, he can usually turn to his school counselor for good advice. This is not always the case, however, when computer training is considered, because this field is so new and has grown so rapidly that many counselors and parents are not familiar with the facts. To assist school counselors, parents and interested students, I have developed a test which is designed to provide some insights into what to look for when one considers a computer school. (See Figure 1.) This test is designed for use in the selection of a computer school which teaches courses at the entry and technician levels only. People seeking courses at the professional and executive levels generally have enough experience that they can recognize quality training programs, and if they cannot, they know where to turn for advice.

In summary, the future is bright for the young man or woman seeking a career in the computer industry. The need for talent is urgent. In the future we will see better courses of instruction through the good efforts of such organizations as the Engineers Joint Council and the DPMA Certificate program. Additionally, we must seek to encourage better communications among the people in the computer industry, in educational circles, in government and in business. Efforts to facilitate this improved communications are being sponsored by such societies as ACM and DPMA and by the Association for Educational Data Systems.

NOTES

1 FORTUNE, January 1968, "The Deeper Shame of Our Cities" by Max Ways, page 133.

2 Remarks made by Dr. Samuel Halperin, Deputy Assistant Secretary for Legislation, U.S. Department of Health, Education and Welfare, at Project ARISTOTLE Symposium, Washington, D.C. on December 6, 1967.

3 TIME Magazine, August 18, 1967 "Computers, The Software Snarl" Page 76.

4 Memorandum from President Lyndon B. Johnson to Heads of Departments and Agencies dated 28 June, 1966.

5 Business Automation, May 1966, "Let's Close The Knowledge Gap at The Top" by Fred Gruenberger and Richard H. Hill, page 39.

Figure 1.

A TEST FOR EVALUATING COMPUTER TRAINING SCHOOLS

ADVERTISING:

1. Does the school suggest an affiliation with IBM by printing these three letters in large, boldface type? Yes ___ No X
2. Does the advertisement suggest that the school will lend the student money for tuition? Yes ___ No X
3. Does the school suggest that a high school graduate can start at a salary of $10,000 per year? Yes ___ No X
4. When you first looked at the advertisement, did you think it was a HELP WANTED ad? Yes ___ No X
5. Does the school guarantee the graduate a job? Yes ___ No X

APTITUDE TESTING:

6. Does the school give aptitude or entrance exams? Yes X No ___
7. Will the school permit you to take the aptitude test in your home? Yes ___ No X
8. Were you advised what the passing score was before you took the exam? Yes X No ___
9. Were you required to make a down payment before the test was given? Yes ___ No X
10. Are people who fail the test given the opportunity to try the course briefly to get the hang of it? Yes ___ No X

FACILITIES:

11. Are the classrooms well-lighted and equipped with necessary instructional devices and training aids? Yes X No ___
12. Are there computers on the premises for training purposes? Yes X No ___
13. Is the atmosphere in the classrooms and the school conducive to a learning situation? Yes X No ___
14. Does the average class size exceed 20 students? Yes ___ No X

STAFF:

15. Are the instructors experienced in teaching, as well as in the applications of computers? Yes X No ___
16. Does the managerial staff of the school have experience in education and the use of computers? Yes X No ___
17. Were you given the opportunity to speak with members of the instructional and managerial staffs? Yes X No ___

STANDARDS:

18. Does the school have a reasonable refund policy? Yes X No ___
19. Did you get the impression that representatives of the school understood the professional and technical standards required by employers? Yes X No ___
20. Do students fail the course for academic reasons? Yes X No ___
21. Were you encouraged to visit other schools before making up your mind? Yes X No ___
22. Did the admissions representative make derogatory remarks about other computer schools in the area? Yes ___ No X
23. Did the admissions representative encourage you to enroll because of price considerations or the length of his course? Yes ___ No X
24. Was there a course outline available showing the number of hours devoted to each segment of the course? Yes X No ___
25. Is COBOL treated as the most important language in the programming course? Yes X No ___

ADVICE AND ASSISTANCE:

26. Did you seek advice from a high school or college counselor in your area regarding the school of your choice? Yes X No ___
27. Did you contact the Better Business Bureau in your area for information on the school? Yes X No ___
28. Did you know that your State Board of Education may be able to provide you with useful advice regarding computer schools? Yes X No ___
29. Did you contact members of professional organizations such as the Association for Computing Machinery or the Data Processing Management Association for information on computer schools in your area? Yes X No ___
30. Did you know that accrediting agencies such as the National Association of Trade and Technical Schools and the Accrediting Commission for Business Schools provide useful information regarding computer schools? Yes X No ___

If after visiting a computer training school your answers are the same as the ones marked X on this test, then you can be reasonably certain that you have found a good school and the money spent for your training will be a sound investment in your future.

COMPUTERS IN HIGH SCHOOLS — A "HANDS ON" APPROACH

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"Upper elementary students can often learn high level (conversational mode) programming languages and the binary system faster than the average adult."

Students at South Windsor High School, Wapping, Conn., use a computer for a computer science course, as well as extra-curricular activities.

About four years ago, educators and computer experts were forecasting that some day well into the future computers would be small enough and priced low enough to be used in high school classrooms. In 1966, this forecast proved correct as Pomfret School in Pomfret, Connecticut installed a PDP-8 system (*Computers and Automation,* March 1967). Since that time, small computers have been installed in classrooms from coast to coast.

A variety of installations have shown several advantages to a "Hands On" approach to the use of computers in high schools. Teachers have found the physical presence of the computer in the classroom to be a stimulant to the student. Most users find the availability of a small computer in the school an advantage because interested students are able to use it during off-hours. Cost is a third significant factor. Small computers, which are now priced as low as $10,000, may be purchased outright. Leasing plans also are available, bringing the cost as low as $400-$500 per month on a three-year contract.

Diversity of Applications

Not every installation follows an identical pattern. Student bodies differ from one school to the next, from private schools with 100% of the graduates going to college, to heterogeneous public high schools with 40% of the students going on to college. Individual teachers and school systems also have different objectives. The computer requires one approach when used as an aid in math courses to teach a large percentage of students to program in Fortran or a conversational mode language. Teaching only those interested students who elect to take a computer science course requires a different approach. Here, a range of programming skills from machine language through high level software is taught. In this way, the student is introduced to computer technology, regardless of whether he will find his place as a technician, a programmer, or a research physicist. And, of course, applications vary with the length of time the teacher has used the computer.

Languages

Computer manufacturers and software companies are becoming more keenly aware of the educational market and its special needs for a powerful, but easy-to-learn language. Conversational mode languages have been written and are available, sometimes free of charge, from selected companies. Digital Equipment Corporation's newly announced FOCAL* language, for example, can be used for problem solving as well as teaching. Finding roots using Newton's method, generating trig and log tables and solving statistical problems (matrices) are some of the uses a student can make of the new software, without having to become an expert programmer first.

Upper elementary students can often learn high level (conversational mode) programming languages and the binary number system faster than the average adult. With the Hands On approach, the computer is not dedicated to just one programming language, but has available the whole

*Trademark of Digital Equipment Corp.

range from machine language through high level, conversational mode. In addition to the primary use of the computer as a tool to teach math and science, courses in computer science and all levels of programming can be added to the curriculum to prepare students for the technological advance this generation faces.

Computer Combined With Closed-Circuit TV

At the Highland Park and Deerfield High Schools in District 113 in Illinois, a small, general-purpose, scientific computer resides at Deerfield, with an experimental data phone connection to Highland Park High School. According to Mike Doren, Math Lab Director, Deerfield has two primary purposes for the computer: "1. To demonstrate concepts in mathematics to all levels of classes; and 2. To teach actual computer programming and operation."

To implement the first phase, eight teachers from both high schools spent four weeks in a summer workshop writing a booklet of Fortran programs for use in the algebra, geometry, analysis, statistics and calculus courses. Implicit in demonstrating math concepts on the computer is getting the computer "into" the classroom. Deerfield increased the availability of its computer by locating it in a laboratory equipped with closed-circuit TV, so that any of the ten math classrooms may view computer demonstrations simultaneously. The laboratory is also equipped with a two-way voice communication system so that teachers can specify data. A crew of computer lab assistants (students), are trained to enter programs, type in data, focus the TV camera on the output, and explain and interpret the results.

The teachers at Deerfield High School can use Fortran Programs they develop in two ways:

(1) To give repeated examples of a concept that they have already proved to the class — to illustrate that the theory is correct (deductively); or

(2) to give repeated examples of a concept that they have *not* proven to class — so that students might be able to find the general rule for themselves (inductively).

Homework answers can be compared to the answers produced by the computer, which gives the students the added incentive of matching the computer.

To implement Deerfield's second objective of teaching actual computer and programming operation, a semester course in "Fundamentals of Digital Computation" is offered. (See Figure 1 for the time block outline of this course.) So many students were interested in this course and its Hands On approach that a second section had to be scheduled this year.

In addition to Fundamentals, which requires the students to have four or more years of math, Deerfield began a new, six-week course called M-16 for underclassmen. M-16, a non-credit elective course, accomplishes the following:

- It enables students to make use of the computer in their high school courses.
- It trains students as computer operators to assist teachers in classroom computer use.
- It prepares students for the credit course, "Fundamentals of Digital Computation."

Connecticut Suburban and Shoreline Educational Computer Center

Hamden High School in Connecticut has also chosen a small digital computer as an aid in teaching math. (Hamden is headquarters for COSSECC — Connecticut Suburban and Shoreline Educational Computer Center.) The school offers Computer Mathematics, an elective course open to juniors and seniors, which uses the Fortran Language. Their approach gets the students programming on the computer as quickly as possible. Although underclassmen are not included in Computer Mathematics because of the math background deemed necessary, Hamden has organized two extra-curricular computer activities which welcome students from all grades in the high school. One activity uses Fortran, the other uses Focal.

Hamden High School, a member of COSSECC, purchased their computer with school funds. Two other COSSECC schools recently obtained their own computers through a federal grant.

According to Richard Bigelow, Planning Coordinator for COSSECC, no computer science course is offered or proposed. Hamden's objective is to use the computer strictly as a tool, not as a facility to train programmers. This same view is held by Gilford and Amity High Schools, the two other schools in COSSECC with their own computers. In order to realize their objective, however, these latter two schools will be seeking to integrate the computer into Algebra II, Calculus and Trigonometry classes, rather than scheduling a separate course.

Hamden High School uses several off-line teletypes for tape preparation so that more than one student can use the facility at a time.

Gilford and Amity High Schools offer a two-month program of Saturday computer workshops to math teachers. Hamden High School had only to acquaint their teachers with the operation of a PDP-8/S and its Fortran, since Hamden has had two years' experience with a time sharing terminal.

Mr. Bigelow has commented that he feels the time is approaching when "more elaborate equipment will be necessary for Applied Math."

Pomfret School

Another Connecticut installation, Pomfret School, has developed a computer math program over the last year and a half similar to those planned by Gilford and Amity. It differs in that Pomfret has introduced its computer into the physics course as well as the math courses.

Pomfret, a private school with virtually 100% of their boys going on to college, leaves its computer lab open 24 hours a day. Well over 70% of the students have had a two-week minimum introduction to the computer and Fortran programming in their math and physics classes. Freshmen are instructed in the necessary basics like advance and control statements, but do not get full exposure to Fortran. When the student takes geometry, and then Algebra II, he receives a more extensive two weeks of Fortran instruction. A senior course, Probability and Statistics, offered before Pomfret had their computer, now has been revised to incorporate the computer one-third of the time. And an advanced Programming Seminar, offered to seniors, teaches the student assembly language and the development of software.

Teaching Physics With the Computer

There are three areas in physics where the computer is used at the Pomfret School. One is demonstrational simulation, especially in areas where the necessary equipment for a real demonstration is prohibitive due to its complexity. For example, to demonstrate a projectile in space, William Hrasky, Chairman of the Science Department, has written a program that, given the angle of elevation of a cannon and the initial velocity of a ball, will type out height and distance as a function of time. The students plot the parabolic trajectories on the blackboard.

The second area of computer use in physics is assigning problems which will increase the student's understanding of a phenomenon. Students are asked to program such principles as simple harmonic motion, elastic collisions of billiard

Figure 1.

DEERFIELD—HIGHLAND PARK HIGH SCHOOL

Course Outline for

FUNDAMENTALS OF DIGITAL COMPUTATION

Week		Topic
1	I.	Number Systems and Codes (ex: decimal, binary and octal operations; codes and subtraction by complementation)
2-3	II.	Fundamentals of Boolean Algebra (ex: definitions, logic blocks, laws of combination)
4-5	III.	Boolean Visual Aids (ex: Venn and Veitch Diagrams)
	IV.	Truth Tables and Designation Numbers (ex: development of truth tables, proving identities, designation numbers)
6	V.	Problem Solving (ex: logic blocks in electronic applications, Boolean Algebra and designation numbers)
7-8	VI.	Components (ex: series and parallel circuits, power, combination circuits, diodes, basic semi-conductor physics, flip-flop, half adder, full adder)
9	VII.	Input-Output Media (ex: punched cards, paper tape, magnetic tape, magnetic ink)
	VIII.	Alpha-Numeric Codes (ex: Hollerith; 7-bit punched tape; 5 and 8 channel code; 7-bit magnetic tape)
	IX.	Internal Storage Devices (ex: core, magnetic drum, disk)
	X.	Input-Output Devices (ex: card readers-punches; paper tape readers-punches; magnetic tape units; cathode ray tube; optical scanners; magnetic character sensors)
10	XI.	Flow Charting
	XII.	Computer Languages (ex: FORTRAN, ALGOL, MAD, BALGOL, JOVIAL, NELIAC, COBOL, IT)
11-12	XIII.	PDP-8/S Software (ex: FORTRAN, FOCAL, PAL III, MACRO-8, EDITOR, LOADER, DDT, ODT)
13-17	XIV.	Programming and Computer Operation
18	XV.	Report on Projects

balls, and finding the area under force-distance curves to determine potential energy.

In the third approach, students use the computer to evaluate experimental data. Mr. Hrasky comments: "By statistically analyzing the data obtained by all the lag groups, I found that the discussion of the experiment was easier and generated more interest than before."

Mr. Hrasky stresses the use of the computer as a tool. Pomfret does not teach a computer science course because

> "the nature of the course makes the computer central, which isn't the way a scientist or engineer looks at a computer, unless he is a computer specialist, and they are few and far between. The scientist or engineer looks at the computer as a tool. He is interested only in the solution to the problem and he wants to get it as quickly as possible. So we want to show that the computer is *the* technological advance providing this tool."

A Concrete Approach

Taking a stand for simultaneous development of certain math principles along with computer fundamentals is South Windsor High School in Connecticut. Miss Ann Duffy teaches a Computer Science course to "slightly above average students — 115 to 120 IQ." In order to achieve her objective of fully acquainting the students with the syntax of the Fortran language, she feels that a knowledge of assembly language programming is necessary first. She devotes twenty lessons, about half of her course, to complementation, distributive law, algorithmic techniques, base conversions, machine and assembly language before she goes on to Fortran. Starting a very bright student with Fortran is fine, she feels, but the average student cannot start on an abstract level. They will rarely ask or understand the "why" of the Fortran commands unless they are taught the correlation. The statement that "F" is a signal to the machine to start a subroutine for computation should not be taught as a fact to memorize. What a subroutine is, what the machine does and why it does it should be fully understood.

Next year, South Windsor's second year with a computer, 7th and 8th graders will be taught machine language, and 9th graders Fortran. The more advanced sophomore, junior and senior math courses will use the computer as a tool. Many other math classes will have the iterative technique of problem solving demonstrated via the computer. At least 50% of the students at South Windsor will get some contact with the computer next year. Miss Duffy wants to reach as many students as possible. She believes there is a place for people of various levels of abilities to work with computers. She comments: "You've got to hit kids young to plant seeds to direct them in their lives."

Computing Without Credit

Hoover High School in Fresno, California has a unique opportunity to see how far each student will progress with the computer on his own, since the Computer Math course was not able to be scheduled for the 1967-68 school year. Students are taking full advantage of the facility without any credit or grade motivation. Even though the Mathematics Resource Room is open as late as 6:30 PM, Allen Smith, math department chairman, said that weekends are the only time students aren't waiting in line for the machine — and even then they might show up at the door if they see his car outside.

The computer is actually used by the Computer Club and by four of the seven math teachers in their classes. Students are doing daily weather forecasting via the computer, solving math homework problems such as generating trig tables using Taylor's theories, and scouting the local high school football teams and finding patterns. They choose the language they wish, from assembly language to Fortran to Focal. One junior high school student discovered the computer installed in a room, came by to pick up a manual and returned the next day with a working program complete with a dimension statement! This year Mr. Smith hopes to get 100 of the school's 1700 students proficient in programming.

Plans are underway to offer a computer math course next year which will teach a level of programming skill which will enable students to solve advanced level calculus problems. The course will be an elective with the purpose of opening another avenue for those students who wish to pursue it. A regular incorporation of the computer into existing math classes is not expected. Mr. Smith mentioned that, although math is not a required course in California, 64% of Hoover's students are taking it by choice. He feels that this same attitude of allowing the students a choice should also be taken with the computer, and gives two reasons:

1. Availability of the computer would be a problem if even 50% of the students were required to use it; and
2. Encouraging a smaller number of students who are interested is a better approach than forcing a larger number who may have little interest.

Hoover is taking full advantage of familiarizing teachers with the computer; they have just begun their second in-service seminar this year. Mr. Smith feels that the year has given him and the other teachers a chance to better prepare for next year's program.

In Technical-Vocational Schools

A number of technical-vocational schools are using a small computer in conjunction with training devices to teach digital logic. Ottawa Technical High School in Ottawa, Ontàrio, Canada offers training in Computer Technology on their 4K machine. Boys take courses of varying depth in programming and digital techniques.

Carl B. Weick, director of the Computer Technology program, has observed that most students of average intelligence are able to program and debug their assigned problem. With 1/3 of the current term remaining, 22 out of 25 students either have submitted complete tested programs or are engaged in various stages of tape preparation. See figure 2 for an example of a student programming problem.

The computation area is operated as a distinct facility independent of the electronics shop, and computer use in all the mathematics courses has resulted from a curriculum revision to include an algorithmic approach.

Plans are underway to offer a major in computer technology. Boys taking this option will receive up to 8 hours per week in the lab, and will take a basic electronics course in grade 11 and a course in Digital Techniques in grade 12. They will be taught maintenance procedures on I/O equipment as well as logic circuitry, with the purpose of providing them with a saleable skill as a computer technician upon high school graduation.

In summarizing his computer program Mr. Weick said: "The basic aim at Tech is still to produce a good high school graduate. We feel we can do a better job by exposing students to computer education."

Conclusions

Thus a variety of approaches to the use of computers in education can be seen by examining what some of the pioneers are doing. One common factor exists: Each teacher is experimenting and investigating and seeking ways to improve. Mr. Hrasky, describing Pomfret's outlook, says, "Assigning problems on the computer is the typical and standard approach to its use. This is one way. It is not the only way. Now we are interested in putting the computer into the course, not as an artificial addition, but as an integral part." Many educators on all levels are applying their efforts in this direction. Although the impact of the computer on the future is unpredictable even now, educators — through the use of small, general-purpose, scientific computers — are helping students to learn about this new force in their lives.

Figure 2.

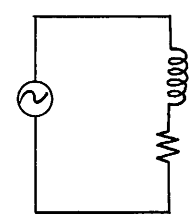
STUDENT PROGRAMMING

Table of Impedances for series LR Circuit when frequency is varied.

Formula:

$$Z = \sqrt{R^2 + X_L^2}$$

$$X_L = 2\pi f L$$



Input To Program

- Resistance in floating point
- Inductance in floating point
- Initial Frequency in floating point
- Final Frequency in floating point
- Frequency Increment in floating point

Output from Program

Table of frequencies and impedance in floating point form

f = $\pm$ 0.xxxxxxxE $\pm$ xx	Z = $\pm$ 0.xxxxxxxE $\pm$ xx
....	....
....	....
....	....

THE TEACHING OF PROGRAMMING TECHNOLOGY

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"The teaching of programming technology is woven from the same fast-paced, ever-changing, challenging 'cloth' as the entire field of data processing. This educational effort must be nourished, prodded, strengthened — even trimmed where necessary, if it is going to effectively mold tomorrow's programmers."

In every new area of knowledge which mankind painstakingly discovers, education soon becomes a major factor for its successful development.

Computer programming is no exception. In the past two decades a whole new body of principles and techniques has evolved, somewhat haphazardly, out of sheer necessity. In this short span of time, electronic computation has grown from its laboratory incubator into a still fuzzy-cheeked but muscle-flexing young giant.

One of the unique developments in computer education has been the establishment of the private computer training institutes. President William C. Norris of Control Data summarized this trend concisely in a recent address:

> "Because computer technology has been moving so fast, it is very difficult for the public school system to quickly provide adequately trained teachers to give courses in important areas of computer technology. Also the dollar investment with computing equipment required is another big hurdle because of the budget limitations of many public schools."

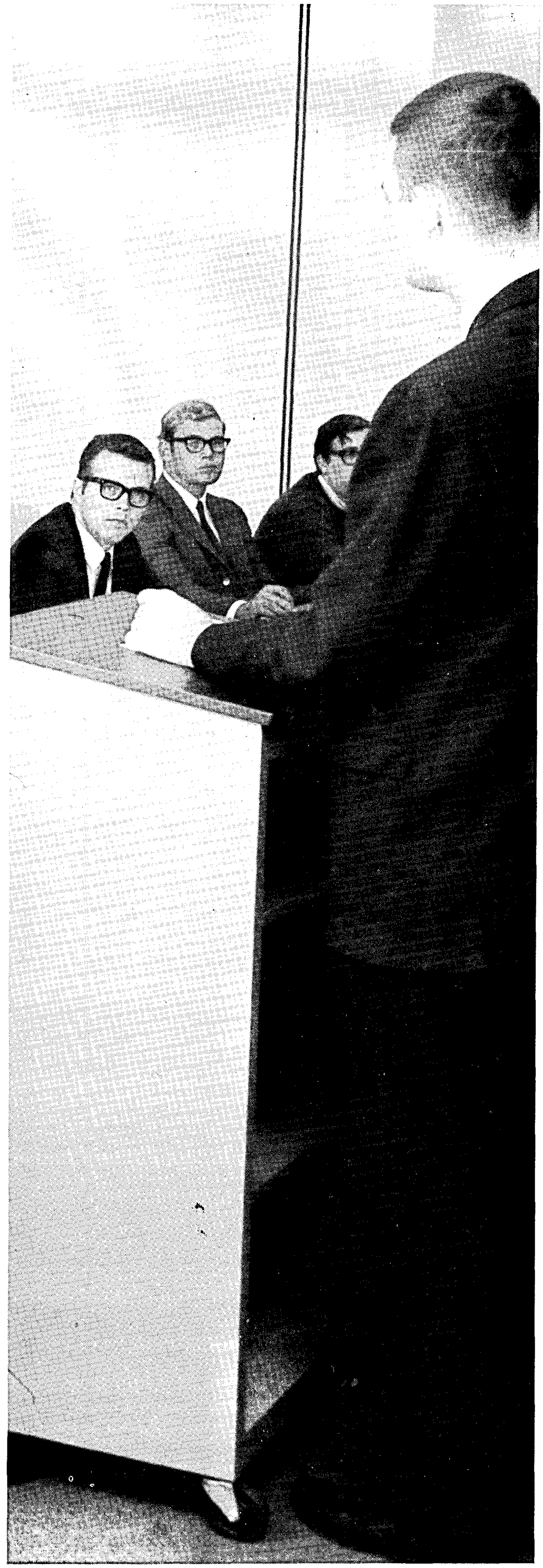
In another aspect, the well-known automation consultant, John Diebold, recently commented in an address at Dartmouth College: "In time, if business understands what its needs truly are, and makes these needs known, the public educational system will begin to produce young men and women trained not just to use automation equipment, but to understand the potentials of automation."

Training to Fit the Student

One of the major factors in the organization of the educational approach to computer programming is the programmer himself. The training system has to be tailored to fit the student, to recognize his general abilities, his background, and importantly, his professional requirements as a programmer. Who is this programmer-student? Statistics acquired in training hundreds of programmers reveals a wide-spread range of personal characteristics in age, general education and professional background. Students enrolling in programmer technology courses typically range in age from the late teens to the early 50's, both male and female. No one age group has a clear-cut majority. Naturally, the educational backgrounds of these students correspond according to this age span: high school graduates and junior college students and graduates, university-level students, former servicemen, professionals with undergraduate and graduate degrees, and people with many years of general working experience.

The Ability to Think

Perhaps the single most significant characteristic required in students of programming technology, is the ability to think logically, or the capacity for concentrated inductive and deductive reasoning. Despite the common fallacy that a mathematical background is essential for programming, the ability to think logically is by far the most important asset a student should possess. For this reason, the aptitude tests administered at the Control Data Institute (CDI) are designed to reveal the presence, or absence of this characteristic. With it, an applicant can embark on a course in programmer training with a high degree of assurance that he will be able to complete the course successfully. Without it, personal interest, general education or work experience will scarcely insure success. The type of person who enjoys, and is skilled at solving crossword puzzles and playing logical games will reveal this logical aptitude in the qualification tests.



Personal Motivation

Finally, the most logical intangible but perhaps the most critical qualifying characteristic is personal motivation. A person with a strong personal desire and interest in becoming a programmer, whether the actual motive be that of acquiring greater technical skill, financial rewards, or professional prestige, will usually overcome all of the personal or educational obstacles that can spring up on the sometimes rocky path to programming achievement.

Curriculum

What of the curriculum for programmer training? Should we look to the computer logic designer first for guidance in developing a curriculum? Or to the computer designer or compiler expert? In organizing our curriculum at CDI, we studied the needs of the computer systems users for primary guidance. The basic reason for this approach is two-fold. First, the computer user has many EDP staff-written programs in his own library which are too specialized and too detailed to have been supplied as "off-the-shelf" items by the computer manufacturer. Secondly, "unmolded" programmers who are well-educated in the concepts and principles of programming technology and have been trained in the basic compilers and assemblers, operating systems and peripheral equipment, can adapt more easily to a new employer's particular endeavors and procedures, and thus can use their basic foundation in training to the best advantage.

Thus CDI does not attempt to train programmers in the in-depth intricacies of such specialized data processing applications as accounting, payroll processing, production scheduling or scientific analysis, for example. Time and resources would not permit such in-depth training in any event. The goal of a programming course should be a solid training and understanding in the basic concepts and principles of the art. A realistic survey of the on-site processing scene confirms the wisdom of this approach, time and again.

At CDI, the basic curriculum consists of:

1. An introduction to data processing
2. Unit record equipment
3. Machine language programming
4. Assembler language programming
5. Operating systems
6. Problem oriented languages
7. Utility programs
8. Machine variations
9. Current developments in computer software.

Experience with the Computer

Of no less importance in teaching programming technology is actual computer system exposure and experience. The format followed at CDI is one in which total training is divided into one-half classroom instruction, and the remainder devoted to the execution of programs on the computer and solving program problems. It is in this latter area that the student also gets an opportunity to learn the important aspects of test runs and de-bugging. Of course, and optimally, this vital experience should be undertaken on an in-house third generation computer system to insure compatibility with current system users' needs.

Staff

The instructional staff is also an integral part of a programming training course. Experience has shown that the most effective approach to the proper instruction of instructors is continuous and adequate cross-training; that is, they must be given in-depth knowledge of all the various aspects of a programming course curriculum. Otherwise, they are not fully equipped to teach the multi-faceted aspects of modern computer programming technology. A combination of hands-on data processing experience, and the educational equivalent of at least two years of college plus related teaching experience, all contribute to the formation of the effective teacher. The indefinable quality of personal projection in conducting class sessions is also very important. Without it, the other combined elements may not be adequate to accomplish the task.

In support of the instructors there must be an administrative staff which is constantly studying and reviewing the swift-moving advances in computer technology and the consequent programming technology. Otherwise a programming course can become outdated in a very short time.

Course Load

As for the "nuts and bolts" of actual participation, experience here has shown that there are fairly specific limits to the length of daily classes and homework assignments which should be followed to maintain optimum learning efficiency. Since many students are also working in part-time or full-time time jobs, five hours of daily class, five days a week comprises our maximum limit. Homework should be kept to the bare minimum, again with regard for the limited time for study that is available to working students. For students taking an evening course, 10 hours weekly has proven to be the most practical period of classroom time.

Counseling

Naturally, not all of the students who enroll in programming courses complete their study. There are various reasons for such attrition, as in most any educational system. The most definable reasons come under the heading of financial or personal problems. Unfortunately, there are invariably those who will enroll in various courses of instruction without proper motivation. The initial aptitude tests can do no more than make some reasonable predictions about ability, and they cannot supply the data on the many other ingredients which comprise successful course completion by the student. It is the policy at CDI to provide counseling and guidance, particularly wherever trouble seems to be brewing. The importance of sound, realistic evaluation and appraisal of a student's performance cannot be underestimated; good counseling must be a constituent of any progressive teaching course.

Finally, all the previous principles and techniques will be of little value, if, at the time when graduates begin work in data processing installations, they show that the effort has not provided the student with the right type and amount of professional training to do the job. The yardstick of training effectiveness is the ultimate acceptance and enthusiasm of the respective employers. In other words, it is not enough to train and to graduate students; a school must keep a continuous check on its graduates and their progress in the eyes of others.

The teaching of programming technology is woven from the same fast-paced, ever-changing, challenging "cloth" as the entire field of data processing. This educational effort must be nourished, prodded, strengthened — even trimmed where necessary if it is going to effectively mold tomorrow's programmers. For man is really the key to his machines. If he designs, builds, and programs them properly, he can change our world faster and more profoundly than he has ever done before.

SCHOETERS FROM GREAT BRITAIN

WORLDWIDE

European Countries Seek Home Computer Industry

It may seem odd, to the average American computer user and to the tens of thousands of men and women who depend for their livelihood on a continued expansion of EDP, that Britain (or to put it more precisely, one influential section of the British Government), should set such great store on an independent computer industry. Yet America herself has strict anti-trust laws which are probably not applied as closely as they should be, or else big business there would surely have taken a different pattern by now.

When thinking of the way in which European Governments are behaving on computer questions, it is as well to remember the virtual monopoly position of IBM in Germany, where the company has at least 80% of the market, and the not very different but much more complicated situation in France where IBM has possibly 65% of the total sales, GE-Bull has 30%, and the remaining 5% is shared by a galaxy of home, U.S., and British companies.

It is in this light that attempts to revive a home industry by the French and the Germans must be viewed, though it is only fair to say that the money so far laid down for the purpose of creating a nucleus of excellence and a manufacturing center is just paltry compared with what will be needed to get either project going with a swing.

The French earmarked 600m new francs at the start of Plan Calcul. The Germans were variously reported, but the figure seems to have been comparable. A leading light at Philips told me two years ago that £40m had been set aside for the development of the then unnamed P-1000 series, which the company will begin delivering by the middle of this year.

Now I am sure that Philips has had to revise its ideas on development costs and manufacturing costs, not once, but several times. Nevertheless, all these sums start at about the same levels — which demonstrates once again the totally different management approach to new technologies prevailing in Europe, and this despite the example set by too many companies in the U.S.

I have in mind the numerous computer divisions of major corporations which still are in the red and seem to be getting into even larger crimson balances as they sell more and more of their unprofitable product. The answer surely lies in management failure, at the outset, to evaluate just what it takes to beat a dominating product, and to absorb the simple fact that it is not enough to emulate it but that whatever you have to sell must be immediately seen to be better.

Honeywell grasped that fact for its H-200 drive and cleaned up that sector of the market for a time — which still did not prevent IBM subsequently selling several odd thousand equivalent machines.

American manufacturers operating in Europe have seen the storm warnings, however. Both IBM World Trade and GE-Bull-Olivetti-De La Rue are hard at it, acquiring a multinational image. Whether this will cloak their somewhat inflexible manufacturing policies is doubtful, particularly when the boys at home cast a somewhat jaundiced eye at these outward signs of what might become a direct challenge to authority vested in the parent company once the European market becomes as important as that of the U.S. — which it surely will within five to ten years.

Honeywell, Burroughs and National Cash on the other hand, by design and by good fortune, are in the happy position of being able with a large measure of truth to claim "Europeanhood" in view of the high and still mounting proportion of local components used in equipment made by these groups, mainly in Britain. In fact, the Gilbertian situation has arisen that H-200 computers built in Scotland — only now grudgingly accepted as British — have a far higher content of UK-made circuits and other components than the blue-blooded System-4 machines from English Electric.

"Buy British — or French or German"

The main fear of all U.S. operators is, of course, the appearance of "Buy British, or French or German" policies. Hints that such a policy was already operating in Government purchases here in London have often been made and with some degree of truth. There is a ruling aimed at pushing UK manufacturers into emulating the latest U.S. techniques provided they can deliver on time and at not more than 15 per cent higher cost. But how often has it been applied? Once, twice? Certainly not more.

Yet why should these operators complain? No European country has so far succeeded in bending the Buy American Act.

ICT's 1900 Range

It is against this background of freshly screwed-up European courage that the long-awaited launching of the International Computers and Tabulators microminiature versions of its successful 1900 range must be seen. Just after the announcement of the range of four central processors, the company passed the 1000 mark in sales of the series, which is good going for a smallish concern in a three-year run. Turnover is coming up to $200m a year and aimed at $400m by 1972.

The company expects to install 100 micromin processors this year, and while most of these will be the smallest machine in the range, the new twin-disc peripheral will give them a work capacity equal to that of many bigger machines.

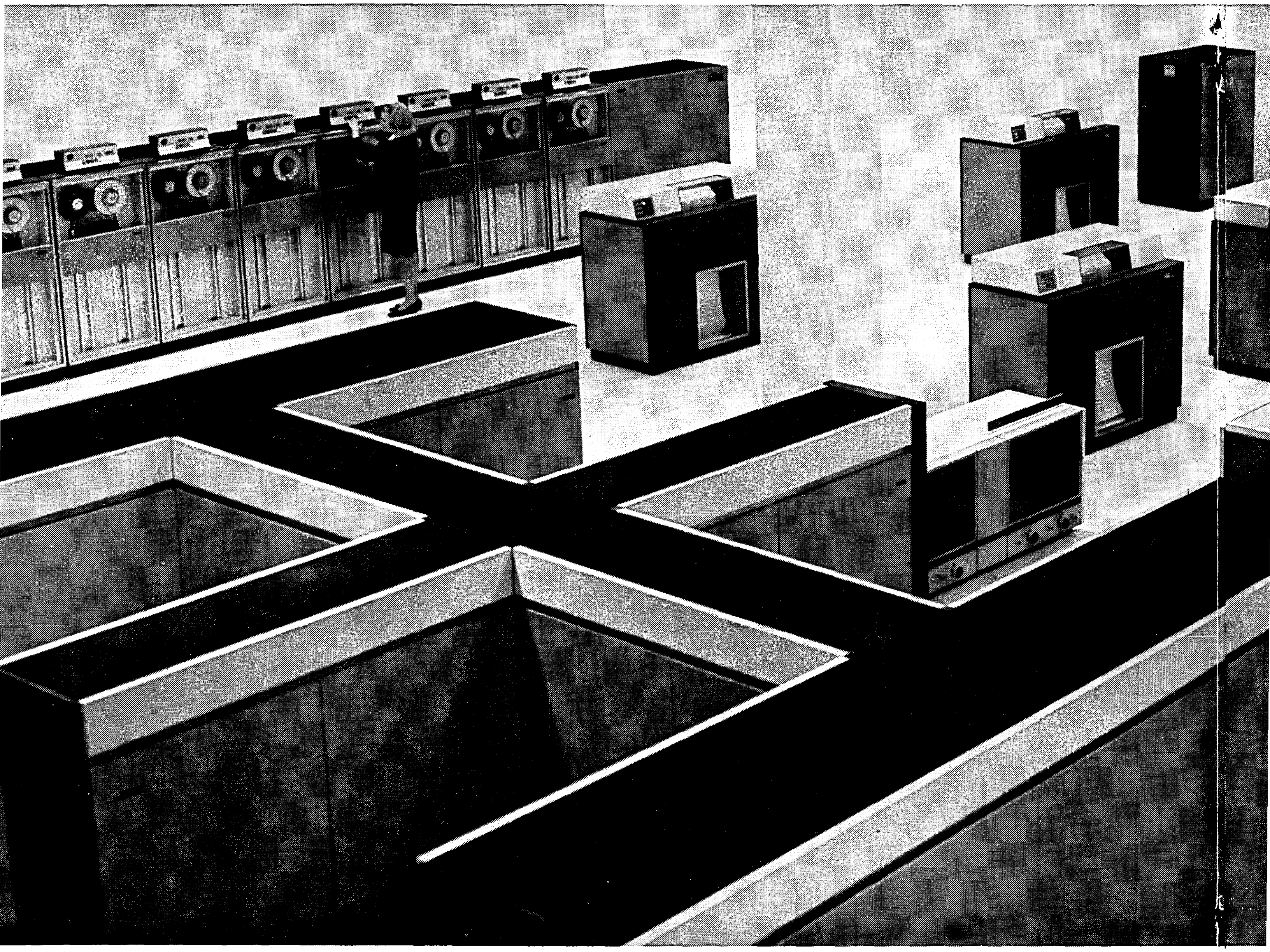
Meanwhile, English Electric, most unwilling bedfellow for ICT in the slowest shotgun marriage ever staged by a Government Department drunk with a sense of its own infallibility, is trying everything it can not to be swallowed up by the latter.

At the time of this writing, the pundits were saying that June would bring the wedding bells. But a hitch threatens the proposed "British Computer Corporation's" dowry, the 25 percent Government stake — probably about $140m — because the Treasury will not allow the Ministry of Technology to decide by itself how much it is worth to the country to have a single business machine maker.

Ted Schoeters

Ted Schoeters
Stanmore, Middlesex
England

IBM introduces the new System/360

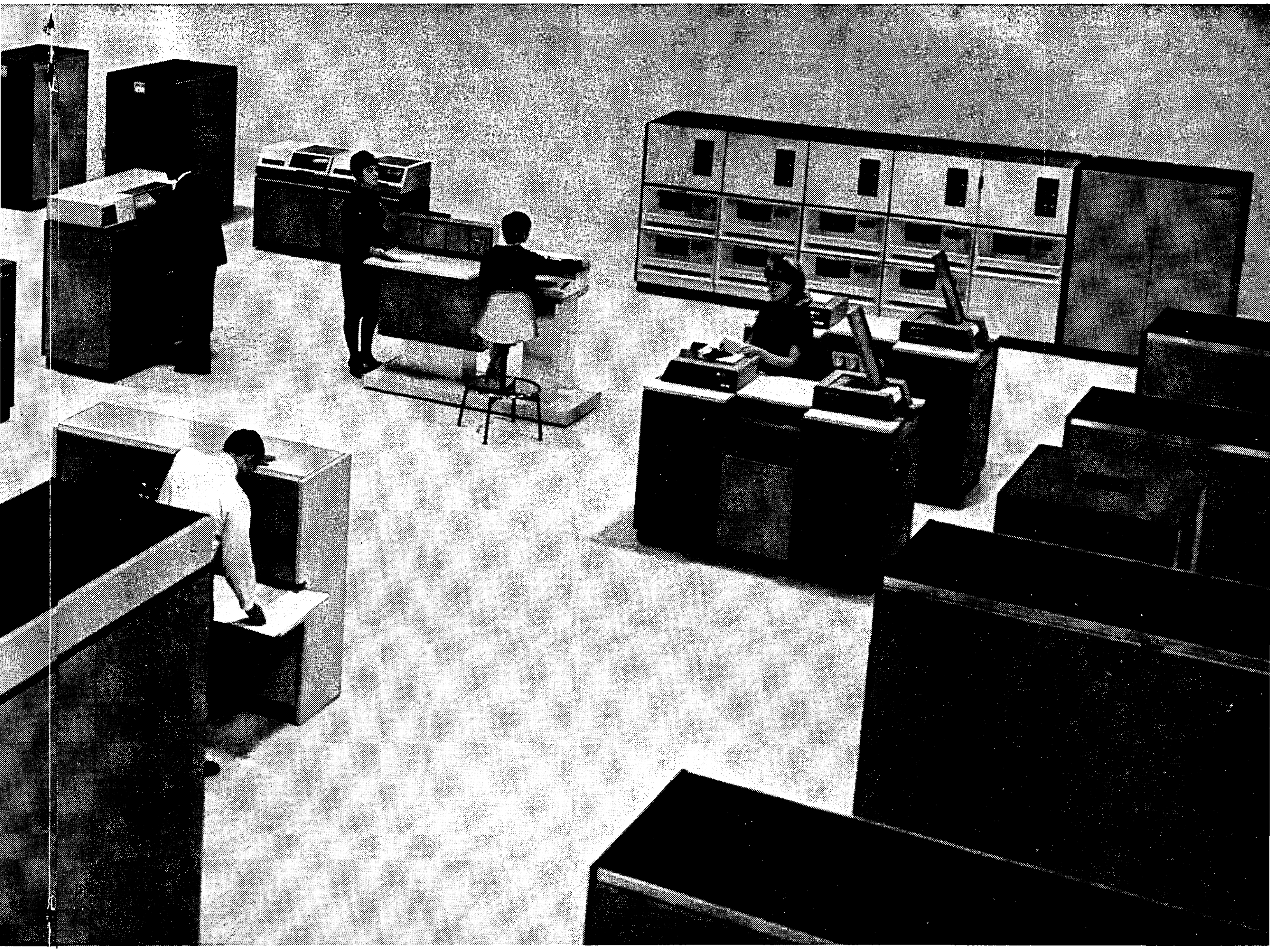


It's big. Big enough to take on scientific or commercial jobs for companies that need more powerful computing. It has an expanded main storage capacity four times greater than the next largest model of System/360. And it's fast.

This combination of size and speed means that in scientific areas you can solve more complex problems faster... problems like differential equations, linear programs, matrix inversions or simulations.

In commercial areas you can use Model 85 for the complete range of business applications, from determining optimum use of resources to general accounting. But now you can do them faster than before. Probably the most important feature

Model 85.



is compatibility— the ability to grow into this model from a smaller model, without reprogramming.

Model 85 is backed with tested programming support including FORTRAN, COBOL and PL/I. It's backed with a library of application programs for both science and industry. And it's backed with the IBM Operating System/360, a comprehensive set of language translators and service programs.

In 1964, IBM announced System/360 as an open-ended system capable of satisfying a wide range of computing needs. Model 85 is part of this concept.

Model 85 is not for everyone. But if you have large-scale and expanding computing needs, think Model 85.

IBM®

THE "SYSTEM GENERATOR":

Brooke W. Boering
Talman Federal Savings & Loan Assoc.
5501 South Kedzie Ave.
Chicago, Ill. 60629

Some Historical Observations

In the beginning there was the word, — and the word was inscribed in the memory of the stored-program, relay-switched, computing machine . . . without input/output. To get at this word required a dialogue in which you spoke the language of this machine — or you just didn't communicate. Providing the computer with the bit-by-bit instructions required for the solution of particular problems became known as programming.

The old problems of machine language programming are almost legendary by now. From these problems grew the need for "software," as distinguished from "worker" or user programs.

The difficulties of actual operation of the equipment gave rise to another set of headaches, from which evolved the "operating system" in common use today. This, too, was "software." Thus, software reflects the effort to increase the efficiency of both programming and equipment operation.

First steps included "assembly languages," followed by a proliferation of "macro languages." The effort to make the "high level" languages machine-independent was considered crucial. FORTRAN and COBOL substantially achieved this goal, so that equipment could be changed without reprogramming — also, incidentally, without the need (or opportunity) for system redesign. Development of the Operating Systems, including some significant early multi-programming efforts, paralleled the Macro Language period of growth.

Brooke W. Boering is the Manager of Data Systems and Programming and an Assistant Treasurer at the Talman Federal Savings and Loan Association of Chicago. He attended DePaul University, and entered the computer field in 1962. He holds a Certificate in Data Processing, is a member of the Data Processing Management Association and the Association for Computing Machinery, and is an author of previous articles in *Computers and Automation.*

Time-Sharing

Project MAC showed how we could provide a truly powerful Operating System for a certain class of users. With Time-Sharing, the problem of operations was reduced to hardware maintenance and occasional monitoring functions. In such an environment, a significant extension of diagnostic, debugging, and tutoring functions was implemented in software. Also, all the old Macro languages as well as many new t-s languages were available on call, so this system provided its users with direct access to the problem-solving facilities of the computer. That the user had to learn an English-like language was hardly more of an encumbrance than an author's problem of typing.

Except for those engaged in software development, time-sharing has now virtually eliminated the need for the intermediary between the user and the computer system, for the class of scientific and engineering problems. Characteristic of most time-sharing systems is the almost total lack of file management capability. Typical t-s users simply don't need large files.

However, commercial data processing benefits little from the power of time-sharing. This is not to say that business today cannot make good use of t-s systems in engineering and research. But it does mean that data processing, as opposed to direct problem-solving, has not achieved a comparable leap in efficiency. The glaring proof of this thesis is the continuing acute shortage of programmers and systems people, most of whom today are employed to implement systems to process and maintain data files.

Trends

A look at the "trends" today reveals some surprisingly knotty problems to be faced tomorrow. The shortage of programmers will apparently get worse. Perhaps of even greater significance is the ballooning problem of systems design and redesign. On the horizon are plans for enormous total information systems. Some of the goals will even be achieved. Most will fail because of the enormity of the task.

Such systems basically do not provide "solutions" but rather create new problems in quantity. The world changes ever more rapidly. If last year's systems design can be implemented this year (something questionable, at best), might it not be obsolete by next year? The really big systems are taking 3 or 4 years to implement. If they work at all, can they be "frozen" in order to obtain the hoped-for payback?

THE ULTIMATE IN SOFTWARE

"If last year's systems designs can be implemented this year (something questionable, at best), might they not be obsolete by next year? If they work at all, can they be "frozen" in order to obtain the hoped-for payback? How does the system generator fit into this picture?"

Imperfect Systems

The impossibility of implementing a "perfect" system is broadly accepted. Imperfect systems tend to act like boils: very painful when fooled with and uncomfortable to live with. Accordingly, we typically tread a middle ground of caution, occasional clumsiness, and paternal protection.

The trend to "on-line" processing of data represents an effort in business to attain the efficiency available to time-sharing users. This, coupled with the desire for immediate access to "total" data files, will surely see increasing implementations of such installations despite the present economic burdens. The worsening problems and the apparent trends are on a collision course unless a significant breakthrough can be realized within the next five to ten years.

Something we shall call the "System Generator" appears to offer the breakthrough. Since it will take at least ten years of groundwork, yesterday appears to be the best time to start work on it.

A "Data Theory"

Before we examine the workings of the System Generator, basic theoretical work must be done to serve as a foundation for the entire concept. This foundation, it seems, may be expressed in the following DATA THEORY: "All processing is implicit within the specifications of fully defined data." In other words, if data can be described sufficiently, then required processes are extractable from such definition.

Clearly, a large amount of detailed study of the nature, characteristics, and relationships of data must be undertaken if the theory is to be proved. Among the questions which must be answered are: What are the many ways in which data may differ? Or be the same? What are the possible relationships between datum, data sets, and future occurrence? How many characteristics need be defined to guarantee uniqueness and reveal implicit processes? Is there a size limit on data? Can inter-field relationships be implicit, or need they be specified? Etc.

Maintaining a Data Inventory

The direct practical result of this research could lead to the development of two pieces of software. The first would be a general program for maintaining a "Data Inventory," a file designed to retain the complete definitions and relationships of all data involved in the system environment. The job of file maintenance would be a continuing one. It would reflect the dynamics of changing information and systems requirements. Since it is apparent that the people who "feed" this inventory must be highly trained, it follows that a new discipline could evolve.

The System Generator

The second piece of software will be the System Generator, which is the economic justification for the entire undertaking. Predictably, the System Generator will be a number-cruncher of significant proportions. Its actual development may entail an effort the like of which has not been encountered since SAGE. It will depend greatly on the basic research in data definition. It might easily include: regenerative sub-routines; dynamic objectives definition; new developments in trial-and-error theory; and novel techniques being presently evolved for advanced time-sharing systems.

The function of the System Generator is digestion of the data inventory and the birth of a complete new system. Major outputs would include: file conversion runs with cutoff and cutover timing schedules; multi-level flow charts; operating instructions (if any) and running times; specifications of supplies and projections for them; complete object programs, debugged and ready to run. Optional outputs might include: suggested configuration adjustments and related economies; budgetary projections; input-output planning; etc.

Cheapness of Computing Power

Raw computing power continues to become cheaper to an astonishing degree. Since computing power is the main requirement for the generator, the scope and frequency of regeneration should prove of minor economic importance. However, since the user's equipment would normally be configured for optimum processing capacity, it could develop that the equipment manufacturer would provide the service of the System Generation on demand. Given the economies inherent in present-day computers, such service would surely be welcomed if it meant an end to the need for continually expanding applications support.

Will the arrival of the System Generator mark some kind of abrupt end to systems design and programming as we know it today? Most likely not. It should, however, indicate a true maturing of information processing. (What it will do for (or to) those of us who make our living as information technicians, is another question.)

Standardization — And Current

Ted Schoeters
Stanmore, Middlesex
England

Two major political happenings at the turn of the year spelled out the views of a large section of members of the Senate and House on the burning topics of standardization and sales of current EDP equipment to Russia and her satellites.

Standardization In EDP

A letter to Charles L. Schultze, Director of the Budget Bureau, from Representative Jack Brooks, Chairman of the House Government Activities Subcommittee — drafted with the obvious intention of telling the whole industry what this body was thinking — strongly suggested that the time to examine the standardization moves in EDP was now.

He warned that unless criteria were fixed well ahead of time, the industry at large would be compelled to adopt PL/I, the IBM-backed new generation language, because of the simple fact that the majority of installations would use or be able to use it. But, Brooks said: "There is considerable sentiment among those well-versed in COBOL and FORTRAN and not in the employ of IBM that there is little value in PL/I". Indeed, the U.S. Navy is one non-believer, since it is in the middle of a standardization program to base all its operation on COBOL apart from high-level scientific laboratory processing.

He added that PL/I could, by default, become the *de facto* language of the next generation of computers, though it might not be the best.

The first step if this was to be avoided would be the establishment of independent criteria to identify the characteristics of a new generation common computer language — and no organization now operating would be suitable to establish these.

The criteria could be applied to PL/I and other proposed systems and "it would be reasonable" to expect IBM to make changes in PL/I to meet the general criteria. Other manufacturers, and major user groups, could be expected to participate in the effort or accept the conclusions reached with their tacit approval.

The outcome of this move could be the establishment of a multi-interest working group, which would inevitably have the grave weakness of slow working, or of a team under the National Academy of Sciences, which would be given the opportunity to attract the best systems scientists in America.

In the meantime the National Bureau of Standards (NBS), through its Center for Computer Sciences and Technology, is pushing ahead with work on COBOL standards. But it finds progress in implementing the Brooks Bill on EDP standards for the U.S. Government hampered for lack of staff and money. It has 170 professionals, needs 2,000, and is clearly not geared to tackle the major problem of PL/I defined above.

Sales to Eastern Europe

It looks as if IBM Paris sources are going to be right after all in their appraisal of the chances of sales to Eastern Europe in any volume of new equipment — and the Europeans do not want outmoded second-hand designs. Their view is that nothing will be done by the U.S. administration to ease selling to Eastern bloc countries, particularly East Germany, Poland, Russia and Bulgaria, till the end of the war in Vietnam. Reinforcing this view is the sharp reaction from Rep. Bob Wilson (R., Calif.) to the indication that the Department of Defense had been asked by the State Department to "comment on the advisability of proposals by Western powers to negotiate with Iron Curtain countries to provide them with industrial knowledge needed to build the latest types of computers, the knowledge to include miniaturization techniques". He quoted fire control of missiles in Vietnam by computers built to U.S. specifications and control of the USSR's H-bomb carrying orbital satellites by such units as possibilities to be avoided.

The State Department has a major influence — some Europeans call it a stranglehold — on COCOM, the body which advises the NATO organisation on the strategic embargo which countries participating in this military alliance apply to goods which might aid the Eastern military effort.

Computers, microcircuits of the latest types, big vibration machines, and a host of other devices are included.

One project hanging fire because of COCOM is the Czechoslovak proposal to set up its own computer line. Two machines which are candidates are the International Computers and Tabulators 1901, with discs going up to configurations worth about $350,000 and a design from Bull-General Electric, France, which was developed by Bull prior to the G-E take-over, but not built thereafter. It might, by a piece of dialectic sophistry, be represented as a purely French machine escaping both the long arm of the State Department and the strictures of NATO, to which France has said au revoir, if not adieu.

Be that as it may, ICT has completed work on microminiaturizing all the 1900 series, and in this version the 1900 will be technically more advanced than the Bull-GE unit. Moreover, while its circuits have been designed by Texas Instruments, the latter is only one supplier of the TTL packs, the others being Ferranti and Mullard, the U.K. offshoot of Philips of Eindhoven. Moreover, Texas Instruments has production lines in Britain.

There is thus nothing COCOM or the State Department could do to prevent Britain licensing this particular machine to the Czechs, any more than it could indefinitely block big machines for De Gaulle. But for larger computers ICT still buys some peripherals in the U.S., and here is where pressure could be applied. It has already operated to block a sale of ICT's biggest unit — 1907 — to East Germany.

The agreement on technological cooperation between Britain and the USSR recently signed by Mr. Wedgwood Benn and Mr. Kirilinin can only be viewed with great reserve in

Sales in the World Market

view of the foregoing. We all know that after the space spectaculars which have made NASA all but bust a gut to draw level, no one can teach Soviet EDP experts anything about real time. The crux is mass production techniques for complex electronic equipment, and this Russia will master — if not this year, then next.

Market Trends

After a prediction that 1968 would see a 12 to 15 percent growth in the computer industry, Isaac L. Auerbach, president of the Auerbach Corp. stressed that much more effort than ever before would go into improving the efficiency of computers already installed.

Depending on the skill with which this is done — and it will hinge to a very large degree on the work carried out by the users — the amount of new equipment put on order will not grow as rapidly as in the past.

That the growth rate may be nearer 12 than 15 percent is borne out by Mr. Auerbach's expectations that business leaders will begin to take a more positive attitude toward EDP, using it as a tool to increase profits rather than to realize economies of staff and, for instance, capital tied up in stocks.

The spectre of dollar devaluation may also act as a brake on the rate of new plant expansion in the computer world and in that of the installation of computers as major items of capital equipment.

Even the massive expansion of computer exports from the U.S. resulting from the almost explosive growth rate in computer installations overseas (in many instances 15 to 20 percent annually) — is unlikely to have much effect on trends in the U.S. market itself, simply because the U.S. is so much more advanced than the world at large — at least for the next five years.

Exports to June, 1967 at close on $117m were nearly double those for the same period of 1966, and 1967 closed with a total export result for computers alone of some $300m in the digital field, and $50m for analogs, with EDP equipment at about $110m. The best overseas customers were Britain and Japan.

Effect of Federal Cutbacks

Federal cutbacks also should have little effect in Europe, where U.S.-based manufacturers are largely financed from local earnings. But where they may have radical influences is in Britain, more than ever a springboard for major U.S. manufacturers into European, Commonwealth and generally non-dollar markets.

Federal cutbacks should not, however, hamper Burroughs plans for an outlay of $6m to build a 144,000 square foot facility at Paoli, Pa., principally for the building of the super-scale B-8500 machine which has already scored two major successes in the UK banking field, and could well score a further two for a total systems value of some $100m. Added to the company's resounding success in Phase II with the Air Force, this places Burroughs in a commanding position for the future with what it claims to be the widest range of equipment available.

Of course, Burrough's main strength still is in office equipment, but with the advent of the high-powered accounting machines with visible recording on ledger cards, indistinguishable from the small computer, the link-up with the smaller machines of the Burroughs computing range is simple.

Here again, the fact that a large share of the company's total output of office and banking equipment (including such items as the magnetic ink cheque encoder and the TC500 computer terminal) is made in devalued Britain with its correspondingly smaller production and labor costs, could further enhance the appeal of the Burroughs product world-wide and induce other companies not now manufacturing or assembling in Britain to do just this. These companies include, notably, Univac and CDC. The former has the possibility of finding tailor-made facilities in the large premises occupied by the Sperry organization in Britain.

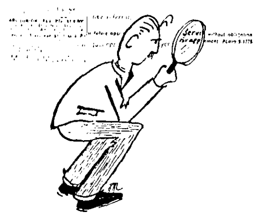
IBM 360/25

IBM started the new year with the announcement of a brand-new member of the 360 range, the 25, smallest compatible machine of the series. This will be delivered a year from now with capacity to take card, tape and disc peripherals. It is not, the company is at pains to point out, a replacement for the 20, though this machine is not compatible with the other machines of the 360 range. It is hard to accept, however, that IBM will not phase out the 20, replacing some of the 7000 machines on order with "25's".

IBM also brought out a system whereby coupled 65's can operate in a time-sharing operation of very considerable size. Though the company is mum on this topic, the coupled 65's are believed to be the "Model 85" which scuttlebutt said was in the offing several months ago. The coupled 65's could well be the company's come-back after the disappointing response to the 67.

There is a good deal of dissatisfaction with the versions of the 360 operating systems so far issued. These provide rich pickings for the specialist organizations with expert staff capable of taking limping systems and turning them into far better tools than they were when first designed. As Alex d'Agapeyeff, a leading UK analyst said to me recently, "360 is the most exciting thing that ever happened in computing, not because of what the company has done, but because of the immense amount of brilliant ideas the challenge of this range has sparked off among users".

His group — CAP — is carrying out a generalized minimum requirement study on operating systems which might be used by the Ministry of Technology to set the norm for future government systems.



The Ten-Mile Gap—Part 1: The Problem

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2701 Fourth Ave. S.
Minneapolis, Minn. 55408

The computer industry is characterized by its high technological content, the great variety of disciplines it brings to bear on problems, creativeness of solutions, and the careful organization and intensive planning required. These are "brainy" industries, dependent on a good supply of human resources. They require people with intelligence, education, motivation, and a good supply of old reliable Yankee ingenuity.

Such people are needed everywhere in industry today. More and more we are relying on trained intellect to find opportunities for new products, develop these products, and bring them to market. To illustrate, let me give you a profile of a typical, contemporary growth company. I describe my own company because I know it best — and it is one of many with the same characteristics.

Honeywell employs about 50,000 people in the United States. Of these, 22,000 are hourly-paid employees — machinists, factory assemblers, plus a few unskilled workers — who make up the blue collar corps. But 28,000 — well over half — are salaried white collar workers: engineers, salesmen, accountants, scientists, managers, and their clerical and secretarial support.

Contrast this with the Honeywell census just 11 years ago. In 1957, well over half of Honeywell people were hourly-paid employees, and less than half were salaried. The balance has been changed significantly. The trend of industry is even more sharply drawn in New England, where Honeywell has 10,000 employees. Of these 10,000 people, *3,000* are hourly-paid employees, while 7,000 — more than *two-thirds* of the total — are salaried.

Employee Shortages

Obviously, the population of the office and laboratory is growing more rapidly than that of the factory. Every growth company knows the harsh competition for engineers, accountants, scientists, mathematicians, and salesmen. As the brainy industries continue to grow, this competition can only become increasingly severe.

This emphasis on higher skill levels, coupled with the increasing production needs of our growth economy, is also creating severe shortages of skilled factory people. You may detect an undertone of desperation in the help-wanted ads:

> Call us. We need qualified tool makers, tool grinders, electricians.
>
> Immediate openings for tool and die makers, machinists.
>
> Honeywell needs wiring technicians, machine repairmen.

The third level of workers is unskilled, untrained people — and here, too, the supply of applicants is short of industry's need. Does this surprise you? The shortage is very real in even the most sophisticated industries. Honeywell is an automation company. Our business is making people more productive by automating jobs that demand the lower orders of skill. But Honeywell itself has more of these openings than we can fill.

Today in one Honeywell plant near Boston we have almost as many vacancies for unskilled workers as we have for engineers, accountants, mathematicians, and all other professionals. That is just one example. All over Honeywell, we're running another kind of help-wanted ad. Here's what those ads sound like:

> Help Wanted — No experience necessary.
>
> No High School Diploma? Honeywell has immediate job openings.
>
> Building Custodians — immediate openings.
>
> Cafeteria — General Helpers.

Untapped Source of Manpower

This same need is experienced by company after company. They are eager to recruit people who have no training, no experience, who don't even have a high school diploma. Yet, in the midst of this need, a large, untapped source of manpower is unused. It lies in the unemployed and the underemployed in the poverty pockets of our cities — in the slum, the ghetto, the crowded tenement neighborhood.

It is important to all of us that this resource be used — for social reasons, and for industrial reasons, as well.

The long hot summer of 1967 illustrated in dramatic terms the great numbers of people who await with trepidation a long cold winter. Until the last few years, the people in this "other America" were almost invisible to us — now they are headlines. In our general affluence we were hardly conscious of them — now we understand they are a significant minority.

I am not qualified to speak as a sociologist, educator, labor leader, or political scientist. In this forum my credentials are those of a businessman. But sociologists are in pretty general agreement that the riots in Newark and Detroit and, with lesser violence, in 70 other American cities can be assigned economic causes. Daniel Moynihan put it this way:

> Only a limited number of Americans see contemporary problems as a result of the malfunctioning of that system of economic and social relationships that are defined as urban. . . . We seem somehow unable to recognize that what it means to be poor is not to have enough money.

You can call it an urban problem, or a ghetto problem, or a civil rights problem, or a freedom problem. But the pattern that runs through the riots indicates that it is most meaningfully described as a poverty problem.

As citizens, we are embarrassed that in the midst of general affluence a surprising portion of our people are deprived. As a businessman, I recognize the sad irony of rioters protesting the despair of joblessness while around them jobs go begging.

With industry trying to fill jobs that require no training or

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"The Ten-Mile Gap — Part 2: The Solution" will appear in this column in the April, 1968 issue.

skills, why can't we approach true full employment? If people are out of work and suffering poverty, why aren't these jobs filled today? Don't the people who need those jobs read the papers?

The Effects of Poverty

The sad fact is, they probably don't. If they didn't finish school, a major reason is that they don't read well, certainly not well enough to enjoy reading.

For another thing, the need to be where the action is seems more urgent than the papers, magazines, or books — or even television. These communications media are highly valued by most of us as a link with the rest of society. Remove them, and the world we know changes.

Most Americans were born into an environment where fathers worked and mothers cooked, and both parents bandaged cuts and read fairy tales and saw to it that the homework got done. These helped to establish the values we hold as adults and try to pass on to our children.

But among disadvantaged youths of 18, probably not more than 25% have lived with both parents all of their lives. In their homes there is little tradition of work, little tradition of education — even through high school — little tradition of family stability, community responsibility, or individual achievement.

Their environment is totally different from that of mainstream Americans. It's like a different country. As a matter of fact, the middle-class American probably shares more common experiences and attitudes with the middle-class Frenchman or Japanese than with the disadvantaged family living a few blocks away.

A Honeywell interviewer tells of sitting across a desk from a young man, offering him a job and explaining that the shift starts at 8:00 a.m. The applicant replies, without rancor or sarcasm, and in a matter-of-fact way, "I don't get up that early." And he walks out.

Young people who never finished school come into employment offices and apply for jobs as salesmen or technicians. They seem to have no idea of the training such jobs require or how people ready themselves for these assignments.

It seems to me that education, counseling, and a changed environment are desperately needed to bring these youngsters into contact with the realities of business life.

Suburban Industry

The greatest tragedy of the young person from the slum neighborhood is that he has been deprived of meaningful contact with the mainstream of our modern industrial society. Nothing symbolizes this lack of contact more dramatically than a simple fact of urban geography. When people go to work today they don't go down to the mill — they go out to the plant. Disadvantaged people are residents of our core cities — but the job opportunities in our new industries are in plants around the beltlines.

In Boston is a prime example of suburban industry. Honeywell employs 9,000 people in this area — but only 510 of them work inside the Boston city limits. The signs on the buildings along the beltway around the city read Sylvania, RCA, Raytheon, Polaroid, Itek, E G & G, Honeywell.

Of course, the Boston area is a national leader in this new kind of industry, but the trend is universal. In Manchester, New Hampshire, Honeywell people don't go down to the mills on the river to work — they go out to the airport where our plant is located. The phenomenon occurs everywhere — people who need work are at the city's center; the plants are in the suburbs.

Perhaps is it difficult for most of us to appreciate the importance of this objective physical fact. But personnel people say it is a real barrier in filling openings with the core-city unemployed. The Honeywell plant at Framingham, Mass., is advertising job openings — but there are no applicants from Boston. The core-city job seeker — even if he is actively and seriously looking for work — is often reluctant to invest twenty cents for bus fare to look into an opportunity.

The ten-mile gap between plant and tenement is significant because it represents much more than bus fare. It symbolizes the wide cultural gap between the ghetto environment and the industrial environment. Sociologists say that often disadvantaged children reach their late teens before they ever venture outside their own neighborhood. The closed, limited view in the ghetto offers no breadth of understanding, and little notion of the options and opportunities society offers an individual.

The ten-mile gap — unknown, unexplored no-man's land to the disadvantaged — is symbolic of the ground we have to cover if we are to assimilate the hard-core unemployable into our modern industrial system.

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c.a **IDEAS: SPOTLIGHT**

Our Limited Ability to Understand and To Specify

(From an article "Human Personality and the Computer" by Prof. D. M. MacKay, University of Keele, in ***The Times,*** **November 11, 1967, London, England)**

The uncanny speed and capacity of the great "number-crunchers" and other more sophisticated automata have become a byword; and headlines are easily made by sensational rumours that man will soon be dethroned by his own creatures.

Of course the big difference between the computer and all previous inventions lies in its power to take over "intelligent" human functions. It would be hard to exaggerate the benefits from the relief of clerical drudgery, and the rapid call-up of relevant information in the library, the clinic, or the law-courts that will soon be possible. Even more exciting are the possibilities of using computers to search for patterns in masses of experimental results, and so aid the scientists in discovery itself.

Indeed it was shown many years ago that no logical performance that we know how to specify is beyond the capacity of a "universal" computing machine. Each term in the specification can be routinely turned into a corresponding item in the machine's programme. The ultimate limit to the powers of our machines — and it is a serious one — is in our own limited ability to understand and specify the human performances we would like them to imitate. . . .

c.a

PROBLEM CORNER

Contributed by George Blondin
Dept. of Water Resources
State of Calif.
Sacramento, Calif.

Problem 683: What's WHAT?

"Do you suppose someone is trying to pull our leg with this WHAT program?", Bob said, pointing to a coding sheet that had been left on his desk.

Al looked at the program:

```
      FUNCTION WHAT (X,Y)
      WHAT = X
      DO 4 J = 1,20
    4 WHAT = SQRT (WHAT)
      WHAT = (WHAT - 1.0) * Y + 1.0
      DO 7 J = 1,20
    7 WHAT = WHAT * WHAT
      RETURN
      END
```

"Well, we could punch up a few cards and run it", Al said.

"Yes, but we ought to be able to figure it out without going through all that." Bob had been making a few calculations on the back of the sheet. "Well, I see what it would compute, at least for the range we're likely to handle on our machine," he said.

What's WHAT?

Solution to Problem 682: Changing a Bit

The intervening numbers must be the binary equivalents of 13, 9, 11, 10, 2, 6, 4, 0.

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

C&A UNIVERSAL MAILING LIST — NEWS

As we go to press, Computers and Automation's Universal Mailing List — CAUML — (see the editorial on page 6 of the January issue) seems to have broken all records on response; over 900 computer people have sent us their names to be included in the list. Do send your name for inclusion: use any piece of paper or circle No. 2 on the Readers' Service card in this issue.

C.a
CALENDAR OF COMING EVENTS

March 14-16, 1968: Second Annual Indiana Computer Users Meeting (INCUM), Purdue University, West Lafayette, Ind.; contact David G. Fryer, G-161, Math Sci. Bldg., Purdue Univ., West Lafayette, Ind. 47907

March 14-16, 1968: Sixth Annual Symposium on Biomathematics and Computer Science in the Life Sciences, Shamrock Hilton Hotel, Houston, Texas; contact Office of the Dean, The University of Texas Graduate School of Biomedical Sciences at Houston, Div. of Continuing Education, P. O. Box 20367, Houston, Texas 77025

March 18-21, 1968: IEEE International Convention & Exhibition, Coliseum & New York Hilton Hotel, New York, N.Y.; contact J. M. Kinn, IEEE, 345 E. 47th St., New York, N.Y. 10017

Apr. 3-5, 1968: The Numerical Control Society Annual Meeting and Technical Conference, Marriott Motor Hotel, Philadelphia, Pa.; contact Mary Ann Devries, Numerical Control Society, 44 Nassau St., Princeton, N.J. 08540

April 17-19, 1968: Cooperating Users of Burroughs Equipment (CUBE) spring meeting, Roosevelt Hotel, New Orleans, La.; contact John Dorosk, Financial Computer Services Inc., Coronado Tower, El Paso, Texas

Apr. 19, 1968: Technical Symposium on "The Effective Use of High Level Languages", Jack Tarr Hotel, San Francisco, Calif., contact Chairman, San Francisco Bay Area ACM, P.O. Box 2447, Menlo Park, Calif.

Apr. 23-26, 1968: Cybernetics Conference, Munich, F.R., Germany; contact H. H. Burghoff, 6 Frankfurt/Main 70, F.R. Germany, Stresemann Allee 2, VDE-Haus

Apr. 30-May 2, 1968: Spring Joint Computer Conference, Atlantic City Convention Hall, Atlantic City, N.J.; contact American Federation for Information Processing, 345 East 47th St., New York, N.Y. 10017

Apr. 30-May 3, 1968: The Association for Educational Data Systems Convention, Hotel Texas, Fort Worth, Tex.; contact Convention Coordinator, Assoc. for Educational Data Systems, 1201 16th St., N.W., Washington, D.C. 20036

May 1-3, 1968: Sixth National Workshop Conference of the Interagency Data Exchange Program, (IDEP), Ambassador Hotel, Los Angeles, Calif.; contact Peter Amedeo, Grumman Aircraft Engineering Corp., Bethpage, Long Island, N.Y. 11714

May 1-3, 1968: Joint National ORSA/Americans TIMS Meeting, St. Francis Hotel, San Francisco, Calif.; contact Miss Joan T. Sullivan, Computer Usage Co., Inc., 3181 Porter Drive, Palo Alto, Calif.

May 3-4, 1968: Fifth Annual National Colloquium on Information Retrieval, University of Pennsylvania, Philadelphia, Pa.; contact Dr. David Lefkowitz, Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pa. 19104

May 6, 1968: Tenth Annual Systems Conference, Dallas Chapter, Systems and Procedures Assoc. (SPA), The Inn of the Six Flags, Arlington, Tex.; contact J. Rowly, Jr., Dallas Chapter, Systems and Procedures Assoc., P.O. Box 474, Dallas, Tex. 75221

May 8-10, 1968: Electronic Components Technical Conference, Marriott Twin Bridges Motor Hotel, Washington, D.C.; contact F. M. Collins, Speer Res. Lab., Packard Rd. & 47th St., Niagara Falls, N.Y. 14302

May 22-24, 1968: Fourth Annual Data Processing & Automation Conference, National Rural Electric Cooperative Assoc. (NRECA), Sheraton-Chicago, Chicago, Ill.; contact Diane Szostek, NRECA, 2000 Florida Ave., N.W., Washington, D.C. 20009

May 24, 1968: New England Systems Seminar, New Ocean House, Swampscott, Mass.; contact Samuel Ryder, 275 Wyman St., Waltham, Mass. 02154

June, 1968: Sixth Annual Conference of The Special Interest Group on Computer Personnel Research of the Association for Computing Machinery; contact A. J. Biamonte, Program Chairman, West Virginia Pulp and Paper Company, 299 Park Ave., New York, N.Y. 10017

June 11-14, 1968: GUIDE International Meeting, Conrad Hilton Hotel, Chicago, Ill.; contact Jack Eggleston, Sec'y., GUIDE International, P.O. Box 1298, Omaha, Nebr. 68101

June 12-14, 1968: Annual Meeting, The Association of Data Processing Service Organizations (ADAPSO), Waldorf-Astoria, New York, N.Y.; contact W. H. Evans, 947 Old York Rd., Abington, Pa. 19001

June 25-27, 1968: Second Annual IEEE Computer Group Conference, "The Impact of LSI [Large-Scale Integration of Circuits] on the Information Processing Profession," International Hotel, Los Angeles, Calif.; contact John L. Kirkley, 9660 Casaba Ave., Chatsworth, Calif 91311

June 25-28, 1968: DPMA International Data Processing Conference and Business Exposition, Statler Hilton Hotel, Washington, D.C.; contact Mrs. Margaret Rafferty, DPMA, 505 Busse Hgwy., Park Ridge, Ill. 60068

July 15-18, 1968: Fifth Annual Design Automation Workshop, sponsored by SHARE-ACM-IEEE Computer Group, Washington, D.C.; contact Dr. H. Frietag, IBM Watson Research Ctre., P.O. Box 218, Yorktown Heights, N.Y. 10598

July 29-31, 1968: Conference on Pattern Recognition (IEE Control and Automation Div.), National Physical Laboratory, Teddington, Middlesex, England; contact Conference Dept., Institute of Electrical Engineers, Savoy Place, London, W.C.2, England

Aug. 5-10, 1968: IFIP (International Federation for Information Processing) Congress 68, Edinburgh, Scotland; contact John Fowlers & Partners, Ltd., Grand Buildings, Trafalgar Square, London, W.C.2, England

Aug. 27-29, 1968: Association for Computing Machinery National Conference and Exposition, Las Vegas, Nev.; contact Marvin W. Ehlers, Program Committee Chairman, Ehlers, Maremont & Co., Inc., 57 West Grand Ave., Chicago, Ill. 60610

Sept. 22-25, 1968: Fourth National Annual Meeting and Equipment Show of the Data Systems Div. of the Assoc. of American Railroads, Pick Congress Hotel, Chicago, Ill.; contact Frank Masters, Trade Assoc. Inc., 5151 Wisc. Ave., N.W., Washington, D.C. 20016

Oct. 14-16, 1968: System Science & Cybernetics Conference, Towne House, San Francisco, Calif.; contact Hugh Mays, Fairchild Semi-conductor R & D Labs., 4001 Junipero Serra Blvd., Palo Alto, Calif. 94304

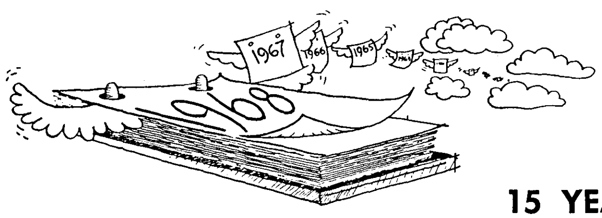
Oct. 20-23, 1968: International Systems Meeting, Systems and Procedures Assoc., Chase-Park Plaza Hotel, St. Louis, Mo.; contact Richard L. Irwin, Systems and Procedures Assoc., 24587 Bagley Rd., Cleveland, O. 44138

Oct. 28-Nov. 1, 1968: Business Equipment Manufacturers Assoc. (BEMA) Annual Business Equipment Exposition and Management Conference, International Amphitheater Chicago, Ill.; contact Laurance C. Messick, Business Equipment Manufacturers Assoc., 235 East 42nd St., New York, N.Y. 10017

Nov. 17-21, 1968: Engineering in Medicine & Biology Conference, Shamrock Hilton Hotel, Houston, Texas; contact not yet available.

Dec. 9-11, 1968: Fall Joint Computer Conference, San Francisco Hilton Hotel, San Francisco, Calif.; contact American Federation for Information Processing (AFIPS) 345 E. 47th St., New York, N.Y. 10017

March 24-27, 1969: IEEE International Convention & Exhibition, Coliseum and N.Y. Hilton Hotel, New York, N.Y.; contact IEEE Headquarters, 345 East 47th St., New York, N.Y. 10017



Compiling Routines

Reprinted from Vol. 2, No. 4 — May, 1953

*Dr. Grace M. Hopper**
Vice President
Society for Industrial and Applied Mathematics
Philadelphia, Pa.

An often-repeated principle in detective work is: "set a thief to catch a thief." This principle has a new parallel: "set a computer to program a computer." Half a dozen years years ago, few would have suspected the rich rewards to be gained from programming a computer to put together programs for itself. And yet this was forecast by the symbolic logician, Dr. A. M. Turing, of the University of Manchester, England. In a paper published about 1936, he showed that if a computing machine is able to modify its own instructions, it can solve any problem capable of numerical solution.

In the design of computing machines up to the present, the total number of different single instructions or orders that can be given to the computer ranges from about eight to about eighty. The actual number needs to be large enough to be fairly convenient for human beings to use when instructing or programming the machine, yet small enough to place no undue complexity on the hardware of the machine. This compromise at first glance excludes many special orders which in a few problems could be very useful, such as an order for finding the cube root of a number.

The absence of special orders of this kind is solved by the technique of programming their equivalent and recording them in the memory of the computer for reference, rather than by installing additional hardware. This is possible as soon as the computer is supplied both with an adequate internal primary memory, and rapid and flexible input-output equipment providing a very large secondary memory. This secondary memory must be at the beck and call of the computer itself, completely and at all times, if the computer is to be capable of modifying its own instructions with marked efficiency.

The concept of a computer constructed with a minimum instruction code in hardware, and yet delivered to the customer with a large and flexible set of orders stored in the secondary memory, is not new. The computer known as the Harvard Mark III had a "coding machine", and was one of the first to be so constructed. The Remington Rand Univac machine has been supplied with a general code stored on tape. The trend is evident. In the future, customers will express less concern as to whether a computer is "mathematical", "commercial", or "logistic". For the computer will be truly general-purpose, while its library of programs will particularize it as may be convenient for mathematical or commercial or logistic applications. The identical computer may be an engineering instrument at one moment with one program and a payroll clerk at the next moment with another program.

The development of a library of subroutines for the machine EDSAC has been described by Dr. V. M. Wilkes, of Cambridge University, England. Following the knowledge of his work, an extensive family of program-making programs known as "interpreters, compilers, generators, operators, editors, executives" have been developed for major operating computers. Since there is a current shortage of programmers, and considerable pressure on computer time, these developments have been so far somewhat of a hodge-podge with overlaps and gaps.

Consequently, more lines of communication among programmers need to be opened and a comprehensive plan for expansion of program-making programs needs to be laid down. Also, it is desirable that programmers work side by side with logical designers and engineers at the time that the design of a computer, large or small, is begun. Thus, a computer will be delivered with its basic program tested and proved, ready to be used flexibly and conveniently.

First attempts to reduce programming time were made in the direction of mathematical programs. Here the concept of subroutines is most evident. The elementary algebraic and transcendental functions are clearly defined, easily symbolized, and convenient. In the Harvard IBM Mark I computer, which in 1944 could not compute its own instructions to any great extent, these functions were wired in as relay circuits automatically sequenced by the step-counters which controlled the "multiply-divide" unit of the machine. Faults of such wired-in circuits soon made themselves evident. They always computed to full accuracy. They tied up the transfer buss and hence the entire computer. They took no cognizance of approximations that might be available in the current computation, but depended on stored function tables. They evaluated series or iterated to the limits of computer accuracy always for the worst possible case. They were inflexible.

By contrast, the computer able to modify its own program can be directed to evaluate the terms of a series only until these terms became less than an assigned tolerance. Iterative routines can be repeated only until the difference between two successive approximations becomes sufficiently small. No longer is it necessary to write an all-inclusive "straight-line" program; instead an iterative "loop" program with a test for repetition of the loop is used. Subroutines are carefully planned, both to conserve memory space and to operate with

*Dr. Hopper is now on special assignment in the Office of the Secretary of the Navy, Pentagon, 5 D 840, Washington, D.C. 20350, (on "loan" from Univac, Div. of Sperry Rand Corp.).

as much speed as possible. Naturally, when effort and ingenuity have been expended upon such subroutines, the desire to use them again in another program is strong.

This desire to use again a good subroutine however, immediately poses the problem of locating it in the computer's memory. For an "operative subroutine", i.e., a subroutine which carries out a complete mathematical operation, two courses are available. These lead to the *interpretive method* and the *compiling method.*

The interpretive method of using good subroutines consists of fixing the location of the subroutine in the computer memory, and causing the main program to interpret what may be called a "pseudo-code", and thus refer to the subroutine and perform it. Evident or concealed, this procedure, beyond the decoding, involves the following steps: (1) Transfer arguments to the subroutine or to some standard location; (2) Mark position in the main routine; (3) Transfer control to the subroutine; (4) Carry out the subroutine; (5) Transfer control back to the main routine; (6) Retrieve results from the subroutine or standard location. All but step 4 are waste motions if the program is executed more than once.

The compiling method of using subroutines consists of copying the subroutine into the main routine, adjusting memory locations as necessary to position the subroutine properly in the program, and to supply arguments and results. This method is subject to all of the errors of human copying until the computer itself is instructed to carry out the copying.

With computer copying and either interpretive or compiling routines, it becomes possible to construct *pseudo-codes,* in which mathematical functions are represented by single computer words. For example, in UNIVAC the computer word COO OOX OOO OOY means $y = \cos x$, and the computer word EOO OOU OON OOV means $v = u^n$.

Furthermore, no memory locations are now assigned by the programmer. Instead, they are systematically assigned by the interpretive or compiling routine. If an interpretive routine or *interpreter* is used, a word is examined, the computer carries out the required operation, and then returns to examine the next word. Since the interpretive routine programs and computes simultaneously, it is well adapted for problems which need to be repeated. But if a compiling routine or *compiler* is used, when a word is examined, the required subroutine is transcribed, suitably modified, into a running program. Thus, after compilation, all the reference steps are eliminated and only step 4 may need to be repeated — the desired operation.

Hence, for a program to be repeated, the compiling method offers a saving of time. The decision to use an interpreter or a compiler however depends upon the particular computer and the number of times the program is to be repeated; and the choice to be preferred can be evaluated mathematically.

In both cases, the advantage over manual programming is very great, once the basic subroutines have been tested and proved. The saving of time for a compiler is usually greater. In fact, the reduction in programming time for those classes of problems upon which compilers have been tested is incredible, actually little short of fantastic. Programming can be reduced from weeks to a matter of minutes. . . .

FORUM

(Continued from page 16)

SIXTH ANNUAL COMPUTER ART CONTEST AUGUST, 1968

1967 Winner

The front cover of the August issue of Computers and Automation will again display the first prize in our Annual Computer Art Contest.

Guidelines for entry in this, our Sixth Annual Contest, are as follows:

1. Any interesting and artistic drawing, design, or sketch made by a computer (analog or digital) may be entered.
2. Entries should be submitted on white paper in black ink for best reproduction. Color entries are acceptable, but may be in black and white if published.
3. Each entry should be accompanied by an explanation in three or four sentences of how the drawing was programmed for a computer, the type of computer used, and how the art was produced by the computer.

There are no formal entry blanks; any letter submitting and describing the entry is acceptable. We cannot undertake to return the copies of artwork submitted, and we ask that you do not send us originals if good copies are available.

The deadline for receipt of entries is Friday, July 5, 1968.

EDITORIAL

(Continued from page 7)

> negative action, "Well, I will not do that, I will not be a party to that, because I think that's not professional conduct, because I think that harms people."

With these first steps, the computer field may develop more knowledge, more concern, more action, and a higher level of professional conduct.

We extend to our readers, as always, an invitation to discuss and argue about the social implications and moral questions connected with computers. Perhaps groups of people can send in reports of joint discussions. We hope that in 1968, *Computers and Automation* will be at least as lively a forum in this area as it was in 1967.

Edmund C. Berkeley

Editor

COMPUTERS AND MORAL QUESTIONS

Inventory of Pieces Published 1967 in Computers and Automation

ACROSS THE EDITOR'S DESK

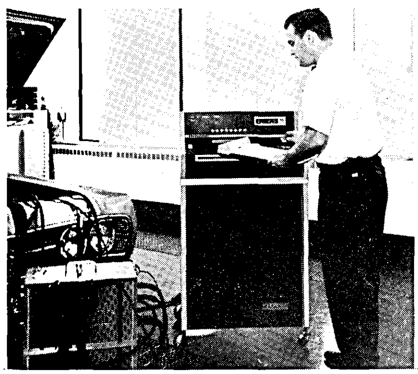
Computing and Data Processing Newsletter

Table of Contents

APPLICATIONS

COMPUTER IMPROVES CAR DIAGNOSIS TECHNIQUES

When Universal Testproducts, Inc. (UTI), Chatsworth, Calif., a subsidiary of Allen Electric and Equipment Co. (Kalamazoo, Mich.), introduced the Allen Model 1280 UTI Automotive Computer, one of the biggest variables in automotive safety was neutralized — the human element. In the past, it has been necessary for motorists to take their cars in to mechanics — some skilled and some not so skilled — for maintenance, repair and safety checks. Diagnosis was primarily a function of the experience, skill-level and judgement of the operator; thus human error and failure of proper interpretation was an ever-present problem.



— Service technician runs sequence of automobile engine and electrical systems tests on Allen 1280 automotive computer.

Now the human element has been eliminated by the substitution of a computer. The Allen system is capable of performing up to 150 different tests on automobile parts and components. Standards for a car by make, model and year are fed into the computer on a Mylar program card. Engine and electrical leads are attached to the car. The series of tests of auto performance are completed by the computer. Several hundred individual component operations may be tested.

The program card also contains instructions to the operator for accurate testing in each sequence. Test results are shown, on the console, in digits — and in words, such as "good", "fail-high" and "fail-low". The computer also will give a recommended action such as "replace" or "adjust" to the operator for the specific component under test. Additionally, the computer has certain built-in capabilities to prevent mis-testing by the operator.

Computerized results are transmitted to the printer read-out in another room. Here the customer can watch the results of the tests being printed on a special two-part carbonless form listing each check-point. Results, which can be amplified by the skilled technician if necessary, are recorded on the form in one of the three columns indicating the component is good, marginal or failing. The form is a special two-part carbonless form manufactured by the 3M Company, St. Paul, Minn. One copy of the form is given to the customer to take with him when he leaves the garage and the other is retained in the garage's files. The entire process is completed in seven to fifteen minutes.

O. P. Pilgrim, UTI vice president-sales, said the system was designed to provide "a much higher degree of thoroughness, accuracy and objectivity than conventional automotive diagnostic capabilities afford, and at an investment level practical for a wide range of service installations."

COMPUTERIZED 'INSTANT' LIBRARY LOAN SYSTEM DESIGNED AT BELL LABORATORIES

A computer-aided library loan system that gives instant circulation information to librarians who are miles apart has been demonstrated at Bell Telephone Laboratories, Murray Hill, N.J. The system, called BELLREL (Bell Laboratories, Library Real-time Loan), permits more efficient pooling of book collections and provides borrowers with a faster, more responsive loan service.

The system which began operation in January, links via telephone lines the BTL Technical Information Libraries at Murray Hill, Holmdel, and Wippany, N.J., with a central store of information in a computer at Murray Hill. Book and borrower data required for immediate information retrieval is maintained in direct-access disc files. Also, a complete history of all transactions is recorded on magnetic tapes. These provide library supervisors with statistics and other information necessary for analyzing the flow of library materials and the patterns of borrower demand.

The BELREL System offers "real-time" handling of information for loans, returns, renewals, reservations, and queries. In all, 18 types of "real-time" questions or transactions can be handled.

Overnight processing on a "batch" basis is used for ready-to-mail overdue notices, printed with all information including the borrower's address. Batch processing also provides a number of records to aid library workers in determining the current status of books, journals, and other publications.

Another feature of the system is the automatic chargeout of any returned item to the next borrower on the waiting list. When a book is returned, the computer sends a message to the librarian, instructing her where next to mail the book.

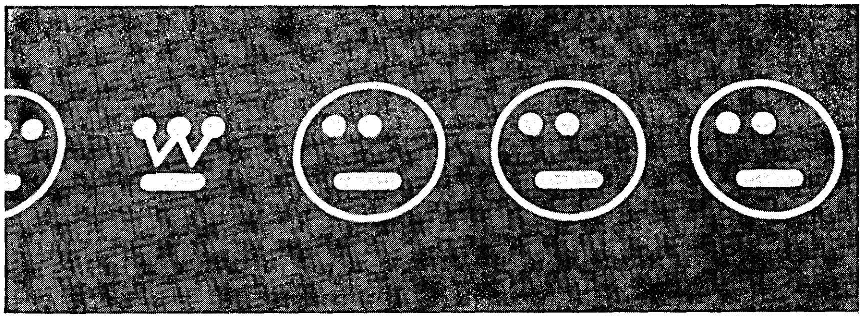
Because information can be recorded either directly through the typewriter console or through the use of a card reading unit at the input terminal, the system can handle all classes of library publications with or without the use of pre-punched book cards.

Bell Telephone Laboratories has one of the largest technical library systems in private industry with more than 100,000 bound volumes and subscriptions to thousands of periodicals.

SIGN LIGHTING CONTROLLED BY WESTINGHOUSE PRODAC 50

The games computers can play have been known to only a few insiders until a Westinghouse Prodac® 50 computer recently began playing a game for all the world to see. It controls an outdoor electric sign on Pittsburgh's (Pa.) north side, facing the city's Golden Triangle across the Allegheny River. The sign departs radically from the simple on-off sequence of most flashing signs because it is programmed to be sophisticated, humorous, and challenging to the imagination.

The sign consists only of a row of nine of the Westinghouse trademarks. Each trademark measures 17.5 feet in diameter and is made up of nine geometric elements — the circle, three dots, four lines in the W, and the letter's under-score — for a total of 81 light circuits. This combination makes possible 81 factorial ways in which the lights can come on (81 times 80 times 79 times 78 and so forth), or 10^{120} ways, each completing the assembly of the nine trademarks. The lights are turned on in a number of sequences of instantaneous patterns at half-second intervals.



— Humorous sequence of Westinghouse trademarks shows all but one of the emblems as faces that glare drolly at their nonconforming associate.

Each sequence of patterns is first programmed on sets of drawings. From these drawings, coding is generated on punch cards; the card data in turn is coded on magnetic tape and loaded into the computer. The computer transforms the data, which includes bit patterns and timing information, into its own language and stores the information in its 4000-word memory core.

Sequences are changed from time to time by reprogramming to introduce new and intriguing ways of assembling the nine trademarks. Because of the tremendous number of sequences available, they can be changed without repeating any that have been used before. Twenty different sequences were used initially in a nonrepeating cycle of five minutes. More can be added by enlarging the memory core, and space was provided for adding three more memory cores to permit use of nonrepeating programs more than half an hour long.

COMPUTER MONITORING SYSTEM USED FOR POSTOPERATIVE CARE OF OPEN-HEART SURGERY CASES AT UNIVERSITY OF ALABAMA

A specially equipped computer monitoring system now in use at the University of Alabama Medical Center is enabling UA physicians and nurses to provide better intensive care to open-heart surgery patients during the critical postoperative hours. University Hospital officials say that an IBM 1800 system, used in some 60 cases to date, improved patient care by insuring continuous and accurate recording of physiologic function, and, at the same time, has enabled health professionals to increase their efficiency with respect to time usage.

Sensors linking the patient and the computer transmit information on temperatures, intra-arterial pressure, intracardiac pressures, chest drainage, and electrocardiographic signals. These signals are analyzed, translated, and displayed over closed-circuit television located at the patient's bedside, giving the physicians and nurses readings on heart rate, systolic blood pressure, average right and left arterial pressures central body temperature, skin temperature, chest drainage, and volume of blood infused.

Dr. John Kirklin, chairman of the Department of Surgery, said, "Since it operates within limits which are pre-set by the physician, the computer is under our direct control. Also, there is never a break in the manner and frequency with which data on the patient's condition are taken and recorded."

At five minute intervals, new readings are logged and compared with specific criteria set by attending physicians. Any data revisions, plus messages to attendants, are displayed at the bedside. These messages may include recommendations to clean or adjust sensors, or to infuse blood. At the direction of the physician, the computer can automatically turn on a pump to add the required amounts of blood to the patient's blood stream. "Our system now manages infusion of blood and soon will manage infusion of glucose and medication," Dr. Kirklin said.

Dr. S. Richardson Hill, Jr., dean of the Medical College of Alabama, pointed out, "Other institutions have used computers to monitor a variety of patient functions. Our system includes the important feature of 'real work' in patient care....."

U.S. FOREST SERVICE IS USING COMPUTERS TO AID FIRE RESEARCH

The United States Forest Service, in its continuing effort to solve the annual $270 million forest fire problem, is conducting extensive research in basic fire chemistry with the aid of modern electronic simulators. Research in fire chemistry and other fire research is conducted at the Pacific Southwest Forest and Range Experiment Station in Berkeley, Calif., its Forest Fire Laboratory in Riverside, and at other Forest Service Experiment Stations across the country.

In California, the computer-aided attack on the big-fire problem is aided by an "unexcelled natural outdoor laboratory for fire research". In the period 1960-1965, California had 34 big fires — fires which devastated 791,623 acres of forest resources. Yet, these 34 fires represent a slim five per cent of the total number of fires in California during the period. The remaining 95 per cent were controlled at 15 acres or less.

Scientific knowledge about large fires — those which engulf 10,000 acres or more — is limited. Yet even more startling is the fact that the burning process itself is not completely understood. In fact, theories on the basic process are divergent, even contradictory.

One basic research effort underway at the Berkeley Station is the continuing study of cellulose pyrolysis. To aid in the study of cellulose dehydration and decomposition by heat, research scientists are using a modern desk-top electronic simulator, manufactured by Electronic Associates, Inc. (West Long Branch, N.J.) to simulate combustion kinetics of various types, and to solve the complex mathematical "models" involved. The decomposition of cellulose is being studied so that additional information — needed to make accurate predictions of the effects of experimental fire extinguishing and flame retardant chemicals — can be obtained.

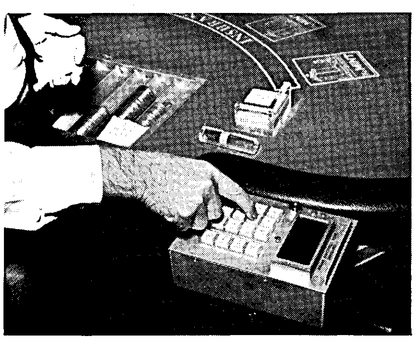
The use of computers in fire research goes beyond laboratory studies on the kinetics of cellulose pyrolysis. Research of a long range type — into the use of computers as an aide in making decisions in actual fire line situations — also is underway. So far, research on national fire problems is providing answers which will eventually lead to new chemical fire retardants, and other more effective methods of forest fire control. Further research is essential. Until the carelessness which each year destroys thousands of acres of valuable forest watersheds can be prevented, methods of controlling big fires will have to be improved.

ELECTRONIC MONEY COUNTERS TO AID TAX COLLECTORS OF NEVADA

Electronics will be taking some of the gamble out of gambling — at least as far as Nevada's tax collectors are concerned. To insure an accurate count of money won from gambling tourists, the State of Nevada has permitted a test for a 13 week trial period of electronic money counters on gaming tables.

The Mint Hotel in Las Vegas (owned and operated by Del C. Webb) is the first to install the new system, reports Robert Howard, President of Centronics Data, Inc. of Flushing, N.Y.

The system, designed and manufactured by Wang Laboratories, Inc., Tewksbury, Mass., for Centronics Data, Inc., consists of



individual keyboards for each gaming table on which the amount of every cash, chip, or marker transaction is entered, then processed on a central computer. The exact amounts are then automatically identified with the specific keyboard, and simultaneously printed out on a teletype unit.

The installation at the Mint Hotel is based on Wang's electronic calculators which are used in business, scientific, industrial and educational operations. The system currently is undergoing evaluation by the Nevada Gaming Control Board.

ORGANIZATION NEWS

RANDOLPH COMPUTER CORP. TO ACQUIRE UNITED DATA PROCESSING SERVICES

John M. Randolph, president, Randolph Computer Corporation, New York, and John Roy, president, United Data Processing Services, Inc., Cincinnati, Ohio, have signed an agreement under which Randolph Data Services, Inc., a newly-formed subsidiary of Randolph Computer Corporation, will acquire the assets and business of United Data Processing Services, a privately-held company, originally organized in 1959.

United Data Processing Services is a computer service center with operations in Cincinnati and Columbus, Ohio, and Dryden, Va. Also, in August 1967, United started the College of Automation in Cincinnati. Mr. Randolph said that this is the first time that Randolph Computer Corporation has moved into the field of computer education. The continuing shortage of trained computer personnel, he said, makes this a particularly interesting area for the company.

Randolph Computer, originally a computer leasing company exclusively, first diversified into the service center business in May 1967 when it acquired United Data Processing, Inc., Portland, Ore., a company unrelated to the Cincinnati company. It is planned that United of Portland also will become part of Randolph Data Services. Both Portland and Cincinnati companies will operate as Randolph Data Services with no changes in divisional management.

NCR ACQUIRES KRUPP MINORITY HOLDING IN GERMAN COMPANY

The National Cash Register Company, Dayton, Ohio, has announced its acquisition of the 20 per cent interest in NCR's German subsidiary formerly held by the late Alfried Krupp von Bohlen und Halbach.

The transfer makes the German organization — National Registrier Kassen GmbH, with headquarters in Augsburg — a wholly-owned subsidiary of the Dayton, Ohio, business equipment manufacturer.

The Krupp minority interest dates back to 1934. NCR's purchase of the Krupp stock was handled through executors of Krupp's estate and the managing board of the Krupp Foundation.

LEASCO BEGINS OPERATIONS IN EUROPE — TO LEASE COMPUTERS IN FIVE COUNTRIES

Saul P. Steinberg, President of Leasco Data Processing Equipment Corp., has announced that computer leasing programs have begun in Great Britain and Germany and will begin shortly in France, Belgium and Holland. Leasco's foreign operations are being conducted through wholly-owned subsidiaries of Leasco Europa, Ltd., a Delaware corporation, in which the company holds more than 70% of the common stock with the balance controlled by several major European banks and a European subsidiary of a major U.S. bank.

Leasco will not be utilizing its domestic lines of credit to finance its European programs. The company has reached an agreement in principle with a European banking group for a loan of $15 million for its purchase of computers.

DATA PRODUCTS TO ACQUIRE FAIRCHILD'S MEMORY PRODUCTS SECTION

Data Products Corporation and Fairchild Camera and Instrument Corporation have reached agreement in principle, subject to approval of their respective Boards of Directors and the execution of a final agreement, for the purchase for cash by Data Products of the Memory Products Section of the New Products Group of Fairchild. It was anticipated that the final agreement would be signed and the sale consummated by March 1.

Erwin Tomash, President of Data Products, stated that the acquired business would be conducted in conjunction with the similar activities of Core Memories Ltd., a Data Products subsidiary based in Dublin, Ireland. After the purchase, the Memory Products operation located in Mountain View, Calif., will continue in that location and an integrated marketing program will be initiated in cooperation with Core Memories Ltd. Data Products' offices and manufacturing facility are located in Culver City, Calif.

DIGIMATICS INC., NEW CONSULTING FIRM

Digimatics Inc., Garden City, N.Y., recently was organized as a computer consulting, systems, and programming firm. Digimatics will provide systems studies, and the application of computer systems to the problems of business, industry and science.

Officers in the new firm are Richard Fauvell, Newton Kerman, and Harold V. Greenberg.

DIGITEK AGREES TO ACQUIRE MEASUREMENT ANALYSIS CORP.

Digitek Corporation (OTC), Los Angeles, Calif., has reached an agreement in principle to acquire Measurement Analysis Corporation, Los Angeles computer software company, for 196,000 shares of Digitek stock, according to James R. Dunlap, president.

Under terms of the proposal, Measurement Analysis Corporation would be acquired on a pooling of interest basis and operated as a wholly owned subsidiary under the direction of its president, Dr. Julius S. Bendat. Measurement Analysis, founded five years ago, produces various types of computer software systems, which includes the MAC/RAN system, a proprietary package of digital computer programs developed by the company for use in random data analysis.

Digitek Corporation specializes in building complex programming systems, including compilers, operating systems and management information systems. Mr. Dunlap said the acquisition will have the effect of approximately doubling the sales of Digitek Corporation.

The acquisition is subject to execution of a definitive agreement and approval by the shareholders of Measurement Analysis and to the issuance of a permit by the Commissioner of Corporations of the State of California.

VERNITRON CORP. TO ACQUIRE OEI COMPUTER SYSTEMS CORP.

Bernard Levine, Chairman of the Board and President of Vernitron Corporation (ASE), Farmingdale, N.Y., has announced that Vernitron has agreed to acquire OEI Computer Systems Corporation, a computer service organization headquartered in Great Neck, N.Y.

Vernitron will acquire OEI from Murray Miller, who founded the company in 1957. Mr. Miller is to receive about 40,000 Vernitron common shares, contingent upon future earnings. He and three other key employees have entered into employment contracts with Vernitron.

Vernitron, a leading producer of components for analog computers and systems, began manufacturing digital equipment several years ago. Acquisition of OEI is Vernitron's third expansion in the electronic data processing and digital computer field during the past year.

BUNKER-RAMO CORPORATION, AMPHENOL CORPORATION COMBINE BUSINESSES

The Bunker-Ramo Corporation, New York, N.Y., and Amphenol Corporation, Chicago, Ill., announce they have signed definitive agreements to combine the businesses of the two companies. This move followed the completion by each company of business and financial studies of the other.

The combined business will operate under the name Bunker-Ramo, with the various divisions of Amphenol and Bunker-Ramo operating under their respective names and present management.

EG&G ENTERS AGREEMENT TO ACQUIRE WOLF RESEARCH AND DEVELOPMENT CORPORATION

EG&G, Inc., Bedford, Mass., has announced the signing of an agreement to acquire Wolf Research and Development Corporation. The 350-member computer consulting firm is headquartered in Concord, Mass., and maintains several additional operating facilities at other locations.

The acquisition will involve an undisclosed amount of EG&G common stock in exchange for all the outstanding stock of Wolf Research and Development. EG&G President Bernard J. O'Keefe said that the Wolf organization will continue to operate within its existing management structure, and will function as a wholly owned subsidiary of EG&G, Inc.

COMPUTER SERVICES, INC. MERGES WITH UNITED DATA CENTERS, INC.

Bernard Goldstein, President of United Data Centers, Inc., a New York based chain of data centers, has announced the merger of Computer Services, Inc. of Salem, Mass., with United Data Centers, Inc.

Computer Services, Inc., which serves clients in the Greater Boston area, Rhode Island and New Hampshire, has received industry-wide recognition for its "Comput-a-fuel" program, a specialized service designed to assist fuel oil dealers to optimize their services through the medium of computer techniques. Stanley A. Ferbank continues as president of Computer Services, Inc.

BUREAU OF NATIONAL AFFAIRS INC. ACQUIRES FISHER-STEVENS, INC.

John D. Stewart, President of Bureau of National Affairs, Inc., Washington, D.C. publishers, has announced acquisition by the company of Fisher-Stevens, Inc., Clifton, N.J. Mr. Stewart indicated Fisher-Stevens would be operating as a subsidiary and no significant changes were planned in its operation.

Fisher-Stevens, founded in 1918, provides addressing and mailing services to various industries, in particular, the pharmaceutical manufacturers. It has recently opened a school, Institute for Computer Technology, in Belleville, N.J. The firm was privately held by members of its management and members of the family of one of its founders.

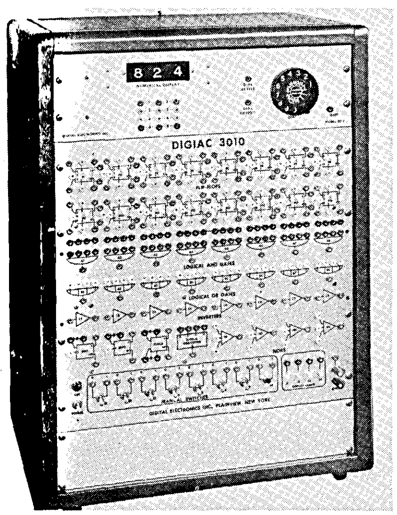
The Bureau of National Affairs, Inc., a private business enterprise owned by its employees, publishes daily and weekly reports in the fields of taxation, labor-management relationships, international trade, patent law and others.

EDUCATION NEWS

DIGIAC 3010DD, A DIGITAL LOGIC TRAINER

The Digiac division of Digital Electronics, Plainview, N.Y. has introduced the DIGIAC 3010DD, a digital logic trainer designed especially for the teaching of digital computer logic. The versatile trainer may be used in the teaching of computer maintenance and logic system breadboarding.

Sixty separate basic computer circuits — identical to those employed in computers in industrial and commercial use today — enable the student to construct computer logic circuits. Each of the 60 circuits is screened on the front panel and corresponds to the logic diagram in the student manual which accompanies the 3010DD.



A telephone dial and numerical display panel combine to serve as an input-output device which simulates entering and retrieving data from a computer. Designed for continual use, the 3010DD uses solid-state components mounted on individual printed circuit boards. It also contains built-in short-circuit protection. A removable rear panel provides access to all components for instruction in computer maintenance and servicing. (For more information, designate #41 on the Reader Service Card.)

PRISON INMATES LEARN, THEN TEACH COMPUTER PROGRAMMING

Inmates are teaching other inmates the computer business at the Massachusetts Correctional Institution at Walpole, the state's maximum security prison. It is an experiment which may well become a permanent part of the prison's education program.

Honeywell's Electronic Data Processing Division went into Walpole in July 1967 to teach computer programming in answer to an inmate's request passed on by a Roman Catholic laymen's organization which regularly visits the prison.

Malcolm D. Smith of Honeywell's Programming Systems Division set up the course. Working with Walpole's Catholic chaplain Father John Foley, and State Corrections Commissioner John Gavin, he arranged to have a battery of six tests given at the prison. These tests were designed to determine the individual's ability to think logically, the prime requirement for a programmer. Fifty-five men, about 10 per cent of the prison's population, showed up for the tests. Ten were chosen, ranging in age from the early 20s to the late 40s.

"Although none of these ten men had been to college," Smith said, "their scores were equivalent to the scores of college graduates. In a couple of cases, they scored much higher than college graduates." Seven of the ten men completed the ten-week course in the fundamentals of data processing. These men went back to work immediately on a fifteen-week second-phase course to learn COBOL (COmmon Business Oriented Language), a basic programming language.

At the same time, the seven graduates began teaching the fundamentals course to a second crop of 22 inmates and to write an instruction textbook on electronic data processing.

How good are the inmate teachers? "Great," Smith said. "They go way beyond the things we taught them. They're teaching things they had to pick up from outside reading." He believes the men will be able to continue the course by themselves with only minimum assistance from Honeywell.

Meanwhile, Smith keeps a volunteer team of six Honeywell programmers working hard to instruct the COBOL class. "One teacher couldn't handle them," he said. "The students were going into it with such detail that we had to bring in specialists to teach segments of the course. There's no limit to how far these men can go."

BRANDON SYSTEMS INSTITUTE SCHEDULES FOUR NEW DATA PROCESSING COURSES

Brandon Systems Institute, Arlington, Va., has expanded its operations to eight major U.S. cities, and four new data processing courses have been developed and scheduled for the six-month period from March through August. The new offerings bring to 18 the number of data processing courses and seminars conducted by the Institute, which is the training division of Brandon Applied Systems, Inc., New York, N.Y.

The new offerings include: three-day courses in "Converting to Third Generation Computers" and "Systems Analysis and Programming in a Multi-Programming Environment"; a two-day course in "Management and Control of Multi-Programming Operations"; and a five-day case study course, "Data Base Management Workshop". In addition, a special two-day course on "Practical Inventory Management" will be offered to senior managers during May in New York and Chicago.

The Institute, which previously conducted most of its public courses in New York and Washington, D.C., now is offering them also on a regularly scheduled basis in Chicago, Atlanta, Los Angeles and Boston. Some courses also will be offered in Las Vegas. A catalog is available free from: Director, Brandon Systems Institute, 1611 North Kent Street, Alrington, Va. 22209.

ELECTRONIC TEST-SCORER PROVIDES HIGH-SPEED GRADING

An electronic test-scoring instrument that automatically scores both teacher-made and standardized, objective tests in a matter of minutes, is available from Automata Corporation, Richland, Wash., a subsidiary of Scientific Advances, Inc. The machine, known as the Automata 450, can be used by higher elementary grades up through college level.

The Automata 450 uses computer circuitry — input-output, memory, logic and control — to score tests at a rate of 30 every four minutes. One hundred test cards can be scored in one loading, and up to 450 can be marked in one hour.

The machine prints the number of right and wrong answers on the top of each student's test card, and records the class totals for the number right and wrong so the teacher can easily determine the class average. The Automata 450 also enables the teacher to determine, at a glance, the progress of the entire class. During scoring, the machine's exclusive Data-Dot Edge Marker puts a mark on the edge of the student's test card for every wrong answer. By simply glancing at the stack of cards, the teacher can ascertain immediately which questions were missed most frequently.

Students mark their answers on test cards which can handle up to 100 questions. No special pencil is required, and because detection is optical, no metallic mark can confuse the system. Only one teacher program card is needed for each set of 50 questions.
(For more information, designate #42 on the Reader Service Card.)

CUSTOM-MADE SCHOOL LESSONS PROVIDED BY IBM COMPUTER

With so much to learn in elementary school, why must Johnny spend time studying what he already knows? To help teachers solve this problem, an IBM computer is being used to schedule daily lessons on closed circuit television in the Indian community of Pueblo Isleta, New Mexico. Each day more than 200 students are pre-tested on hundreds of subjects, and the computer then selects the lesson which would best suit the class as a whole from a list of 600 brief films. The experimental project is being conducted by EVCO, an educational research and design firm in Albuquerque, N.M.

Two schools in the Indian community are equipped with television receivers in all six grades. Each TV set is equipped with earphones so that small numbers of children can listen to a film without disturbing other classroom activities. A special trailer has been built to house the closed-circuit TV system and video recording equipment as well as other audio-visual equipment.

Dudley E. Cornell and Dr. James Evans, partners in EVCO, explained how the program works:

— Each grade is given a pre-taped, closed-circuit television test consisting of 10 questions designed to test a child's knowledge about one of 1,500 different school subjects such as, health, nature, farming, and transportation.

— Each child is given an IBM card which has been pre-punched with coded information about his name and class. These cards have been specially designed by EVCO with 10 pictures of smiling faces and 10 of frowning faces. Children mark over the smiling face for "yes" or over the frowning face for "no".

— In the EVCO trailer the cards are processed into machine readable form and transmitted on a data communications terminal over telephone lines to the IBM 1130 computer at EVCO's data processing facility in Albuquerque. The 1130 processes the test results and selects from its "memory" the appropriate film for each grade and subject that best meets the overall needs of the students.

— EVCO personnel then transmit to the trailer a printout of the individual test results, class results as a whole and a list of the films to be shown the next day.

"The key element in this project is the provision for individual differences," said Dr. Evans. "The project provides that in each class and for every student, each day's test dictates the next day's prescription."

COMPUTER USAGE EDUCATION ANNOUNCES "ON-SITE" COMPUTER TRAINING PACKAGE

The availability of a new computer education training package aimed at "on-site" instruction and training of commercial, industrial, government agency, educational and institutional personnel at all levels, has been announced by Walter M. Johnson, III, Vice President of Computer Usage Education, Inc., New York, N.Y.

Courses will include long range systems design and planning for modern management information systems, systems analysis and computer programming instruction. These computer courses are tailored to the specific needs of the organization on whose premises they will be conducted. Course development and administration is under the management of Mr. Paul D. Oyer, newly appointed Director of Education for Computer Usage Education, Inc.

Mr. Oyer explained, each educational package will consist of classroom instruction, course materials, case histories and systems aids (for use in the course and on the job). The courses incorporate instruction on all of the most recent technological advances. They are designed basically to up-grade all levels of computer personnel, from beginners to senior technicians. Computer Usage Education also has designed courses for keeping all levels of management current on the latest EDP technology and systems advances.
(For more information, designate #43 on the Reader Service Card.)

UNIVERSITY OF UTAH WILL ESTABLISH AN INSTITUTE FOR BIOMEDICAL ENGINEERING

An Institute for Biomedical Engineering — an interdisciplinary organization that will link medicine with engineering and the physical sciences — will be established at the University of Utah, Salt Lake City, Utah. The new organization will give added impetus to the University's research toward the development of a mechanical heart and other artificial organs. This type of work requires a close knit link between the medical and engineering disciplines.

The announcement was made at the January meeting of the Board of Regents. The Regents also approved the appointment of Dr. Willem J. Kolff, professor of surgery and chairman of the Division of Artificial Organs, University Medical Center, as institute director.

Dr. Kolff said students and faculty members from the departments of chemical, mechanical and electrical engineering, computer science, chemistry and physics will collaborate with the College of Medicine on solutions to medically related problems.

UNIVERSITY OF TEXAS ADVANCES RESEARCH IN COMPUTER-ASSISTED INSTRUCTION

During the current semester at the University of Texas at Austin, a new instructional system is being used by the University's College of Education in a variety of experimental projects, including course work in chemistry and educational psychology, in testing and on basic research into the learning process itself.

The system, an IBM 1500, links special display and response devices to a central computer. These include TV-like viewing screens, image display units capable of presenting up to 1,000 color or black-and-white photographs, and audio systems containing pre—recorded messages. A student can respond to questions by typing an answer on a keyboard, or by using a light pen to identify information on the viewing screen.

"There are a number of computer-assisted instruction programs under development at the University, but we consider our work essentially experimental at this time," Dr. C. Victor Bunderson, director of the Computer-Assisted Instruction (CAI) Laboratory, said. One area in which UT is exploring the possibilities of CAI is a mathematics prerequisite to chemistry.

Under this program the University, at the discretion of individual professors, will screen students entering chemistry classes to discover whether their grounding in math is strong enough for the chemistry course. A student will take a mathematics test presented by the computer to evaluate his competence. If his knowledge is high, he will require no further review. If minor review or more detailed study is called for, the computer will present tailored material needed by the student to help him succeed in the course.

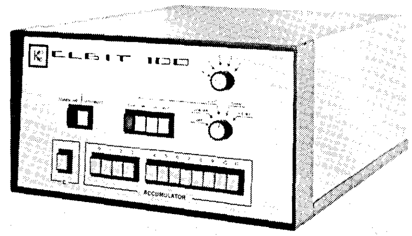
NEW PRODUCTS

Digital

ELBIT 100, A NEW LOW COST DIGITAL COMPUTER

The ELBIT 100 is a new low cost digital computer from Elbit Computers Ltd., Haifa, Israel, designed specifically for integration into a system or control loop. It sells for a single quantity price of less than $5,000 (in O.E.M. quantity, less than $4,000).

The basic price includes a 1024 twelve bit core memory with 2 usec cycle time, a 256 word fixed memory with 400 nsec access time, control panel, all power supplies and interface with any standard Teletype or mechanical tape reader. Using all integrated circuit construction, the machine is micro-



programmable for optimizing speed of real time operations, has a typical add time of 6 usec for a full twelve bit word, and can operate with up to 256 different I/O devices.
(For more information, designate #44 on the Reader Service Card.)

IBM ANNOUNCES POWERFUL SYSTEM/360, MODEL 85

IBM Corporation, White Plains, N.Y., has announced a powerful new computer at the top of its System/360 line — the Model 85. It is designed to help solve complex scientific problems such as those encountered in space exploration, as well as meet the myriad commercial computing needs of large businesses.

The most powerful computer now offered by IBM, the Model 85 can carry out instructions at a maximum rate of 12.5-million a second. For example, it can multiply two ten-digit numbers at a rate of more than two-million complete calculations a second — a task that would take a person using pencil and paper about 38 years of non-stop work. The new computer can process data up to three times faster than the next largest System/360, the Model 75. The only IBM computer more powerful is the Model 91, which was offered to customers on a limited basis.

Among the many innovations contributing to the Model 85's performance are: a main ferrite core memory with a capacity of up to eight-million decimal digits; a "buffer" memory that operates in 80-billionths of a second; and fast monolithic circuits.

Another feature is compatibility among System/360 models. Programs written for other large-scale System/360s will operate faster in the Model 85 without modification. Model 65 and 75 users who wish to increase their computing capability can do so without reprogramming. The Model 85 also is compatible with most IBM peripheral units.

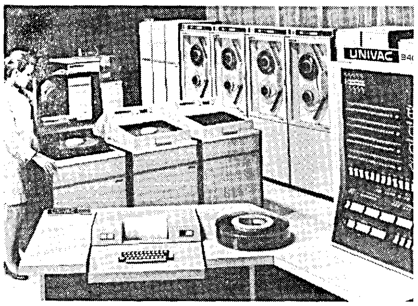
First customer shipments will be scheduled for the third quarter of 1969.
(For more information, designate #45 on the Reader Service Card.)

NEW UNIVAC 9400 SYSTEM ADDED TO UNIVAC 9000 SERIES BY SPERRY RAND'S UNIVAC DIV.

The UNIVAC 9400 is the third system to be introduced in the 9000 Series of compatible computers by Sperry Rand Corporation's UNIVAC Division, Philadelphia, Pa. This new medium-scale computer follows the 9200 and 9300 Systems announced in June 1966.

The new system is capable of real-time operation and multiprogramming. It incorporates the exclusive UNIVAC-developed plated-wire memory, and monolithic integrated circuitry, first employed in the 9200 and 9300 models.

Through the use of a Data Communications Subsystem (DCS) and a communications adapter, the 9400 can be used for communications-oriented data processing providing for a total of 64 line terminals in a two-directional (duplex) mode.



— UNIVAC 9400 System

The central processor has a memory cycle time of 600 nanoseconds per two bytes. Each byte contains eight data bits plus one bit for parity. The main memory capacity can be expanded incrementally from 24,576 bytes to 131,072 bytes. The processor has 32 full word general purpose registers — 16 for user program functions and the remainder for software.

A complete software package will be provided to cover the user's requirements. Customer deliveries are scheduled to begin during the 2nd quarter of 1969.
(For more information, designate #46 on the Reader Service Card.)

HONEYWELL ANNOUNCES THE MODEL 110 — SMALLEST IN SERIES 200 FAMILY

The Model 110 central processor, ninth and smallest in the Series 200 family of computers, recently was announced by Honeywell Electronic Data Processing, Wellesley Hills, Mass. Honeywell's newest, small-scale computer is a "complete low-cost package" for small business. The "package" is a well-balanced system of low-cost hardware, software, training and systems support to provide quick conversion to electronic data processing at minimum cost.

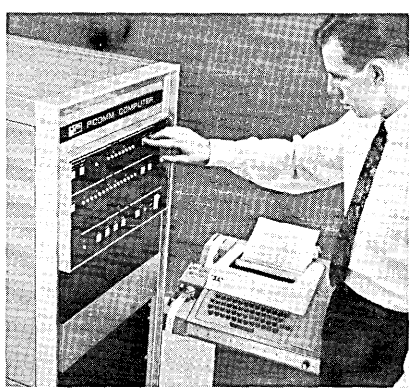
The 110 package includes a central processor with expandable magnetic core memory from 4,096 to 16,384 characters; a four-microsecond cycle time; complete operating software written especially for the system; application packages for general ledger, accounts receivable, accounts payable, payroll and inventory reporting; and an education-training program for the customer's personnel that includes a seminar for customer executives.

Three peripheral devices have been designed especially for the 110 system. These include magnetic tape units, a line printer and random-access disc drives with removable disc packs. A punched card reader, card punch and combination reader/punch that are compatible with other Series 200 central processors are available in a 110 configuration.

The Model 110 is completely compatible with other members of the Series 200 family and can grow with the customer as his business needs grow. Deliveries of the 110 system with magnetic tape units will begin in August, 1968. Delivery of the disc drives for the 110 system will begin in November, 1968.
(For more information, designate #47 on the Reader Service Card.)

POTTER INSTRUMENT CO. INTRODUCES NEW LOW COST GENERAL PURPOSE COMPUTER

An advanced, low-cost, general-purpose computer designed for use with N/C machine tools has been introduced by Potter Instrument Company, Inc., Plainview, N.Y. The new PICOMM Computer, Model PC-9600, for the first time, provides the metalworking industry with a complete computer capability for the generation of N/C tapes. In addition, the new Potter computer, which sells for less than $12,000, can be used for contour generation, automatic "accept-reject" determination of inspected parts and produces a complete record of deviation and tolerances.



— New PICOMM Computer

The computer is available in memory sizes of 2K, 4K and 8K characters, with larger memory sizes available upon factory request. Integrated circuit electronics are used for maximum reliability and maintainability. The location of controls and programming via tape provides a computer system easily operated by shop personnel. Simplicity of operation make it unlimited in its applications.
(For more information, designate #48 on the Reader Service Card.)

Software

BATCH / The Foxboro Company, Foxboro, Mass. / This software system is designed to simplify programming for direct digital control of batch sequence processes. It runs in a minimum of core memory, can be learned easily and applied by process people who do not have a background in computer technology. Process engineers may write batch process control programs using 12 basic control statements such as CONT (Contact Output) and SETV (Set Value). BATCH consists of a language, a compiler and an operating system. The compiler converts the language into an operational sequence control program. The operating system executes the compiled statements and implements the actual sequence control.
(For more information, designate #49 on the Reader Service Card.)

GECENT® III Postprocessor System / General Electric Co., Washington, D.C. / A software support program written for General Electric Mark Century numerical control systems used in conjunction with the APT III computer system, now is available to users of Mark Century NC systems. The new GECENT III Postprocessor can be made to fit large and small computers, multiple programming computers, or eventually a time-sharing computer. Computer processing times of GECENT III are from 1/6th to 1/12th as long as the GECENT II program which it replaces.
(For more information, designate #50 on the Reader Service Card.)

UNITE I / United Computing Corp., Redondo Beach, Calif. / This package allows software written for SDS 900 series computers to be run directly, without modification, on the Sigma 5/7. UNITE I also contains a large number of extra features in addition to its simulation capabilities. These

include: trace, breakpoint, core dump, panel interrupts, and the ability to jump back and forth between 900 and Sigma code. The firm plans to sell the package outright for $8,000 per copy. This price includes the simulator, one week of on-site support, user's manual, and a lifetime warranty on the program's code structure.
(For more information, designate #51 on the Reader Service Card.)

WCS 360 EVALUATOR / Worldwide Computer Services Inc., Port Chester, N.Y. / Using this evaluation program, any 360 user may determine his hardware and software requirements for a communications system before installation. It encompasses DOS or OS communication's systems run with programs written in BTAM or QTAM macros. The Evaluator can pre-determine: the minimum system configuration necessary to handle message loads; the time it takes for messages to pass through the system; the time available for non-communication programs in other partitions; and the optimum design for message processing programs. The Evaluator also can be used as a design tool for further modification of existing communications systems. It can determine the effect of changes to an existing system before the changes are implemented.
(For more information, designate #52 on the Reader Service Card.)

Peripheral Equipment

HONEYWELL ENTERS OFF-LINE DATA PREPARATION MARKET WITH NEW KEYTAPE DEVICES

A complete family of third-generation off-line data preparation devices for the computer industry has been introduced by Honeywell's Electronic Data Processing Division, Wellesley Hills, Mass. The new family of Keytape keyboard-to-magnetic-tape units were demonstrated recently at news conferences in 12 major cities across the nation. Each device is a compact unit that records data onto computer-ready magnetic tape through a typewriter-like keyboard. The Keytape devices are said to increase data preparation production an average of 35 per cent over keypunch machines.

Keytape units will be available in two series -- the 700 Series for seven-channel and the 900 Series for nine-channel magnetic tape — each in four models, all having a basic capability for data entry, data verification, record search, program entry and program verification. In addition, the second model has a punched card reader attachment for off-line card-to-tape transcription; the third model has a data communications capability to perform tape-to-tape transmissions between Keytape devices; and the fourth model has "pooling" capabilities to consolidate short-run tapes onto one lone master tape.

The new devices prepare computer-ready half-inch magnetic tape compatible with all Honeywell Series 200 computer systems, from the new small-scale H-110 (see New Products, Digital) through the large-scale H-8200, and with most computer systems of other manufacturers.

First models of the 700 Series Keytape units will be shipped in July and shipments of the 900 Series will begin in October.
(For more information, designate #53 on the Reader Service Card.)

CANON ANNOUNCES NEW MODEL 130S CALCULATOR

The Canon Electronic Calculator 130S, announced by Canon U.S.A., Inc., New York, N.Y., is so compact it takes up less space than a standard electric typewriter. This high speed calculator adds, subtracts, multiplies and divides, and combines any and all of these operations in a single problem. It can be used as well for direct subtraction, addition, multiplication and division.

Despite the reduction in size, additional advantages, normally found in more expensive equipment, have been incorporated in the 130S. The calculator includes all of the following features: compact size; grand totals; reverse key, which is used for interchanging the dividend and the divisor in division; direct credit balance; constant in both division and multiplication; negative multiplication; automatic floating decimal; overflow warning light; and Canon-designed non-glare display. The all solid state components are noiseless and operation of the calculator is silent save for the faint touch-key sound.

The well-known Canon Keyboard arrangement and key touch are retained, making operation very simple. It requires only a few moments of instruction for expert use. Results up to 13 digits are shown in clear, crisp numbers which are of modular design. The numerals are 5/8" tall, easy to read, clear, with no flickering.

The 130S calculator, priced at $995, carries an unconditional one-year guarantee.
(For more information, designate #54 on the Reader Service Card.)

PORTABLE DIGITAL DATA LOGGER FROM CONTROL EQUIPMENT CORP.

Control Equipment Corp., Needham Hts., Mass., has announced its third-generation, portable Digital Data Logger. The new instrument automatically measures and records signals from multiple installations of transducers or electrical pick-ups. The data is recorded in digital form for later computer entry or manual study.

The new Data Logger is complete in one package. It scans, digitizes, and records analog data. It can be used to measure and record any combination of physical parameters that are convertible by transducers to voltage, current, or resistance. Some examples are temperatures, pressures, velocities, and weights. The Data Logger also records digital data from keyboards, shaft encoders, counters, and digital transducers, and generates time and identification information.

The small size and light weight of the Data Logger (20" x 26" x 15", 75 lbs.) make it suitable for field use and start-up testing, where it must be moved from site to site; and for laboratory use, where it

may be moved about and stored when not needed. For permanent on-line applications, it may be rack-mounted with other equipment.
(For more information, designate #58 on the Reader Service Card.)

NEW FIELD TAPE TRANSPORT WEIGHS LESS THAN 50 LBS.

Potter Instrument Company of Plainview, N.Y., has announced a new, portable digital recorder for field data recording, weighing less than 50 pounds. The new device, Model FT-153, is specifically designed and field-proven for geophysical field recording.

The recorder writes and/or reads data in IBM-compatible, 7- and 9-channel (IBM 360- or ASCII compatible) formats, at selectable tape speeds from 15 to 150 ips at packing densities to 800 bpi, NRZI. Data transfer rate is to 120 kc. Equipped with standard 8-1/2" reels, the recorder accommodates 1/2" tape.

Newly-designed servo amplifiers provide dependable operation at reduced weight. Servo amplifiers and other electronic circuitry are solid-state throughout, and are packaged on printed circuit cards mounted in the back of the transport. A separate power supply provides all voltages required to operate the transport from an input voltage of 12 volts.

Although available for 19" rack mounting, the FT-153 can be supplied with a lightweight, molded fiberglass carrying case for safe, easy handling.
(For more information, designate #59 on the Reader Service Card.)

DATACALL MESSAGE COMPOSER FROM DASA CORPORATION

A new DATACALL Message Composer that can perform in selective or non-selective communications systems has been introduced by DASA Corporation, Andover, Mass.

The DATACALL DC80 Message Composer can store up to 80,000 alphanumeric characters in its motorized, indexed, magnetic-tape cartridge. Specific data can be swiftly located by means of human-readable descriptors on the front of the tape, and the pre-recorded message can be transmitted over teletypewriter lines (or into computers) at the touch of one button.
(For more information, designate #57 on the Reader Service Card.)

PATIENT MONITORING SYSTEM FROM REDCOR CORPORATION

A new patient monitoring system that bridges the gap between transducers (which measure temperature, blood pressure and other variables) and a general purpose digital computer has been introduced by Redcor Corporation, Canoga Park, Calif. The device, called an On-line patient monitoring system, also provides a link between remote display and the digital computer.

A complete network of 64 transducers and 12 display stations, in various hospitals, are connected to the Redcor system via diverse communication media. Under control of a general purpose digital computer, the system monitors physical variables and events in each of the 12 monitor stations. As a result of computer analysis, the system distributes information for display at the various stations. The displayed information assists hospital personnel in diagnosis and treatment.
(For more information, designate #55 on the Reader Service Card.)

AUTOFAX UNIT OFFERS ECONOMICAL TELEPHONE DATA TRANSFER

American Communication Systems, Inc., Van Nuys, Calif., recently introduced Autofax — a solid state system composed of a business machine base, a telephone base and coupler for low cost data transfer over present telephone lines. The system is designed for any business with a telephone, a typewriter and a need for information readout at more than one location. Original inventory reports, directives, purchase orders and typed communication or forms can be produced at each station either simultaneously or when designated.

Autofax offers two-way communication with a centralized data processing location. Data signals from typewriters, adding machines, punched tape, magnetic tape, punched cards, etc. are converted into tones. These are transmitted over existing telephone lines at 200 words per minute. Autofax system equipment has built-in error control circuits for correct data transmission.

Autofax is economical because it operates at regular telephone rates across the street or across the country. Hard copies are produced at both transmitting and receiving ends. Expensive time delays in mailed or messenger communications are eliminated.
(For more information, designate #56 on the Reader Service Card.)

Data Processing Accessories

MICR TAPE DEVELOPED BY DIVISION OF HOWMET CORP.

Howmet Corporation's Roll Leaf Division, Union City, N.J., has developed a magnetic ink character recognition (MICR) tape for encoding checks and other documents which are sorted and processed by high speed electronic equipment.

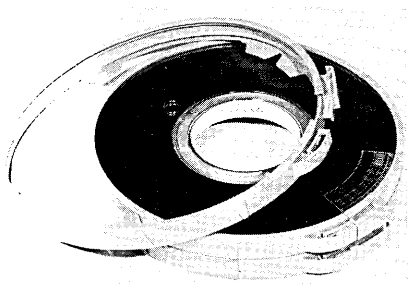
Daniel L. Schoenholtz, general manager for the Howmet division, said the company's new MICR tape possesses an unusually uniform coating and high signal response levels for rapid sorting and reading, and meets all American Banker Association (A.B.A.) specifications. The tape can be used in all printing equipment, including special application printing machinery.

The tapes, available in a variety of widths and roll sizes, can be delivered in a week to ten days. They are expected to be of particular interest to banks, insurance companies, general offices, EDP and other users of magnetic ink character recognition systems. (For more information, designate #60 on the Reader Service Card.)

3M COMPANY OFFERS NEW COMPUTER TAPE ACCESSORIES

Three new computer tape accessories are being offered by the 3M Company, St. Paul, Minn. These include plastic collars for 10 1/2-inch reels, and 7-inch reels and canisters.

The one-piece, break-resistant computer tape reel collar (shown) has a telescopic locking device



which adjusts tightly to protect the tape from dirt and dust. It is compatible with present storage systems, and can be hung or inserted on shelf racks. Other features include an identification label pocket, stacking rings, and tabs which support the reel while the collar is being adjusted.

The new 7-inch reel has a clear front which makes it possible to see the tape on computer drives. The new 7-inch canister protects short lengths of tape in storage and shipping.
(For more information, designate #61 on the Reader Service Card.)

RESEARCH FRONTIER

AUTONETICS DIVISION OF NORTH AMERICAN ROCKWELL DEVELOPS ADEM (AUTOMATIC DATA EQUALIZED MODEM)

A simple, automatic device that assures error-free high-speed transmission of data over ordinary telephone lines has been developed by engineers at North American Rockwell's Autonetics Division, Anaheim, Calif. Feasibility of the device, called ADEM (Automatic Data Equalized Modem), was demonstrated under company sponsorship and developed under contracts from the U.S. Air Force's Rome Air Development Center.

Since all telephone lines have different distortion characteristics which interfer with the transmission of digital computer data at high speeds, devices to compensate for these variations are a necessity. Senior Vice President C. F. O'Donnell of Autonetic's Research and Engineering Division, said ADEM can replace costly, complex and bulky devices which have been used in the past to compensate for such distortion. He said it has both commercial and defense application potentials.

ADEM is compact, and can be easily attached, in less than a minute, for sending and receiving data simultaneously. Existing devices must be manually adjusted, a process that often takes hours. The device has been tested on ordinary telephone lines. It is adaptable to most telephone lines, needs no manual adjustments except setting one knob for the desired rate of transmission, and is easily transportable.

ADEM has a small memory capacity which enables it to "learn" the distortion characteristics of any phone line within seconds. The device can be programmed to transmit data at 1200, 2400 or 4800 bits per second without distortion. This capacity will be increased to as high as 7200 bits per second.

Prototypes of the device are about the size of a small table radio, and can be even further reduced to about the size of a pocket transistor radio by use of microminiaturization.

MEETING NEWS

INFORMATICS TO CO-SPONSOR MARCH SYMPOSIUM WITH UCLA

For the fourth consecutive year, Informatics Inc., Sherman Oaks, Calif., will co-sponsor a three-day symposium on data processing with the University of California Extension at Los Angeles. This year's symposium, entitled "Critical Factors in Data Management, 1968: Problems and Solutions," will be presented at UCLA on March 20, 21 and 22.

Representing Informatics will be Dr. Walter F. Bauer, President; Mr. Francis V. Wagner, Senior Vice President; Mr. Irving Cohen, Vice President/Systems Engineering; Dr. Robert W. Rector, Vice President/Aerospace Systems Division and Mr. John A. Postley, Vice President/Advanced Information System Division.

This symposium will cover many fields bound together by problems associated with management of large data bases. Proceedings of the conference will be published and may be ordered at the time of the symposium.

Information may be obtained by writing Engineering/Physical Extension, 6532 Boelter Hall, University of California, Los Angeles, Calif. 90024. There is a $75 fee for the symposium.

COMPUTER SOCIETY OF CANADA SIXTH NATIONAL CONFERENCE

The Sixth National Conference of the Computer Society of Canada will be held June 3-5, 1968, in Kingston, Ontario, at the new Holiday Inn. Manufacturers' displays will be on the nearby Queen's Univ. campus.

A conference highlight will be a programmed series of film presentations. All aspects of computer development and growth will be covered. In addition to some of the classic films concerning computers, there will be some films which have not been shown publicly before.

For information about registration, fees, and accommodations, write to: W. H. Jenkins, Program Chairman, P. O. Box 455, Kingston, Ontario.

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Scientific Data Systems, Santa Monica, Calif.	Link Group of General Precision Systems Inc.	Sigma 5 computer which will be used as components of large simulation systems designed and built by Link	$7.5 million
Burroughs Corp., Detroit, Mich.	U.S. Post Office Department	Production and installation of 59 letter sorter machines; fifth in a series of contracts for the sorter raising total number of machines installed or on order to 178. Value of contracts to date, over $25-million	$7.3 million
National Cash Register Co., Dayton, Ohio	Autolite-Ford Parts Division of Ford Motor Company	Transferring Ford's parts catalogs to a micro-image dissemination and retrieval system	over $5 million
Planning Research Corp., Los Angeles, Calif.	Rome (N.Y.) Air Development Center, Griffiss Air Force Base	Two-year contract for information processing support of the Program Assisted Console Evaluation and Review (PACER) program	$2,180,000
Bausch & Lomb, Rochester, N.Y.	National Cash Register Co., Dayton, Ohio	Completing development of and producing special lens systems to be used in NCR's new PCMI microfilm documentation equipment	$1.6 million
	Stromberg Carlson Corp., Data Products Div., San Diego, Calif.	Special microfilm projection lenses to be used in the S-C 1325 and S-C 1700 Viewers for business microfilm printing systems	about $512,000
Honeywell Electronic Data Processing, Wellesley Hills, Mass.	Western Savings Fund Society, Pa.	A computer system to handle its savings and loan operations; system will include a Honeywell 1250 linked with 42 teller terminals in Western Savings' 17 branches	$1.1 million
Scientific Data Systems, Santa Monica, Calif.	CAE Industries, Ltd., Montreal, Canada	Five SDS Sigma 2 computers; four for use primarily to control flight simulators; one will be integrated into a CAE system designed to monitor and control crude oil production at Getty Oil Company's Bakersfield oil fields	over $1 million
Data Products Corp., Culver City, Calif.	Electro-Mechanical Research, Inc., Minneapolis, Minn.	Model 4500 high-speed LINE/PRINTERS which will be used in conjunction with EMR's 6130 computer	$217,000
	Univac Division of Sperry Rand, St. Paul, Minn.	Model 4500 LINE/PRINTER modules, with selected electronic control circuitry to be incorporated into Univac computer systems	over $165,000
National Retail Merchants Association (NRMA)	The National Cash Register Company, Dayton, Ohio	Development of a new computerized system of reporting operational statistics to its membership	$150,000
Industrial Product Division of the National Cash Register Co.	Department of Health, Education and Welfare's ERIC (Educational Research Information Council)	Transferring education study reports handled through ERIC to microforms; contract calls for 60 initial copies of each report	$125,000
Information Displays, Inc., Mount Kisco, N.Y.	AAI Corporation, Cockeysville, Md.	A Computer Controlled Display System to serve as part of a Maneuvering Tactics Training Device which AAI is developing for the Naval Training Device Center	$108,000
Aerojet-General Corp., Computing Sciences group, Sacramento, Calif.	State of Washington, Department of Institutions	Assisting the Department personnel in implementing a communications network and in designing and installing the Division of Research Information System (DORIS)	$101,820
The National Cash Register Company, Dayton, Ohio	National Aeronautics and Space Administration's Marshall Space Flight Center	Preliminary studies toward a high-speed computer which could be used in space-flight simulations	$70,000
Control Data Corp., Data Centers Div., Minneapolis, Minn.	East-West Gateway Coordinating Council of East St. Louis, Ill.	Design of an integrated data flow system for the initial phase of an extensive metropolitan planning program	$40,000
Management Data Corp., Philadelphia, Pa.	Eastern Airlines, Miami, Fla.	Eight-year period lease agreement for computer systems costing $8.3 million	—
Bailey Meter Company, Wickliffe, Ohio	Arkansas Power & Light Co.	Instruments and control systems including an 880 Nuclear Instrumentation and Safeguard System, an 855 Process Computer, and a 721 Electronic Analog Control System	—
Information Engineering, Philadelphia, Pa.	American Federation of Information Processing Societies (AFIPS)	A study contract to provide reliable estimates, by major subject areas, of the current rate of publication of technical literature in the field of information science and technology; results will be basis for recommending action concerning publication of abstracts of current technical literature in this field	—
National Cash Register Co., Dayton, Ohio	Merrill Lynch, Pierce, Fenner & Smith, Inc., New York, N.Y.	Placing firm's entire corporation files of the Securities Research Division Library on microfiche	—
Lockheed Missiles & Space Co., Sunnyvale, Calif.	St. Paul (Minn.) Regional Red Cross Blood Center	A whole-blood inventory control system; a communications link will connect St. Paul center to Lockheed computers, which will process blood-use information from St. Paul nightly and report on the location of every unit of blood each morning	—
Interface Inc., Ann Arbor, Mich.	University of Michigan	Providing a system of statistical and data management programs to be used in highway safety research	—

NEW INSTALLATIONS

OF	AT	FOR
Control Data 3150	Bell Telephone Company of Canada, Montreal, Canada	Handling the computing needs of its headquarters statistical staff; presently being used for business research and general purpose scientific computing
Control Data 3300	Royal Netherlands Blast Furnace and Steel Works, Ijmuiden, The Netherlands (2 computers)	Daily production planning and control procedures
Control Data 3300/1700	U.S. Air Force, Western Test Range, Vandenberg AFB (2 systems)	Use individually or as dual systems, to process pre-flight missile checkout data, as well as data acquired by telemetry during actual launchings; also for post-launch data reduction
Control Data 6600	Control Data Corp., Houston Data Center, Houston, Texas	Computer users on an hourly charge basis; will be able to serve the entire Southwest area
Digital Equipment PDP-8	Teradyne, Inc., Boston, Mass.	An integral part of the Teradyne J259 automatic system for production-line testing of integrated circuits
GE 115	North Hudson Hospital, Weehawken, N.J.	Cutting costs of hospital administration and aiding in analyzing medical records
Honeywell 120	London Borough of Hammersmith, London, England	Accounting needs in the treasurer's office; later a variety of applications ranging from preparing election roles to keeping track of books in the public library
Honeywell 200	Office of the Superintendent of Public Instruction, Illinois	Handling 17 paper work jobs which include teacher certification, enrollment, payrolls, transportation and bus drivers' permits, statistics and student scheduling
	Southern Indiana Gas and Electric Co., Evansville, Ind.	Replacement of manually operated accounting machines; will be used for payroll, stockholders' records, inventories and personnel records; also will keep track of the transformer loads
Honeywell 1200	Boston Globe, Boston, Mass.	Completion of a million dollar computer system to automate hot metal typesetting and photocomposition; other applications of the system are being directed toward financial management
IBM System/360 Model 30	Aid Association for Lutherans, Appleton, Wis.	First phase of an electronic information system designed to expedite services for members and agents
IBM System/360 Model 44	Ohio University, Athens, Ohio	Support of a planned program of joint academic-industrial research; may make computer time available to nearby industry at a later date
IBM System/360 Model 65	University of Pennsylvania, Philadelphia, Pa.	Start of the growing complex which is intended to serve as a regional computing utility for the academic and scientific community of the Delaware Valley (system valued in excess of $3,000,000)
IBM 1130	Joseph Marshall Imports, Los Angeles, Calif.	Keeping track of almost 2,000 wig styles being marketed by the firm across the United States
NCR 500	Factoryguards, Worcestershire, England	Helping maintain and analyze confidential crime records as well as handling all accounting operations for the industrial security organization which is comprised of four companies; Factoryguards Ltd., Cash-in-Transit Ltd., Securitas Alarm Ltd., and Store Detectives Ltd.
	James Burrough Ltd., London, England	Computerizing all order invoicing and sales reporting
	Electricity Department of Londonderry, Northern Ireland	Processing bills as well as other financial accounting work
SDS 940	Dow Chemical Co., Midland, Mich.	Use by hundreds of scientists and engineers, via their Teletype consoles, to advance the company's various research and development projects
UNIVAC 1108	French National Railway Co. (SNCF), Paris, France (2 computers)	Focal point of a message switching center for a national communications network designed to expedite and improve freight car control (systems valued at over $5 million)
UNIVAC 1108-II	United Air Lines, Elk Grove, Ill. (3 systems)	The core of one of the world's largest commercial real-time electronic information networks (systems valued at $67 million)
UNIVAC 9200	George S. Nolte Consulting Civil Engineering, Inc., Palo Alto, Calif.	Processing civil engineering problems related to subdivisions and project costs, and general accounting
	Interstate Drug Exchange Inc., Plainview, N.Y.	Inventory control on over 8,000 items
	Roegelein Provision Co., San Antonio, Texas	Payroll processing, accounts receivable, accounts payable, sales analysis, invoicing and for handling records of truck maintenance
	Fruitvale Canning Co., Oakland, Calif.	Payroll processing, inventory control, billing, accounts payable, and sales analysis
	Hubbs Engine Co., Woburn, Mass.	Parts inventory control, billing, parts ordering, and associated applications
	Teledata, Inc., San Marcos, Texas	Billing, accounts receivable; processing of toll calls and traffic studies for San Marcos Telephone Co.
UNIVAC 9300	Pennsylvania Railroad, Philadelphia, Pa.	Fiscal and statistical accounting of the Pennsylvania Railroad's operations
	Washington Daily News, Washington, D.C.	Circulation accounts billing; local, national and classified advertising billing; inventory control; as well as for a management information system

MONTHLY COMPUTER CENSUS

The following is a summary made by "Computers and Automation" of reports and estimates of the number of general purpose electronic digital computers manufactured and installed, or to be manufactured and on order. These figures are mailed to individual computer manufacturers from time to time for their information and review, and for any updating or comments they may care to provide.

Our census has begun to include computers manufactured by organizations outside the United States. We invite all manufacturers located anywhere to submit information for this census. We also invite our readers to submit information that would help make these figures as accurate and complete as possible.

The following abbreviations apply:

- (R) - figures derived all or in part from information released directly or indirectly by the manufacturer, or from reports by other sources likely to be informed
- (N) - manufacturer refuses to give any figures on number of installations or of orders, and refuses to comment in any way on those numbers stated here
- (S) - sale only
- X - no longer in production
- C - figure is combined in a total (see column to the right)
- E - figures estimated by "Computers and Automation"
- ? - information not received at press time

AS OF FEBRUARY 15, 1968

NAME OF MANUFACTURER	NAME OF COMPUTER	AVERAGE OR RANGE OF MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	MFR'S TOTAL INSTALLATIONS	NUMBER OF UNFILLED ORDERS	MFR'S TOTAL ORDERS
I. United States Manufacturers							
Autonetics (R)	RECOMP II	$2495	11/58	30		X	
Anaheim, Calif.	RECOMP III	$1495	6/61	6	36	X	0
Bailey Meter Co.	Bailey 756	$60,000-$400,000 (S)	2/65	14		5	
Wickliffe, Ohio	Bailey 855	$100,000 (S)	4/68	0	14	10	15
Bunker-Ramo Corp. (R)	BR-130	$2000	10/61	160		X	
Canoga Park, Calif.	BR-133	$2400	5/64	62		X	
	BR-230	$2680	8/63	15		X	
	BR-300	$3000	3/59	18		X	
	BR-330	$4000	12/60	23		X	
	BR-340	$7000	12/63	19	297	X	0
Burroughs (R)	205	$4600	1/54	38		X	
Detroit, Mich.	220	$14,000	10/58	31		X	
	B200 Series, B100	$5400	11/61	800		31	
	B300 Series	$9000	7/65	370		150	
	B2500	$5000	2/67	35		95	
	B3500	$14,000	5/67	24		74	
	B5500	$22,000	3/63	74		12	
	B6500	$33,000	2/68	0		17	
	B7500	$44,000	4/69	0		6	
	B8500	$200,000	8/67	0	1370 E	5	390 E
Control Data Corp. (R)	G-15	$1600	7/55	295		X	
Minneapolis, Minn.	G-20	$15,500	4/61	20		X	
	LGP-21	$725	12/62	165		X	
	LGP-30	$1300	9/56	322		X	
	RPC-4000	$1875	1/61	75		X	
	636/136/046 Series	?	-	29		C	
	160*/8090 Series	$2100-$12,000	5/60	610		X	
	924/924A	$11,000	8/61	29		X	
	1604/A/B	$45,000	1/60	59		X	
	1700	$3500	5/66	100		C	
	3100/3200/3300	$10,000-$16,250	5/64	261		C	
	3400/3600/3800	$18,000-$48,750	6/63	79		C	
	6400/6500/6600	$52,000-$117,000	8/64	63	(as of	C	
	6800	$130,000	6/67	0	2107 12/30/67)	C	360 E
Digital Electronics Inc. (R) Plainview, N.Y.	DIGIAC 3080	$19,500 (S)	12/64	10	10	1	1
Digital Equipment Corp. (R)	PDP-1	$3400	11/60	59		X	
Maynard, Mass.	PDP-4	$1700	8/62	55		X	
	PDP-5	$900	9/63	114		X	
	PDP-6	$10,000	10/64	22		X	
	PDP-7	$1300	11/64	165		C	
	PDP-8	$525	4/65	1050		C	
	PDP-8/S	$300	9/66	549		C	
	PDP-9	$1000	12/66	81		C	
	PDP-10	$7500	12/67	1		C	
	LINC	?	9/66	90	2186	C	450 E
Electronic Assoc., Inc. (R)	640	$1200	4/67	15		27	
Long Branch, N.J.	8400	$12,000	7/65	21	36	4	31
EMR Computer Div. (R)	ASI 210	$3850	4/62	26		X	
Minneapolis, Minn.	ASI 2100	$4200	12/63	7		X	
	ADVANCE 6020	$4400	4/65	18		C	
	ADVANCE 6040	$5600	7/65	8		C	
	ADVANCE 6050	$9000	2/66	18		C	
	ADVANCE 6070	$15,000	10/66	9		0	
	ADVANCE 6130	$1000	8/67	8	94	C	25
General Electric (N)	115	$1340-$8000	12/65	560 E		600 E	
Phoenix, Ariz.	205	$2500-$10,000	6/64	C		X	
	210	$16,000-$22,000	7/59	C		X	
	215	$2500-$10,000	9/63	C		X	
	225	$2500-$26,000	4/61	200 E		X	
	235	$6000-$28,000	4/64	130 E		C	
	255	$15,000-$26,000	10/67	C		C	
	265	$17,000-$28,000	7/64	C		C	
	405	$5120-$10,000	11/67	C		C	
	415	$4800-$13,500	5/64	350 E		70 E	
	420	$18,000-$28,000	7/67	C		C	
	425	$6000-$20,000	6/64	120 E		C	
	435	$8000-$25,000	9/65	C		C	
	625	$31,000-$135,000	4/65	C		C	

NAME OF MANUFACTURER	NAME OF COMPUTER	AVERAGE OR RANGE OF MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTAL-LATIONS	MFR'S TOTAL INSTAL-LATIONS	NUMBER OF UNFILLED ORDERS	MFR'S TOTAL ORDERS
General Electric (cont'd)	635	$35,000-$167,000	5/65	C		C	
	645	$40,000-$250,000	7/66	C	1600 E	C	850 E
Hewlett-Packard (R)	2116A	$600	11/66	75		C	
Palo Alto, Calif.	2115A	$412	11/67	18	93	C	24 E
Honeywell (R)	DDP-24	$2500	5/63	85		X	
Wellesley Hills, Mass.	DDP-116	$900	4/65	200		30	
	DDP-124	$2050	3/66	46		33	
	DDP-224	$3300	3/65	50		8	
	DDP-516	$700	9/66	85		154	
	H-120	$3900	1/66	650		240	
	H-200	$8400	3/64	1130		87	
	H-400	$8500	12/61	120		X	
	H-800	$28,000	12/60	89		X	
	H-1200	$3800	2/66	175		130	
	H-1400	$14,000	1/64	12		X	
	H-1800	$42,000	1/64	21		X	
	H-2200	$12,000	1/66	78		71	
	H-4200	$20,500	6/67	0		20	
	H-8200	$35,000	4/68	0	2740 E	5	780 E
IBM (N)	305	$3600	12/57	C		X	
White Plains, N.Y.	360/20	$3000	12/65	6000 E		6000 E	
	360/25	$5530	1/68	C		C	
	360/30	$9340	5/65	6000 E		3500 E	
	360/40	$19,550	4/65	3000 E		2000 E	
	360/44	$12,180	7/66	C		C	
	360/50	$32,960	8/65	C		C	
	360/65	$56,650	11/65	C		C	
	360/67	$138,000	10/66	C		C	
	360/75	$81,400	2/66	C		C	
	360/85	$158,000	-	0		C	
	360/90 Series	-	10/67	C		C	
	650	$4800	11/54	C		X	
	1130	$1545	2/66	2700 E		4500 E	
	1401	$6480	9/60	7650 E		X	
	1401-G	$2300	5/64	1700 E		X	
	1401-H	$1300	6/67	C		C	
	1410	$17,000	11/61	C		C	
	1440	$4300	4/63	3600 E		C	
	1460	$10,925	10/63	1400 E		X	
	1620 I, II	$4000	9/60	1500 E		C	
	1800	$4800	1/66	C		C	
	701	$5000	4/53	C		X	
	7010	$26,000	10/63	C		C	
	702	$6900	2/55	C		X	
	7030	$160,000	5/61	C		X	
	704	$32,000	12/55	C		X	
	7040	$25,000	6/63	C		C	
	7044	$36,500	6/63	C		C	
	705	$38,000	11/55	C		X	
	7070, 2, 4	$27,000	3/60	C		X	
	7080	$60,000	8/61	C		X	
	709	$40,000	8/58	C		X	
	7090	$63,500	11/59	C		X	
	7094	$75,500	9/62	C		X	
	7094 II	$82,500	4/64	C	37,700 E	C	18,300 E
Interdata (R)	Model 2	$200-$300	-	0		3	
Oceanport, N.J.	Model 3	$300-$500	3/67	33		57	
	Model 4	$400-$800	-	0	33	5	65
National Cash Register Co. (R)	NCR-304	$14,000	1/60	24		X	
Dayton, Ohio	NCR-310	$2500	5/61	14		X	
	NCR-315	$8500	5/62	625		150	
	NCR-315-RMC	$12,000	9/65	80		50	
	NCR-390	$1850	5/61	600		6	
	NCR-500	$1500	10/65	1550	2893	580	790 E
Pacific Data Systems Inc. (R) Santa Ana, Calif.	PDS 1020	$550-$900	2/64	135	135	20	20
Philco (R)	1000	$7010	6/63	16		X	
Willow Grove, Pa.	2000-210, 211	$40,000	10/58	16		X	
	2000-212	$52,000	1/63	12	44	X	0
Potter Instrument Co., Inc. Plainview, N.Y.	PC-9600	$12,000 (S)	-	-	-	-	-
Radio Corp. of America (R)	RCA 301	$7000	2/61	635		C	
Cherry Hill, N.J.	RCA 3301	$17,000	7/64	75		C	
	RCA 501	$14,000	6/59	96		X	
	RCA 601	$35,000	11/62	3		X	
	Spectra 70/15	$4500	9/65	160		125	
	Spectra 70/25	$6500	9/65	85		57	
	Spectra 70/35	$10,400	1/67	52		135	
	Spectra 70/45	$22,000	11/65	80		107	
	Spectra 70/46	$34,400	-	0		C	
	Spectra 70/55	$34,300	11/66	5	1190 E	14	420 E
Raytheon (R)	250	$1200	12/60	175		X	
Santa Ana, Calif.	440	$3500	3/64	20		X	
	520	$3200	10/65	27		0	
	703	(S)	10/67	12	234	32	32
Scientific Control Corp. (R)	650	$500	5/66	24		6	
Dallas, Tex.	655	$1800	10/66	9		27	
	660	$2000	10/65	4		0	
	670	$2600	5/66	1		0	
	6700	$30,000	10/67	0	38	1	34

NAME OF MANUFACTURER	NAME OF COMPUTER	AVERAGE OR RANGE OF MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTAL-LATIONS	MFR'S TOTAL INSTAL-LATIONS	NUMBER OF UNFILLED ORDERS	MFR'S TOTAL ORDERS
Scientific Data Syst., Inc. (N)	SDS-92	$1500	4/65	120 E		10 E	
Santa Monica, Calif.	SDS-910	$2000	8/62	225 E		25 E	
	SDS-920	$2900	9/62	200 E		20	
	SDS-925	$3000	12/64	C		C	
	SDS-930	$3400	6/64	225 E		30	
	SDS-940	$10,000	4/66	C		C	
	SDS 9300	$7000	11/64	C		C	
	Sigma 2	$1000	12/66	55 E		160	
	Sigma 5	$6000	8/67	C		50	
	Sigma 7	$12,000	12/66	C	980 E	C	360 E
Standard Computer Corp. (N)	IC 6000	$10,000-$22,000	5/67	7	7	12 E	12 E
Los Angeles, Calif.							
Systems Engineering Labs (R)	SEL 810	$1000	9/65	24		X	
Ft. Lauderdale, Fla.	SEL 810A	$900	8/66	50		33	
	SEL 810B	?	-	0		7	
	SEL 840	$1400	11/65	4		X	
	SEL 840A	$1400	8/66	18		29	
	SEL 840 MP	?	-	1	79	6	70
UNIVAC, Div. of Sperry Rand (R)	I & II	$25,000	3/51 & 11/57	23		X	
New York, N.Y.	III	$20,000	8/62	67		X	
	File Computers	$15,000	8/56	13		X	
	Solid-State 80 I, II, 90, I, II & Step	$8000	8/58	222		X	
	418	$11,000	6/63	118		33	
	490 Series	$35,000	12/61	190		30	
	1004	$1900	2/63	3200		20	
	1005	$2400	4/66	960		140	
	1050	$8000	9/63	285		16	
	1100 Series (except 1107 & 1108)	$35,000	12/50	9		X	
	1107	$55,000	10/62	33		X	
	1108	$65,000	9/65	80		75	
	9200	$1500	6/67	110		900	
	9300	$3400	7/67	30		650	
	LARC	$135,000	5/60	2	5340 E	X	1860 E
Varian Data Machines (R)	620	$900	11/65	75		0	
Newport Beach, Calif.	620i	$500	6/67	68	143	298	298
		I. U.S. Manufacturers, TOTAL	——		59,400 E		25,200 E

II. Non-United States Manufacturers

NAME OF MANUFACTURER	NAME OF COMPUTER	AVERAGE OR RANGE OF MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTAL-LATIONS	MFR'S TOTAL INSTAL-LATIONS	NUMBER OF UNFILLED ORDERS	MFR'S TOTAL ORDERS
A/S Regnecentralen (R)	GIER	$2600-$9200	12/60	36		2	
Copenhagen, Denmark	RC 4000	$3000-$20,000	6/67	1	37	1	3
Elbit Computers Ltd. (R)	Elbit-100	$4900 (S)	10/67	6	6	33	33
Haifa, Israel							
G.E.C. Computers & Automation Ltd. (R)	90-2	-	10/65	5		C	
Wembley, Middlesex, England	90-10	-	8/66	1		C	
	90-20	-		0		C	
	90-25	-	7/66	2		1	
	90-30	-	10/65	1		1	
	90-40	-		0		C	
	90-300	-	11/66	1		1	
	S-2	-	1/68	0		1	
	S-5	-		0		C	
	S-7	-		0		C	
	GEC-TRW130	-	12/64	2		X	
	GEC-TRW330	-	3/63	7	19	X	4
International Computers and Tabulators Ltd. (R)	1901 to 1909	$4000-$27,000	12/64-12/66	631		369	
London, England	1200/1/2	-	-/55	60		2	
	1300/1/2	$3500	-/62	192		13	
	1300	$5200	7/62	112		3	
	1100/1	-	-/60	20		0	
	2400	-	12/61	4		0	
	Atlas 1 & 2	$70,000	-/62	5		1	
	Orion 1 & 2	$40,000	1/63	16		0	
	Sirius	-	-/61	22		0	
	Mercury	-	-/57	19		0	
	Pegasus 1 & 2	-	-/56	30	1023	0	404
N.V. Philips' Computer Industrie	P1000	?	6/68	0	0	5 E	5 E
Apeldoorn, Netherlands							
Saab Aktiebolag (R)	DATASAAB D21	$5000-$14,000	12/62	30		3	
Linkoping, Sweden	DATASAAB D22	$8000-$60,000	5/68	0	30	8	11
Union of Soviet Socialist Republics	BESM 4	-	-	C		C	
	BESM 6	-	-	C		C	
	MINSK 2	-	-	C		C	
	MINSK 22	-	-	C		C	
	MIR	-	-	C		C	
	NAIRI	-	-	C		C	
	ONEGA 1	-	-	C		C	
	ONEGA 2	-	-	C		C	
	URAL 11/14/16	-	-	C		C	
	and others				2000 E		500 E
		II. Non-U.S. Manufacturers, TOTAL	——		3100 E		960 E
			Combined, TOTAL	——	62,500 E		26,160 E

NEW PATENTS

Raymond R. Skolnick
Patent Manager
Ford Instrument Co.
Div. of Sperry Rand Corp.
Long Island City, N.Y. 11101

The following is a compilation of patents pertaining to computers and associated equipment from the "Official Gazette of the U. S. Patent Office," dates of issue as indicated. Each entry consists of: patent number / inventor(s) / assignee / invention. Printed copies of patents may be obtained from the U.S. Commissioner of Patents, Washington, D.C. 20231, at a cost of 50 cents each.

December 12, 1967

3,358,237 / Tim H. Houle, Wauwatosa, Wis. / A. O. Smith Corporation, Milwaukee, Wis., a corporation of New York / Data pulse combining system employing scanner to sequentially gate plural memory circuits each having automatic reset means.

3,358,238 / Homer O. Shapiro and Jack J. Pariser, Orange, and Edward J. Darcy, Huntington Beach, Calif. / Hughes Aircraft Co., Culver City, Calif., a corporation of Delaware / Control information flip-flop circuits.

3,358,270 / Beverly L. Crew, Rockville, Md., and Morris N. Gunzburg, Washington, D. C. / General Electric Co., a corporation of New York / Information storage and retrieval system.

3,358,271 / Mitchell P. Marcus, Binghamton, N. Y., George E. Rossman, Newark, N. J., and Cyril J. Tunis, Endwell, N. Y. / International Business Machines Corp., New York, N. Y., a corporation of New York / Adaptive logic system for arbitrary functions.

3,358,273 / Paul Henninger and Josef Brackmann, Munich, Germany / Siemens & Halske Akiengesellschaft, Berlin and Munich, Germany, a corporation of Germany / Magnetic storage conductor device for electronic computers.

3,358,274 / Neil D. Manor, Xenia, and James H. Randall, Dayton, Ohio / The National Cash Register Co., Dayton, Ohio, a corporation of Maryland / Magnetic core memory matrix.

December 19, 1967

3,359,545 / Vernon L. Newhouse and Harold H. Edwards, Schenectady, N. Y. / General Electric Co., a corporation of New York / Bit organized cryogenic memory cell.

3,359,546 / Raymond H. James, Bloomington, Minn. / Sperry Rand Corporation, New York, N. Y., a corporation of Delaware / Magnetic memory system employing low amplitude and short duration drive signals.

December 26, 1967

3,360,785 / Takashi Ishidate, Tokyo, Japan / Nippon Electric Co., Ltd., Tokyo, Japan, a corporation of Japan / Semi-permanent memory system.

3,360,786 / Thomas S. Steele, Minneapolis, and Wayne L. Walters, Bloomington, Minn. / Electro-Mechanical Research, Inc., Sarasota, Fla., a corporation of Connecticut / Magnetic core memory system.

January 2, 1968

3,361,910 / Frederick F. Morehead, Jr., Yorktown Heights, N.Y. / International Business Machines Corporation, New York, N.Y., a corporation of New York / Optical non-destructive read out memory.

January 9, 1968

3,363,110 / James T. Kellis, Tustin, Calif. / Electronic Engineering Company of California, Santa Ana, Calif., a corporation of California / Binary storage counter.

3,363,226 / Francis J. Murphree, Sunnyside, Fla. / The United States of America as represented by the Secretary of the Navy / Data processing system.

3,363,234 / Gordon A. Erickson, Ralph A. Hileman, Ernest G. Mutschler, and Gerald E. Pickering, San Diego, Calif. / Sperry Rand Corporation, New York, N.Y., a corporation of Delaware / Data processing system.

3,363,239 / Warren A. Alexander, Tulsa, Okla. / by mesne assignments, to Esso Production Research Company, Houston, Tex., a corporation of Delaware / Electro-optical data storage and retrieval unit.

3,363,241 / Seening Yee, Whitestone, N.Y. / Sperry Rand Corporation, Great Neck, N.Y., a corporation of Delaware / Magnetic core shift registers.

January 16, 1968

3,364,362 / Robert N. Mellott, Los Angeles, Calif. / by mesne assignments, to The Bunker-Ramo Corporation, Stamford, Conn., a corporation of Delaware / Memory selection system.

3,364,471 / Milton G. Bienhoff and Edward J. Schneberger, Canoga Park, Calif. / by mesne assignments, to The Bunker-Ramo Corporation, Stamford, Conn., a corporation of Delaware / Data processing apparatus.

January 23, 1968

3,365,703 / Werner Ulrich, Colts Neck, N.J. / Bell Telephone Lab., Inc., New York, N.Y., a corporation of New York / Data processor with successive utilizations of an indexing result.

3,365,704 / Werner Ulrich, Colts Neck, N.J. / Bell Telephone Lab., Inc., New York, N.Y., a corporation of New York / Memory system.

3,365,706 / Gilbert W. King, 761 Boston Post Road, Weston, Mass. 02193 / ———— ———— / Photo-optical data storage and retrieval system employing error detection and error location identification components.

January 30, 1968

3,366,045 / Claudio Canarutto, S. Mauro Torinese, Turin, Italy / Ing. C. Olivetti & C., S.p.A., Ivrea, Italy, a corporation of Italy / Printing device for office machines and data processing equipments.

3,366,129 / Edward Schoppe, Jr., Walpole, and Cavas M. Gobhai, Cambridge, Mass. / The Foxboro Company, Foxboro, Mass., a corporation of Massachusetts / Fluid logic anti-coincidence device by delay.

3,366,130 / Trevor Drake Reader, King of Prussia, Pa. / Sperry Rand Corporation, New York, N.Y. a corporation of Delaware / Five state fluid logic element.

3,366,131 / Elmer L. Swartz, Falls Church, Va. / The United States of America as represented by the Secretary of the Army / Fluid logic element.

3,366,928 / Rex Rice, Menlo Park, Calif., and Ralph F. Schauer, Putnam Valley, N.Y. / International Business Machines Corp., a corporation of New York / Accessing system for large serial memories.

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.

Cheap mass storage for small computers and how to get the most out of it

For some people the only limitation of the small computer is the price of the extra memory. What's needed is low-cost mass storage, and lots of it. For filing data. For quick and convenient program manipulation.

DIGITAL, the leader in small computers, has a low-cost disc and unique magnetic tape unit tailored for the small computer. Now, new software is available to take even better advantage of this low-cost memory.

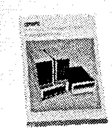
DECdisc adds 32,768 words of memory for $6,000. Additional expander discs (up to 3) can be added at $3,000 each. That means a total of 131,072 words of disc memory for $15,000.

A full scale PDP-8/S computer with 36,864 twelve bit words of memory, for example (4k core plus disc), costs $18,500.

DECtape, Digital's unique fixed address magnetic tape system, provides over 200,000 words of storage on a 3½-inch reel. It's the lowest cost mass storage available anywhere. You can edit and debug programs on line. Then you can put your programs in your pocket and take them away until you want them again.

New keyboard monitor software all but eliminates the laborious use of paper tape and cards. You edit from the keyboard, compile from the keyboard, assemble, load, store, debug all from the keyboard. What might have been hours or days in getting the computer ready for use, is now just minutes.

Available now. PDP-8/S off-the-shelf. PDP-8 in one month. PDP-8/I in the spring. DECdisc and DECtape immediately available. Send for our new Small Computer Handbook. It's free.



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